Maitland Heavy Industrial Estate, Karratha

LandCorp/Department of Resources Development

Advice to the Minister for the Environment from the Environmental Protection Authority under Section 16(e) of the *Environmental Protection Act 1986*

(This is not an assessment of the Environmental Protection Authority under Part IV of the *Environmental Protection Act 1986*.)

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Summary

LandCorp and the Department of Resources Development (DRD) have prepared a concept plan for the development of a heavy industrial estate at Maitland. The Government has requested early advice on the environmental matters associated with the industrial estate concept to assist in detailed planning for the region. To facilitate the process of regional planning, the Minister for the Environment has sought the EPA's advice on the heavy industrial estate concept, pursuant to Section 16(e) of the *Environmental Protection Act (1986)*.

This report provides the Environmental Protection Authority's (EPA) environmental advice to the Minister for the Environment regarding a concept to establish the Maitland Heavy Industrial Estate, as detailed in LandCorp/DRD's Public Environmental Review (PER) of October 1994, and subsequent documentation, at Maitland, approximately 12 km west of the Karratha township.

This report considers the industrial estate concept, environmental factors likely to be important, additional aspects of the proposal and environmental management and procedures.

- **Factors**

The EPA, in formulating its view recognises that, at this stage, it is only dealing with a strategic concept. Based upon the information available the EPA has identified the following important environmental factors:

(a) mangroves;

(b) marine fauna and threatened and priority fauna;

(c) System 8 area;

(d) terrestrial rare and priority flora and vegetation communities;

(e) terrestrial fauna and threatened and priority fauna;

(f) air quality (including odours);

(g) greenhouse gases;

(h) dust and particulate emissions;

(i) noise and vibration;

(j) surface water, marine water and sediment quality;

(k) turbidity;

(l) liquid and solid wastes;

(m) public health and safety;

(n) cultural surroundings.

The EPA also considers that other issues that need to be considered are as follows:

(a) regional planning;

(b) port;

(c) infrastructure.

- **Management and Studies**

Against each of these environmental factors a set of environmental objectives have been established. Considerable attention has been paid to environmental management if the proposal is to be implemented. This includes the development and implementation of environmental management systems and standards both for the estate and for individual industries wishing to establish within the estate, and integration with any associated port facility. For the estate, an

Estate Manager has been proposed that will be responsible for the overall environmental management of the estate and its cumulative impacts.

- **Advice to the Minister for the Environment**

The EPA has made a number of recommendations for management of the industrial estate, and identified further studies, as outlined in Sections 3 and 5 of this Report. If these measures are implemented, and subject to study results, implementation of the industrial estate concept is capable of being managed so as not to compromise the EPA's objectives.

This advice considers the potential impacts of the development of an industrial estate at Maitland in isolation. Although there are general indications of the type of industrial development expected for the region, the EPA cannot forecast what type of specific industries are likely to establish in the estate. The combined impact of possible industries, associated port facilities, infrastructure requirements including rail development and matters relating to the siting and operation of quarries to provide raw materials to allow implementation of the project to proceed, will require further evaluation.

It is the EPA's view that the provision of infrastructure support for the industrial estate concept should be considered through separate referral under section 38 of the Act, or as a function of the consideration of the Planning Scheme Amendment that will precede implementation.

This Scheme Amendment should also consider the status of the buffer proposed.

Recommendations to the Minister for the Environment

Recommendation 1

That the Minister for the Environment notes the environmental factors, the EPA's objective for each factor as set out in Section 3 of this report, and the studies suggested to gain further information.

Recommendation 2

That the Minister for the Environment notes the EPA's advice on meeting EPA objectives for the important environmental factors, estate management, environmental management considerations and suggested studies (Section 3). In particular note the responsibilities of the Estate Manager (or council), the Port Authority or individual industries in environmental protection as set out in summary form in Section 5.3.

Recommendation 3

That the Minister for the Environment notes that infrastructure requirements to the Maitland Heavy Industrial Estate Concept area have not been considered in this advice, and that such matters should be referred to the EPA for consideration as either formal referrals or Scheme Amendments under Part IV of the *Environmental Protection Act*.

Recommendation 4

That the Minister for the Environment notes that industries with the potential to significantly impact on the environment and wishing to establish in the Maitland Heavy Industrial Estate Concept area would be subject to assessment under Part IV of the *Environmental Protection Act.*

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1. Introduction

LandCorp and the Department of Resources Development have referred a concept plan for the proposed Maitland Industrial Estate as part of the planned establishment of industrial land for the Pilbara Region. The Government has requested early advice on the environmental matters associated with the Maitland Heavy Industrial Estate concept plan to assist in detailed planning for the proposal and to assist the process of planning for the region. The Minister for the Environment has sought the EPA's advice on the Maitland Heavy Industrial Estate concept, pursuant to Section 16(e) of the *Environmental Protection Act 1986* (the Act).

This advice is provided with the expectation that, should the heavy industrial estate concept at Maitland be implemented:

- it will allow earlier definition of environmental issues;
- increase the level of certainty for subsequent proposals undergoing environmental impact assessment;
- reduce time delays within the environmental assessment process; and
- ensure the EPA's decision making will be more consistent;

without compromising and more likely enhancing the protection of the environment.

1.1 EPA's Functions under Section 16(e)

Section 16(e) of the *Environmental Protection Act 1986* in relation to the functions of the Environmental Protection Authority (EPA) enables the Minister for the Environment to receive advice on environmental matters referred to the Authority.

The Minister, by letter to the Chairman of the EPA dated 5 March 1996, has requested environmental advice on the concept of an industrial estate in the Maitland locality near Karratha.

1.2 The PER Report

The Maitland Heavy Industrial Estate, Karratha concept (AGC Woodward Clyde, 1994a) was originally assessed at the level of Public Environmental Review under Part IV of the *Environmental Protection Act 1986.*

Following on from the Supreme Court decision of 27 April 1995 (number 1879 of 1995), it was determined that some planning proposals could not be assessed formally under Part IV of the Act because they are not a "proposal" within the meaning of section 38 of the Act. As it was concluded that the Maitland Heavy Industrial Estate evaluation such a proposal, the formal assessment could not be completed and the proponents requested the matter be considered under section 16(e) of the Act.

1.3 Limitations of this report

Information gathered for the earlier formal assessment (AGC Woodward Clyde, 1994a), comments received from both public and Government agencies during the public review period, and the results of subsequent studies undertaken at the request of the Minister for the Environment have been considered in the preparation of this advice.

The advice to the Minister for the Environment provided in this report is prepared pursuant to Section 16(e) of the *Environmental Protection Act 1986* . Under no circumstances should this advice be considered as a formal assessment of a proposal under Part IV of the *Environmental Protection Act 1986.* The EPA reserves the right to assess formally under that Part any proposal in the Maitland locality, infrastructure associated with the estate and industries seeking to locate within the estate.

1.4 Definitions

The following explicit definitions are used in this Report:

"Estate Manager"	-	For the purpose of this report, it has been assumed that the proposed Industrial Estate will be managed by the "Maitland Heavy Industrial Estate Management Body", which will be either a statutory authority or a corporate authority to be determined by Government. Until the appointment and/or incorporation of such a body, this role will be assumed by DRD/LandCorp.
"Maitland Heavy Industrial Estate Management Body"	-	For the purpose of this report, it has been assumed that the Maitland Heavy Industrial Estate Management Body, comprising a representative from each of the industries within the industrial estate will be established to, amongst other responsibilities, formulate and implement operational policy for the industrial park, monitor industry in the park and undertake cumulative impact assessments consistent with the concept plan and subsequent requirements.
"Proponent"	-	In relation to a proposal, means person or organisation who or which is nominated under section 38 of the Act as being responsible for the proposal, or public authority on which the responsibility for the proposal is imposed under another written law.
"Proposal"	-	means project, plan, programme, policy, operation, undertaking or development or change in land use, or amendment of any of the foregoing, but does not include scheme.
"Maitland Heavy Industrial Estate Study Area."	-	The Maitland Heavy Industrial Estate Study Area is assumed for the purposes of this advice to cover the region identified in Figure 1.
"Estate Area"		The estate area is assumed for the purposes of this advice to cover the region enclosed east of the Maitland River to the high water mark in the North, the North West Highway in the South and Dampier Salt Lease Boundary in the east (see Figure 2), and inclusive of the island port and industrial areas.
Environmental Management System	-	The Environmental Management System (EMS) is the environmental management plans and procedures required to implement the proposal. Environmental management principles and components, such as those adopted in the voluntary interim Australian Standards ISO 14000 series (International Standards Organisation, 1995), should be adopted with appropriate monitoring and auditing to ensure compliance. The environmental management plans and environmental management procedures should adopt quality assurance principles such as those adopted in Australian Standards (ISO 9000 series.)
Environmental Management Plan	-	A plan which documents all the environmental plans, management and commitments. The EMP forms part of the EMS.
Port Authority	-	Authority designated under an Act of Parliament, for example the Dampier Port Authority Act 1985, with responsibility to manage port operations and designated waters.

2. The Maitland Heavy Industry Estate Concept Plan

LandCorp and the Department of Resources Development (DRD) are jointly planning the development of the Maitland Heavy Industry Estate near Karratha (Figure 1) to accommodate major industries based on the processing of resources available in the Pilbara region. The generic types of industry considered includes iron ore processing, petroleum processing, power generation, power intensive industries and support industries.

The preparation of this Concept Plan (Figure 2) follows from the recommendations of the Pilbara 21 Study (Government of Western Australia, 1992) and a site selection process involving the evaluation of six options in the Karratha region. Key criteria considered in the identification of the six options included the availability of large areas (>1500 ha) of flat land, proximity to power, gas supplies and potential to develop transport and port connections.

The Maitland Heavy Industry Estate was identified as the preferred option for development following consideration of a further suite of criteria (Long and Fraser Consultants, 1993) which included ethnographic, physical and biological characteristics. The Maitland Heavy Industry Estate Concept plan was considered the preferred option in terms of the above criteria, and incorporates the elements described in Table 1 (refer page 4).

Matters relating to infrastructure requirements (earthworks, water supply, electricity and gas, telecommunications, roads, rail and drainage) have been briefly discussed in the initial document submitted to the EPA (AGC Woodward Clyde, 1994a) and limitations identified. Before meaningful environmental consideration of infrastructure provisions can be undertaken, more current and detailed information is needed prior to decisions on infrastructure provisions. The provision of infrastructure support for the industrial estate concept should be considered through separate referral to the EPA, or through Scheme amendments to provide for appropriate land zoning.

The Concept Plan (AGC Woodward Clyde, 1994a) involves a total land area of approximately 3500 ha on the mainland (Karratha pastoral station), West Intercourse Island, West Mid Intercourse Island, Intercourse Island, and the southern extremity of the Burrup Peninsula. Included in the Concept Plan are service corridors (which may contain causeways/bridges, conveyors, pipelines and utility infrastructure) linking stockpile sites, a tank farm, provision of port facilities (with resultant dredging and dredge spoil disposal requirements) and industrial sites. A summary of the proposed site with respect to development potential is presented in Table 2 (refer page 5).

Table 1. Elements of the proposed Maitland heavy industrial estate at Karratha.

Element	Location	Comments
Mainland industrial site	Karratha pastoral station	Located on a silty sand coastal plain typified by low relief. The northern boundary is set by the 100 year Average Recurrence Interval storm surge. Proposed allocation of land for heavy industrial purposes linked to category, buffer requirements, raw material delivery and product handling considerations.
Burrup industrial site	SW tip of Burrup Peninsula	Igneous rock and boulder landform overlain by thin soils. Optimal utilisation by specific industries requiring close proximity to port facilities.
Industrial/stockpile site	NE West Intercourse Island	Igneous rock outcrops with thin veneer of Holocene sediments (<5m). Presence of two relatively large flat areas and bathymetry which makes this site the most suitable for port development and near port storage.
Industrial site	SW West Intercourse Island	Igneous rock outcrops with thin veneer of Holocene sediments (<5m) and fringing mangrove flats. Development costs for industrial use will be high.
Industrial site	W West Intercourse Island	Igneous rock outcrops with thin veneer of Holocene sediments (<5m). Development costs for industrial use will be high, and may be offset by use of dredge spoil as fill.
Stockpile site	W Mid Intercourse Island	Igneous rock outcrops with thin veneer of shelly beach Holocene sediments (<3m). Considered suitable for a port stockpile/storage area for the export of bulk commodities. Provides the best opportunity for jetty access to deep water.
Tank farm	Intercourse Island	Discontinuous outcrops of igneous rocks overlain by a thin veneer of shelly beach Holocene sediments (<3m). Site for fuel storage and bunkering.
Port facilities and pier options	West Intercourse Island (NE and NW) W Mid Intercourse Island Intercourse Island	Igneous rock outcrops with varying thin veneers of Holocene sediments (<5m), some of marine origin. Relatively flat terrain areas with the potential to readily access deep water have been identified to provide port facilities and loading structures.
Service corridors	Various	To link all industrial and stockpile sites and port facilities.

Table 2 †. Maitland heavy industrial estate proximity and site characteristics summary.

Characteristic	**Site**	
	Mainland Industrial Estate	**Island Industrial Estate**
Description and Area	Maitland heavy industrial estate; *29km^2	
Drainage: **Drains to:** **Average slope:**	N, E, W Mermaid Strait 1:400	all directions Mermaid Strait 1:10 to 1:200
Geology	Clayey silt to red brown silty sands	rocks of igneous origin overlain by a thin veneer of Holocene sediments
Winds: (direction to urban centres) - Critical direction [Occurrence %]	SW [5%] (to Karratha)	WSW [*10%] (Dampier) NW [15%] (to Karratha)
Wind proximity: (distance and critical wind direction from proposed industry sites to) -Karratha distance in km,[direction] -Dampier distance in km,[direction]	15.0 km, [SW] 16.0 km, [SW]	14.1 km, [NW] 5.1 km, [WSW]
Transport: † (distance by road to) -Light industrial area -Karratha -Hamersley Iron rail -NW Coastal Highway	32 km 33 km 15 km 2 km	*45 km *46 km *28 km *15 km
Services †(direct distance to existing services) -Western Power -Scheme water -High Pressure gas pipeline	24 km 24 km 2 km	*37 km *37km *15 km

† distances are derived from Long and Fraser Consultants (1993) and AGC Woodward Clyde (1994a), are approximate only and given from the geometric centre of the site to the nearest service point, except for wind proximity, which is from the edge of the estate area to the part closest to the population area.

* approximate only

The industries that may establish within the Estate include:

- downstream iron ore processing;
- downstream petroleum (gas) processing; and
- power intensive industries.

Typical industry profiles, presenting raw material, product and waste and infrastructure requirements for each of these industry groups are presented in Tables 4.1 to 4.3 inclusive in AGC Woodward Clyde 1994.

Support industries are proposed for the area adjacent to the North West Coastal Highway (Figure 2) at the southern perimeter of the Maitland Heavy Industry area.

LandCorp and DRD, in association with other Government agencies, will be responsible for the planning and development of the estate. LandCorp is an authority of the Western Australian Government, established in part to identify and provide appropriately located and serviced industrial and commercial land.

LandCorp and DRD have proposed that a Maitland Heavy Industry Estate Management Body be established during the operational phase of the concept. This body will be comprised of industrial site operators, community representatives and relevant Government agencies and will be responsible for the ongoing overall coordination of environmental and management issues associated with the Estate. In the interim, site management will remain the responsibility of LandCorp/DRD.

Individual industries wishing to establish in the Estate will need to gain the necessary approvals for their operations and will be required to conform with development guidelines prepared by LandCorp and DRD.

3. Environmental Factors Likely to be Important

3.1 Important Environmental Factors

In the EPA's opinion, and having regard for the views of the public and government agencies listed in Appendix 2, and other relevant information identified in the text and referenced in Appendix 3, the following are the environmental factors likely to be of importance in the development of an industrial estate at Maitland:

(a) mangroves;

(b) marine fauna and threatened and priority fauna;

(c) System 8 area;

(d) terrestrial rare and priority flora and vegetation communities;

(e) terrestrial fauna and threatened and priority fauna;

(f) air quality (including odours);

(g) greenhouse gases;

(h) dust and particulate emissions;

(i) noise and vibration;

(j) surface water, marine water and sediment quality;

(k) turbidity;

(l) liquid and solid wastes;

(m) public health and safety;

(n) cultural surroundings.

These environmental factors are discussed in sections 3.2 to 3.15 of this report.

The EPA also considers that other issues that need to be considered are as follows:

(a) regional planning;

(b) port;

(c) infrastructure.

These factors are discussed in section 4 of this report.

The environmental factors which require further investigation have been identified in this report. It should be noted that this advice does not cover individual proposals but is relevant to the Concept Plan as a whole. The focus is not, therefore, on the direct impacts associated with individual industrial development proposals or infrastructure proposals such as the provision of road and rail transport. These would be considered separately under Part IV of the *Environmental Protection Act 1986,* or during the Planning Scheme amendment stage.

3.2 Mangroves

Aspects of Mangroves

Mangroves are a very important element of the environment as a habitat for a diversity of flora and fauna and for their functions of primary production, export of nutrients, fish nursery, coast protection and sediment stabilisation.

The existing total area of mangroves in the Maitland Delta and West Intercourse system is approximately 2000 ha. About 800 ha has previously been lost as a result of the construction of the adjoining solar salt ponds (AGC Woodward Clyde, 1996). The extent of the remaining mangroves in the concept area are indicated in Figures 3 and 4.

The Concept Plan area has been the subject of Government decision making which has indicated the potential use of the area for industrial purposes.

A description of the mangrove areas that may be affected by the Concept Plan is presented in environmental review documentation (AGC Woodward Clyde, 1994a) and the response to submissions by LandCorp and DRD (AGC Woodward Clyde, 1996). This description is based on studies of the mangrove assemblages and species in the area (Semeniuk, 1983, 1993 & 1994).

The six main mangrove species that are present in the Concept Plan area are *Avicennia marina, Rhizophora stylosa, Bruguiera exaristata, Ceriops tagal, Aegiceras corniculatum* and *Aegialitis annulata.*

The following five geomorphological assemblages, described by Semeniuk (1994), may be potentially affected by the Concept Plan:

- muddy tidal flat (shown as mud flat in Fig 3);
- rocky shore (shown as bare rubble in Fig 3);
- tidal creek (indicated in Fig 4);
- chenier (indicated in Fig 4); and,
- alluvial fan (indicated in Fig 4).

The chenier and alluvial fan assemblages, while occurring elsewhere in the Pilbara region, are regarded as being of particular significance by Semeniuk (1994), for their scientific, heritage and educational values.

The construction and operation of the service corridor between the mainland industrial site and West Intercourse Island is the principal consideration in assessing the impact on mangroves. The extent of impact depends principally on the selected corridor route, causeway design, dust emissions (in particular iron ore dust) from conveyors or vehicles and spillage of harmful materials.

Under the worst case scenario, where all mangrove habitat is removed from the 150m wide service corridors, a total of about 35-40 ha of this habitat (with a variable cover of mangroves) may be directly affected. In addition mangroves could be affected indirectly as a result of altered tidal flux and sedimentation patterns caused by the construction of causeways. The spillage of hydrocarbon or the emission of dust can also cause adverse impacts on mangroves.

The EPA notes from discussions with DRD that the proposed width of 150m for the service corridors may not be required and is likely to be reviewed downward.

AGC Woodward-Clyde, 1994a notes a preference to adopt an open trestle/bridge causeway design and for the causeway aligned as close as possible to the Dampier Salt Pond Zero bund.

The proponent notes that, should this occur, the impact on mangroves should be substantially reduced from the worst case scenario, with no significant impact on the alluvial fan, chenier and rocky shore assemblages. In addition indirect impacts should be minimal with an open causeway design (AGC Woodward Clyde, 1994a).

LandCorp and DRD have indicated that they are committed to:

- constructing the causeway and other infrastructure in the service corridors, to minimise disruption to sedimentation and tidal flow, and as close as possible to the Dampier Salt Pond Zero bund (AGC Woodward Clyde, 1996);
- conduct hydrodynamic studies; and
- minimise dust emissions during construction.

Public submission expressed concern about the impact of the Concept Plan on mangroves and in particular the impact on the chenier and alluvial fan assemblages.

The EPA in association with key Government agencies and with specialist advice is formulating a policy for the protection of mangroves in the arid Pilbara zone biome. This policy will outline environmental objectives for the protection of mangroves and operational performance objectives and guidelines for development.

Proposals for the construction of the causeways and other significant infrastructure in the Concept Plan area will be subject to assessment procedures under the *Environmental Protection Act 1986.*

Consideration

The area considered in this evaluation is the arid Pilbara coast from Cape Keraudren to Exmouth Gulf (Figure 1). This area is defined as an ecological region or biome which has a distinct range of climate, large scale landforms, coastal attributes and local geomorphic and sediment patterns. Within this region there are a profusion of smaller scale habitats that may be restricted and distinctive to a particular setting (Semeniuk, 1993).

The EPA's objective in regard to this factor is to maintain the biodiversity, abundance, geographical distribution, productivity and community assemblages of mangroves.

The loss of mangroves must be considered in the context of the abundance of mangroves in the above biome and the designated industrial land uses in the Concept Plan area . Despite some major historic losses of mangroves in the vicinity, the impact from the construction of infrastructure in service corridors is potentially relatively small.

While there may be a small loss of mangroves, the geographic distribution of mangroves is unlikely to be threatened by the Concept Plan.

The diversity of mangroves is unlikely to be affected by the development of the estate because no rare or endangered species of mangrove have been identified in the Concept Plan area.

The EPA notes:

1. the relatively small area of mangroves that may be lost;
2. the commitments made by DRD and LandCorp;
3. the fact that no identified threatened species of mangrove are present in the areas affected by the Concept Plan; and
4. the incorporation of a trestle/bridge causeway to reduce interference to natural water flow.

In considering aspects of the mangrove communities at this locality, any future proponent should take account of, but not be limited to, the following:

Studies and further action to be undertaken by the Estate Manager and/or Proponents

1. undertake detailed studies and design of infrastructure corridors such that the area of mangrove impact will be minimised;
2. ensure that mangrove assemblages of special value are taken into account such that impacts are minimised or avoided;
3. replace mangroves that may be lost, or as appropriate to meet future policy;
4. prevent dust and spillage impacts on mangroves;
5. comply with present or any future mangroves policy prepared by Government.

Should the above occur, it is likely that implementation of the industrial estate concept plan is capable of being managed so as not to compromise the EPA's objective with regard to mangroves.

3.3 Marine fauna and threatened and priority fauna

Aspects of marine fauna and threatened and priority fauna

Aspects of the shallow marine habitat and subtidal areas in the Concept Plan area have been documented by Astron Environmental (1994). Further discussion is provided on the potential impact of introduced organisms at the Dampier Port.

The Concept Plan includes development of service corridors and port facilities, including bunkering facilities by pipe to specialised berths, in the marine waters on and between islands that may directly affect six shallow marine habitats (Figure 3). These habitats are diverse and well represented throughout the Dampier Archipelago and the region (Astron Environmental, 1994) and include:

- mangrove communities;
- sand and mudflats;
- rocky shores (indicated as bare rubble in Fig 3);
- sand beaches (indicated as sand in Fig 3);
- reef flat (not indicated); and,
- corals on various substrates.

A concern with the development of a bulk cargo port in Pilbara waters is that exotic marine organisms might be introduced from ships' ballast waters, or from hull fouling. A significant number of exotic marine pests have recently been recorded within Australian waters (Furlani, 1996).

Introduced marine species including the barnacle *Megabalomus tintinnabutum*, colonial ascidian, *Botrylloides leachi* and the green algae *Caulerpa taxifolia* have been found within the Dampier area (Furlani, 1996).

To reduce the risk of exotic organisms being introduced when the ballast water is discharged in the vicinity of the proposed port, the Australian Quarantine and Inspection Service (AQIS) has established an Australian Ballast Water Management Strategy (AQIS 1996), which is being introduced through all Australian ports with voluntary compliance by operators of foreign-going vessels. While this strategy is voluntary, it is anticipated that such inspections would be extended to this facility.

In addition, the International Maritime Organisation is developing a mandatory ballast water management code which is likely to be adopted as part of the MARPOL Convention (ANZECC Strategy to Protect the Marine Environment 1996).

Green turtle nests have been found on two beaches on the north east end of West Intercourse Island (Astron Environmental, 1994). The minor seagrass/macro algae beds fringing the islands in the Concept Plan area are considered to only support temporary or very small populations of Dugongs and Green Turtles (Astron Environmental, 1994). These species are specially protected under the *Wildlife Conservation Act 1950.*

Port options have been identified by Fraser Consultants (1994), and adopted by BHP Engineering and Woodward Clyde (1994) for the conceptual industrial estate layout.

LandCorp and DRD have committed to:

- require further work on the significance and usage of turtle nesting areas as part of developing port facility proposals; and
- prepare an environmental management plan to minimise the impact of dredging and port construction to the satisfaction of DEP.

DRD/LandCorp have indicated that provisions will be included in development guidelines to minimise disturbance to faunal habitats including turtle nesting beaches and to manage light spill.

Under the worst case scenario with complete destruction of marine habitat within the service corridors (150m width), about 35-40 ha of mangroves (refer 2.2 above), 20 ha of shallow subtidal sediment, 7 ha of intertidal sand shoal and 2 ha of coral on pavement habitats may be directly affected.

Notwithstanding, DRD and LandCorp have made a commitment to manage the placement of infrastructure and adopt construction methods which will limit impacts on the shallow marine environment. This is reflected in their proposal for a combination causeway - bridge to maintain tidal through flow.

A number of port options are proposed which may directly impact on shallow subtidal sediment, algae on pavement, and coral on pavement habitats.

The EPA cannot forecast the impacts associated with the various port and causeway options in other than the broadest terms. Reclamation along more than one kilometre of the coast on the north west of West Intercourse Island will result in impacts on beach, algae on pavement and coral on pavement habitats. The extent of these impacts is not possible to determine because additional port configurations and concepts are still being considered by DRD (AGC Woodward Clyde, 1994a).

Further direct and indirect effects relate to the dredging of approach channels and turning basins, and resulting spoil disposal. Impacts related to increased turbidity attributable to dredging is further discussed in section 3.12 below.

Benthic communities representative of deeper water habitats are characterised by widespread distribution and consist mostly of ephemeral and mobile animals. (Bowman Bishaw and Gorham, 1994). These communities are less likely to be affected in the longer tern by harbour development.

The present Port of Dampier boundary includes West Mid Intercourse Island, Intercourse Island and most of West Intercourse Island and is indicated in Figure 5. Extension of the Port boundary further to the east to include all of West Intercourse Island is being considered by the Authority and is further discussed in section 4.

The Report of the Marine Parks and Reserves Selection Working Group (CALM, 1994) has recommended that the waters of the Dampier Archipelago, including the waters and mangroves adjoining West Intercourse Island and the mainland industrial site, be set aside as a marine reserve.

Public and Government agency submissions expressed concern that marine surveys were inadequate and more detail is required given the turbid nature of marine waters in the Dampier Archipelago. Concern was also expressed with regard to dredging in an area recommended for marine park by the Marine Parks and Reserves Selection Working Group and presented in Figure 6. The areas that may be impacted are indicated in Figure 3.

The Department of Conservation and Land Management (CALM) has advised that the Marine Parks and Reserves Selection Working Group report has yet to be endorsed by CALM or the Government and progressing any individual reserve recommendations in the report will be subject to detailed assessment and consultation.

Consideration

The area considered in the evaluation of this environmental factor is the marine environment within the Dampier Archipelago within approximately a 45 km radius of Karratha. This area is a defined marine region with similarities of climate, tidal, island and oceanographic conditions. Fauna and habitats are closely interrelated with these factors.

The EPA objectives in regard to marine fauna and threatened and priority marine fauna are to:

- maintain the abundance, species diversity and geographic distribution of marine fauna;
- protect threatened and priority fauna in accordance with the provisions of the *Wildlife Conservation Act 1950;*
- minimise the risk of introduction of unwanted marine organisms.

The EPA has considered the potential impact on abundance, diversity and geographic distribution of marine fauna in the context of the extent of habitats in the Dampier Archipelago. In comparative terms, marine habitat loss seems small but the exact extent of potential impacts is difficult to estimate because of the limitations of available information. In addition to the direct loss of habitat by port and supporting infrastructure development, additional impacts may occur as a result of the disruption of water flow, direct discharge to the marine environment and spoil disposal.

Notwithstanding the relatively small loss of habitat, further information on marine species will be required to determine impact on fauna diversity. Comparative assessments will have to be undertaken to determine the significance and remaining representation of the six habitats predicted to be impacted should implementation of the concept proceed. Further the presence, or otherwise, of threatened or priority fauna and the location of Green Turtle nesting areas should be established.

Any port handling bulk cargoes is subject to potential contamination by exotic organisms from ballast waters. In Australia studies of this risk are being undertaken, and a strategy to limit the discharge of ballast waters near ports is in place (AQIS 1996) .

The EPA notes:

1. the preliminary nature of port location and design characteristics, and information on the marine environment;
2. that the marine environment in the study area is similar to that elsewhere in the Pilbara Coast;
3. the removal of what appears at this stage to be a relatively small area of shallow marine habitat;
4. implementation within Australian ports of the Australian Ballast Water Management Strategy, in addition to the development through the International Marine Organisation of a mandatory ballast water management code; and,
5. the commitments by LandCorp and/or DRD to minimise impacts on marine habitats and the turtle nesting areas.

In considering aspects of the marine fauna and threatened and priority fauna in this area, any future port proponent should take account of, but not be limited to:

Studies and further action to be undertaken by the Estate Manager/Port Authority

1. undertake detailed studies into the physical and biological characterisation of the coast, including accretion, erosion, longshore sediment transport and fauna such as utilisation of the area by dugong and turtle populations;
2. prepare a causeway option design study including a comprehensive analysis of environmental effects;
3. prepare a port design option study including a study of dredging spoil disposal and a comprehensive analysis of environmental effects;
4. prepare a Coastal Management Plan incorporating consideration of the above studies;
5. prepare a Port Management Plan including provision for the regular monitoring for introduced marine organisms.

Furthermore, the EPA advises that port or infrastructure proposals that may have the potential to impact on the marine environment will need to be referred to the Authority under section 38 of the Act.

Documentation produced for the purposes of a formal referral of the port development would have to show that the diversity of marine fauna species could be maintained, that rare and priority species will be protected and that accordingly, the impact on the marine habitat is relatively small. It is anticipated that this would encompass the design and location of structures to minimise impacts and avoid significant areas, and minimisation of reclamation.

Should the above occur and the identified management implemented, and providing any significant impact on turtle nesting or dugong feeding areas can be avoided, it is likely that implementation of the heavy industrial estate concept could be managed so as not to compromise the EPA's objective with regard to marine fauna and threatened and priority fauna.

3.4 System 8 area (8.5 Dampier Archipelago)

Aspects of System 8 area

EPA System 8 Redbook (EPA, 1975) recommended (recommendation 8.5) that the Dampier Archipelago area (refer Figure 6) should be declared a "Class A" reserve for Conservation of flora and fauna. The EPA concluded that the area should be managed in a way that recognised the multiple use of the islands and agreed that the purpose of conserving wildlife would be adequately served if access were permitted to a restricted number of islands provided one was left for wilderness.

The Dampier Archipelago area includes Intercourse Island, Haycock Island, West Mid Intercourse and West Intercourse Islands which are within the Concept Plan area.

In 1977 the Government decided that all the islands of the Dampier Archipelago, south of a line between Phillip Point and the southern tip of Eagle Hawk Island, should be exempted from the A Class category and made Class B so as to allow for their potential utilisation for industrial development. The islands in the Concept Plan area are south of this line.

The Minister for the Environment approved the Dampier Archipelago Nature Reserves Management Plan 1990 - 2000 (CALM 1990, see Fig 6). This Plan covers twenty five islands in the Dampier Archipelago. No islands in the Concept Plan area are subject to this plan.

The Report of the Marine Parks and Reserves Selection Working Group (CALM, 1994) has recommended that the waters of the Dampier Archipelago, including the waters and mangroves adjoining West Intercourse Island and the mainland industrial site, be set aside as a marine reserve.

Consideration

The area considered for this evaluation is the area comprising System 8 Area 8.5 Dampier Archipelago.

The EPA's objective in regard to this important environmental factor is to ensure that the EPA System 8 areas, as modified by the Government, are not compromised.

The Government's decision to allow for the potential industrial utilisation of the islands in the Concept Plan area for industry also recognised the conservation values of these islands by requesting Class B reservation for flora and fauna.

However the EPA, in consideration of the biogeography of island habitats, has some concern with the adequacy of a single island alone being set aside for the conservation of wildlife.

The EPA notes:

1. that there are previous Government decisions relating to the industrial use of islands which are the subject of System 8 area 8.5;
2. the approved Dampier Archipelago Nature Reserves Management Plan; and
3. the significant conservation values of the islands in the Concept Plan area.

In considering aspects of the System 8 area within the project area, any future proposal should undertake to confirm the number of islands requiring protection.

Studies and further action to be undertaken by the Proponent:

1. identify conservation values for offshore islands appropriate to meet System 8 recommendations;
2. demonstrate, for proposals affecting these islands, that areas of conservation significance have been avoided and all practicable measures have been taken to minimise impacts on conservation values established for the concept area, through an environmental impact assessment under Part IV of the *Environmental Protection Act 1986.*

Studies and further action to be undertaken by the Estate Manager

3. The estate manager, in consultation with CALM, shall determine the conservation status of wildlife representative of the Dampier Archipelago and subject to the recommendations of CALM (1994).

Furthermore, the EPA advises that the implementation of aspects of this concept that may have the potential to impact on the conservation value of System 8 areas must be undertaken in recognition of their current and proposed conservation status, and will need to be referred to the Authority under section 38 of the Act.

Should the above occur, and the identified management implemented, and providing any significant impact on designated islands contrary to their conservation value can be avoided, it is likely that implementation of the heavy industrial estate concept could be managed so as not to compromise the EPA's objective with regard to System 8 Area 8.5.

3.5 Terrestrial declared rare and priority flora and vegetation communities

Aspects of terrestrial declared rare and priority flora and vegetation communities

The mainland section of the Concept Plan area lies within the Pilbara Biogeographical Region (Thackway and Cresswell, 1995) and is shown in the insert in Figure 4. The vegetation of islands in the Concept Plan area is similar to that of the Burrup Peninsula. The humid climate and rock outcrops of the Dampier Archipelago provide elements of a tropical climate which

gives the area characteristics more typical of the North Kimberley Biogeographical Region (AGC Woodward Clyde, 1994a).

The plant communities of West Intercourse Island, south west Burrup Peninsula, West Mid Intercourse Island, Intercourse Island and the mainland component of the Concept Plan have been described by E.M. Mattiske & Associates (1994).

Other than mangroves, four vegetation communities, which are well represented elsewhere and which have been degraded by grazing, will be affected by the mainland industrial site and service corridors (Figure 4).

On West Intercourse Island, West Mid Intercourse Island and south west Burrup Peninsula the following four plant communities (in addition to mangroves) may be affected by the proposed service corridors and storage and industrial sites:

- Primary rock outcrops (of high relief) of hummock grassland and emergent shrubs- most of this association on the islands appears to lie outside areas intended for development (designation K6 in Figure 4);
- Secondary rocky slopes of hummock grassland with emergent shrubs - about half of this association on the islands appears to be outside areas intended for development (designation K7 in Figure 4);
- Sandy dunes of shrubs over hummock grasslands - the vast majority of this association on the islands appears to lie outside areas intended to be developed (designation K1 in Figure 4); and
- Drainage lines and narrow valleys of trees over hummock grasslands - the majority of this association on the islands appears to be within areas intended for development (designation K10 in Figure 4).

Three species of introduced flora were located in the study area (Mattiske, 1994). Each has the potential to rapidly colonise areas of disturbance.

Two priority species of flora (*Brachychiton acuminatis*; *Triumfetta appendiculata*) may be affected by the concept plan. LandCorp and DRD have committed to preparing an environmental management plan to minimise construction impacts on the priority flora. The plan will be prepared in consultation with and to the satisfaction of CALM. LandCorp, and subsequently the Management Body, will arrange for the control or removal of weeds, pests and diseases within the industrial estate. In addition, construction related traffic will be required to be cleaned and inspected prior to entering the Estate.

Public and government agency submissions felt that terrestrial biological surveys of the Concept Plan area were limited and did not assess the regional significance of the biological resources.

The introduction of weeds as a result of activity on these islands can lead to degradation of vegetation communities.

LandCorp and DRD have committed to the preparation of an environmental management plan to minimise adverse impacts on fauna habitats by staging vegetation clearing and landform modifications, minimising clearing, implementing traffic hygiene practices, and controlling and removing weeds, pests and diseases.

Consideration

The area considered for the evaluation of these environmental factors is the Maitland Heavy Industrial Estate Study Area within the broader Pilbara Biogeographical Region (Thackway and Cresswell, 1995) . This is a defined ecological region with similarities in climate, landforms, geology, soils and vegetation.

The EPA's objectives in regard to these environmental factors are:

- to protect rare and priority flora, in accordance with the provisions of the *Wildlife Conservation Act 1950*; and

- to maintain the abundance, diversity, geographic distribution and productivity of vegetation communities.

No declared rare flora species have been identified within the Concept Plan area.

One priority 4 species *Brachychiton acuminatus* has been recorded on West Intercourse Island, Mid West Intercourse Island and south west Burrup Peninsula. It occurs frequently over the Burrup Peninsula (70% of which has been set aside for conservation) and has been collected from other locations in the Pilbara. This species is associated with plant communities on the islands and, under worst case conditions and should full implementation of this concept take place, up to 50% of the known habitat may be lost.

One priority 3 species, *Triumfetta appendiculate*, has been recorded at several locations on south west Burrup Peninsula and West Intercourse Island in low rocky slopes.

Priority 4 species are designated by CALM as taxa which are considered to have been adequately surveyed and whilst being rare are not threatened by any identifiable factor. Priority 3 species are taxa known from several populations, at least some of which are not believed to be under immediate threat.

Native flora may be further stressed as a consequence of the distribution of introduced weed species. Measures to minimise the impacts of introduced weeds will need to be clearly described for proposals for industries, port or other infrastructure should the concept be implemented.

The conclusion that can be drawn from the preliminary site assessment carried out is that some locally significant flora, and probably fauna, occur in the concept area. If properly managed, and with the possible exception of *Brachychiton acuminatus* populations, this impact is unlikely to be significant on a Regional scale, and can be further minimised given the early stage in development of the Industrial Estate concept.

The EPA notes the:

1. representation of plant communities outside and unaffected by development in the Concept Plan area;
2. occurrence of priority 4 species, *Brachychiton acuminatus*, in areas outside and unaffected by development in the Concept Plan area;
3. limitations of flora surveys carried out to date;
4. commitments made by LandCorp and DRD with respect to priority species and weed and pest control; and
5. requirement that proponents of industries, port or other infrastructure proposals that may potentially impact on terrestrial declared rare or priority flora and vegetation communities should intensively survey the proposed concept area, and detail appropriate replacement or protection measures (together with the information below) in an environmental impact assessment under Part IV of the *Environmental Protection Act 1986.*

In considering aspects of terrestrial declared rare and priority flora and vegetation communities for the islands and south west Burrup Peninsula, for the EPA's objectives to be achieved, any future proposal should take account of, but not be limited to, the following:

Studies and further action to be undertaken by the Estate Manager

1. develop and implement a programme to control the introduction of weeds onto the estate;
2. rehabilitate areas disturbed during the construction phase;

Studies and further action to be undertaken by the Proponents

3. undertake detailed flora surveys and demonstrate how the survey results have been accommodated in project proposals;

4. take all practicable measures to avoid impacts on vegetation communities, particularly *Brachychiton acuminatus* populations;
5. protect rare or priority flora in accordance with the provisions of the *Wildlife Conservation Act 1950*; and
6. make a commitment to protect within the concept area, or otherwise replace terrestrial declared rare and priority flora and vegetation communities.

Furthermore, the EPA advises that the implementation of aspects of this concept that may have the potential to impact on the status of terrestrial declared rare and priority flora and vegetation communities will need to be referred to the Authority under section 38 of the Act.

Should the above occur, and the identified management implemented, and providing any significant impact on *Brachychiton acuminatus* or any other populations of terrestrial declared rare and priority flora and vegetation communities can be avoided, it is likely that implementation of the heavy industrial estate concept could be managed so as not to compromise the EPA's objective with regard this factor.

3.6 Terrestrial fauna and threatened and priority fauna

Aspects of Terrestrial fauna and threatened and priority fauna

Fauna habitats in the Concept Plan area have been described by Mattiske Consulting (1994).

The mainland component of the Concept Plan has been disturbed by pastoral grazing and fire and consequently is substantially devalued as a faunal habitat. In contrast the offshore islands and south west Burrup Peninsula are relatively unaffected and potential impacts on fauna will be more significant.

Migratory wading birds which use Dampier Salt Pond Zero and are protected under international agreements between Australia, People's Republic of China and Japan are not anticipated to be affected by the Concept Plan.

Haycock Island is recognised as a nesting area for the Bridled Tern which is listed under international treaties with China and Japan. However impacts on this nesting area will be avoided by reorientating the position of port option 3 (Figure 2). No other nesting sites for this species has been confirmed in the Concept Plan area (Astron Environmental, 1994), although Figure 12 in AGC Woodward Clyde (1994a) indicates Intercourse Island may also be a Bridled Tern nesting site.

Two bird species, the Peregrine Falcon and Grey Falcon, which are specially protected, fauna are rare visitors to the area and are not expected to be affected by the project.

The Pilbara Olive Python (subspecies of the widespread tropical Olive Python) is a specially protected fauna subspecies which is likely to be found inhabiting rock piles on West Intercourse Island.

Public and Government agency submissions were concerned that no systematic fauna survey was undertaken and that the Bridled Tern colony on Haycock Island may be severely impacted.

LandCorp and DRD have committed to the preparation of an environmental management plan to minimise adverse impacts on fauna habitats by staging vegetation clearing and landform modifications, minimising clearing, restricting access to sensitive fauna areas, traffic hygiene practices, and control and removal of weeds, pests and diseases.

Consideration

The area considered for the evaluation of these environmental factors is the Maitland Heavy Industrial Estate Study Area within the broader Pilbara Biogeographical Region (Thackway and Cresswell, 1995). This is a defined ecological region with similarities in climate, landforms, geology, soils and vegetation. Fauna and habitats are closely related with these factors.

The EPA's objectives for this important environmental factor are to:

- protect threatened and priority terrestrial fauna consistent with the provisions of the *Wildlife Conservation Act 1950*;
- maintain the abundance, diversity and geographical distribution of terrestrial fauna; and
- meet Australia's international agreements on migratory birds.

Any protected fauna within the Concept Plan area are protected by the requirements of the *Wildlife Conservation Act 1950.*

Should the concept be implemented, proponents of tenant industries, port or other infrastructure proposals will need to ensure that Australia meets its obligations under the Japan-Australia and China-Australia Migratory Birds Agreements (JAMBA and CAMBA), the Convention on the Conservation of Migratory Species (Bonn Convention) and the Convention on Wetlands of International Importance (Ramsar Convention).

Major disturbance of the habitat of the Pilbara Olive Python may lead to a decline in the population on the West Intercourse Island. Special attention will be needed in the development of the island to ensure protection of as much of the python habitat as possible. The Pilbara Olive Python occurs over the Burrup Peninsula (70% of which has been set aside for conservation) and has been collected from other locations in the region.

The EPA notes the:

1. statutory obligations under the Wildlife *Conservation Act 1950*;
2. commitment of LandCorp and DRD to minimise impacts on faunal habitats;
3. international agreements for the protection of migratory wading birds; and
4. requirement that proponents of industries, port or other infrastructure proposals that may potentially impact on terrestrial declared rare or priority flora and vegetation communities should detail such measures (together with the information below) in an environmental impact assessment under Part IV of the *Environmental Protection Act 1986*:

In considering aspects of terrestrial threatened and priority fauna and fauna for the islands and south west Burrup Peninsula, for the EPA's objectives to be achieved, any future proposal should demonstrate:

Studies and further action to be undertaken by the Proponents

1. that Bridal Tern nesting areas should be avoided;
2. that detailed faunal surveys have been conducted of the areas affected;
3. that threatened or priority fauna can be protected in accordance with the provisions of the *Wildlife Conservation Act 1950*;
4. a commitment to avoid areas of significant value, protect them within the concept area, or otherwise replace or relocate terrestrial fauna and threatened and priority fauna; and
5. special attention to be given to retain Pilbara Olive Python habitat on West Intercourse Island.

Should the above occur, it is likely that implementation of the industrial estate concept plan is capable of being managed so as not to compromise the EPA's objectives with regard to terrestrial fauna and threatened and priority fauna.

3.7 Air quality (including odours)

Aspects of air quality (including odours)

The land proposed for the Industrial Estate can accommodate a substantial buffer, the ocean and offshore islands to the north, Dampier Salt Pond Zero to the north east and east, and pastoral

properties to the south and west. The mainland site is 5km north of the Karratha Station homestead, the nearest residence.

Air quality investigations have not been carried out for the purposes of this advice, and will need to be carried out on an individual basis as industries seek environmental approval. Potential air emissions from industries that may establish in the Concept Plan area are generally described in AGC Woodward Clyde (1994a).

The EPA endorses a prescriptive approach to determine acceptable impacts from airborne discharges. Adoption of this approach requires simplifications and assumptions. In accordance with the "precautionary principle", such simplifications and assumptions are biased towards a conservative outcome.

Further, in assessing the acceptability of emissions to the atmosphere, the EPA uses four complementary criteria in its consideration:

- preventing pollution;
- minimising discharges;
- adoption of continuous improvement; and
- agreed emission levels and ground level criteria for air quality.

The Government has provided funding through the DEP to commence development of air quality management plans for industrial estates in the Pilbara, with work initially focussing on the Burrup Peninsula, and thereafter being extended to include the proposed Maitland and Boodarie Industrial Estates. The extent of the data gathered would be sufficient to allow for the determination of coastal fumigation conditions. This information will lead to the development of air quality management plans that is anticipated to include the following components:

- advice on relevant air quality standards;
- advice on air quality issues pertinent to industrial development within a particular estate;
- definition of buffer zones around and within the estate to limit the likelihood of unacceptable impacts;
- guidelines for siting particular types of industries in relation to their air quality impacts;
- comprehensive air quality and meteorological databases; and
- computer modelling capability for dispersion modelling.

The National Health and Medical Research Council (NHMRC, 1985) remains the primary reference for ambient atmospheric quality, pending the finalisation of a National Environmental Pollution Measure (NEPM) for air quality that will specify air quality goals for key pollutants. However in both the NHMRC and proposed NEPM measures, the criteria relate to human health and not the deleterious impacts on agricultural and horticultural plants.

Air quality criteria from stationary sources approved by EPA, as modified from time to time, are available from the Department of Environmental Protection.

The dispersion of air emissions is affected by the local meteorological conditions. Wind data records from the Bureau of Meteorology indicate that winds blow only occasionally from the mainland industrial site to the townships of Karratha and Dampier. This data is presented as an insert in Figure 1. Should poorly managed industrial development be allowed to proceed at West Mid Intercourse Island, air quality could be impacted in Dampier some 5.1 km distant. Distances from potential industrial development sites within the concept plan area to potentially sensitive sites are presented in Table 2.

The EPA is aware of the significance of shoreline fumigation and consequently the need to properly consider the effect of this phenomenon when assessing industrial development proposals.

Experience at Kalgoorlie and Kwinana shows that there will be a limit to the capacity of the local airshed to accommodate emissions from industry in the Concept Plan area. Available environmental documentation has not included the results of any mathematical modelling of the dispersion of air emissions from the Concept Plan area.

Statutory requirements for controlling air emissions are included under Part V of the *Environmental Protection Act 1986.*

Public and Government agency submissions maintained that baseline monitoring and modelling of air quality was required.

LandCorp and DRD or any subsequent Estate Management Body are committed to supporting air quality monitoring programs in accordance with the requirements of the EPA.

Consideration

The area considered in the evaluation of this factor is the Concept Plan (including buffer area) and surrounding land uses.

The EPA objective in regard to this factor is to ensure that emissions of gases, particulates and odours conform with agreed standards and criteria and does not cause health, amenity or environmental problems.

The EPA has an expectation that best practice environmental management of atmospheric emissions will be employed.

The pattern of prevailing winds, distance from the townships of Karratha and Dampier, and an offsite buffer area of 1 km around the mainland industrial site will mitigate the impact of air emissions.

The EPA notes the:

1. favourable location of particularly the mainland site, in terms of distance and prevailing meteorology in relation to Dampier and Karratha;
2. the establishment of an appropriate buffer zone;
3. commitments made by DRD and LandCorp to establish an Industrial Estate Management Body;
4. lack of dispersion modelling of air emissions;
5. commitments by LandCorp and DRD and the subsequent Estate Manager to design, undertake and report on monitoring of cumulative impacts in consultation with the DEP;
6. requirement for industries of a prescribed nature to apply for and if appropriate be issued an operating licence subject to acceptable continuing performance; and
7. the requirement for any industry wishing to establish at the site to refer the project to the EPA pursuant to Part IV of the Act.

In considering aspects of gaseous emissions, any future proposal should take account of, but not be limited to, the following:

Studies and further action to be undertaken by the Estate Manager:

1. support or undertake as applicable the design and implementation of air quality management plan which will monitor air quality parameters outside the industrial park, including impacts on vegetation, and that it be utilised to secure an adequate buffer around the proposed site;
2. develop a dispersion model, verified for local conditions, to model likely impacts from proposals and continually assess the impact of new industries wishing to establish on site to maintain air quality in the core industrial area, buffer zones and adjacent land;

3. design and implement cumulative impacts monitoring sufficient to protect the environment and human health, and establish the capacity of the local air shed to accommodate air emissions.

Studies and further action to be undertaken by the Proponents:

4. monitor and report on air emissions from individual plants using the dispersion model developed in 2 above.

Should the above occur, it is likely that implementation of the industrial estate concept plan is capable of being managed so as not to compromise the EPA's objective with regard to air quality.

3.8 Greenhouse gases

Aspects of greenhouse gases

The potential air emissions from industries that may establish in the Concept Plan area are described in general terms in AGC Woodward Clyde (1994a). Given the nature of these potential industries, greenhouse gas emissions are expected to be substantial.

Carbon dioxide (CO_2), a greenhouse gas, is produced in combustion processes.

In regard to greenhouse gases, the EPA has adopted the following provisional policy:

- proponents should calculate the greenhouse gas emissions associated with their proposal (preferably using methodology developed for Australia);
- proponents should indicate specific measures adopted to limit greenhouse gas emissions for their proposal;
- proponents are encouraged to enter into the C21 'Greenhouse Challenge' voluntary agreement programme for the estimation, reporting and auditing of greenhouse gas emissions, whether on a project-specific basis, company-wide arrangement or within an industrial grouping, as appropriate; and
- proponents should estimate the global emission credit (greenhouse gas offsets) achieved through implementation of the proposal.

The Commonwealth has urged a programme of co-operative agreements between industry and the government to reduce greenhouse emissions. The Intergovernmental Committee on Ecologically Sustainable Development (ICESD) has prepared a discussion paper on the National Greenhouse Strategy (ICESD 1997). The paper notes that Australia, although producing less that 2% of the world's anthropogenic greenhouse gas emissions, is one of the biggest emitters on a per capita basis.

The 1997 Strategy recognises the importance of effective monitoring and review and contains measures that ensure progress against specific greenhouse gas objectives and actions, including CO_2 emission rates and mass quantities, is clearly stated, regularly reported and accessible. Proposed objectives include that Australia's greenhouse inventories reflect best practice, present opportunities for limiting the contribution to greenhouse gas generation from the transport sector and strategies for reducing non-energy related emissions from industrial sources.

These objectives will progressively be implemented as the strategies are further developed.

Consideration

The impacts of these gases are of a global scale and are not restricted to the local or regional environment.

The EPA's objective in regard to this environmental factor is to ensure that greenhouse gas emissions are reduced as far as practicable and comply with EPA policy.

The EPA notes:

1. Australia's obligations under international agreements;
2. the significant potential for greenhouse gas emissions from the Concept Plan area;
3. requirement that proponents of industries, port or other infrastructure proposals that may potentially impact on greenhouse emissions should describe their likely impact (together with the information below) in an environmental impact assessment under Part IV of the *Environmental Protection Act 1986.*

In considering aspects of greenhouse gas emissions, any future proposal should take account of, but not be limited to, the following:

Studies and further action to be undertaken by the Proponents

1. determine the quantity of greenhouse gases produced and identify measures adopted to limit greenhouse gas emissions from the project;
2. during operation and using the generally accepted methods, report greenhouse gas emissions associated with their proposal to the DEP; and
3. report on the comparative greenhouse gas efficiency of the proposal (per unit of product and/or other agreed performance indicators) with the efficiency of other comparable projects producing a similar product.

Furthermore the EPA advises that industrial operators should consider entry (whether on a project-specific basis, company-wide arrangement or within an industrial grouping, as appropriate) into the Commonwealth Government's "Greenhouse Challenge" voluntary cooperative agreement programme, or any subsequent programme which is adopted as a consequence of the outcomes of the National Greenhouse Strategy (ICESD 1997). The EPA considers any reports required under such agreements should satisfy the above reporting requirements to DEP.

Should the above occur, it is likely that implementation of the industrial estate concept plan is capable of being managed so as not to compromise the EPA's objective with regard to greenhouse gas emissions.

3.9 Dust and particulate emissions

Aspects of dust and particulate emissions

Dust emissions may arise from construction activities, loading, conveying, stockpiling and transport of dusty materials such as iron ore, and plant operation. The information provided in Section 3.7 is relevant to this factor.

The concept plan area consists of clayey silts and red-brown silty sands for the bulk of the industrial estate, with massive granite and gabbro outcrops forming the bulk of the island development sites, in a low to medium rainfall area.

The mainland portion of the concept plan area is located more than 15 km from the Karratha Townsite. An indication of the dominant wind direction to impact on the townships of Karratha and Dampier and their relative percentage of occurrence is presented in Table 2.

The most significant potential environmental impact of dust emissions is on vegetation, particularly mangroves. Further consideration will need to be given to the potential impact of both construction and operational dust on the adjoining Dampier Salt solar salt pond.

Current meteorological and dust monitoring within the Karratha region includes:

- Bureau of Meteorology Automatic Weather Stations at the Karratha Airport and Legendre Island;

- total suspended particulates (TSP) at a number of sites in Dampier;
- two TSP monitoring sites managed by Dampier Salt.

Table 3, taken form WNI Science and Engineering 1996, presents measured annual dust concentrations for four dust monitoring stations in the Karratha area. The interpretation of results presented in this review is that annual dust measurements are well below the indicated EPA criteria of 90μg/m^3 (EPA 1992a). No measurements have been undertaken on the proposed Maitland site.

Iron ore and gas processing facilities on the Burrup Peninsula have been monitoring dust, meteorological parameters and air contaminants for many years. The results of this monitoring suggest that air quality in the region is acceptable.

Table 3, taken form WNI Science and Engineering 1996, presents measured annual dust concentrations for four dust monitoring stations in the Karratha area. The locations of the dust monitoring stations are indicated in Figure 1.

Table 3. Measured annual dust concentrations and annualised exceedences of 90 μg m^{-3} level for 1994 and 1995.

Location	**Annual Average (μg m^{-3})1**		**Annualised Exceedences of 90 μg m^{-3}**		**Maximum (μg m^{-3})**	
	1994	1995	1994	1995	1994	1995
Lower Dampier	57	46	65	26	181	118
Upper Dampier	39	35	18	18	122	108
Karratha	-	41[2]	-	12[2]		114[2]
Karratha Station	-	61[3]	-	32[3]		206[3]

notes

1. The WA Environmental Protection Policy (Atmospheric Wastes) Kwinana (EPA 1992a) specifies an ambient dust limit (averaged over 24 hours) for land used predominantly for residential and rural purposes (Area C) of 150μg/m^3 with a standard (a concentration which is desirable not to exceed) of 90μg/m^3.
2. Karratha measurements based on composite 1994 and 1995 (June 1994 to May 1995).
3. Karratha Station based on December 1994 to November 1995.
4. Upper Dampier excludes 1 high event on 18 December 1995 due to local clearing and maintenance.
5. modified from WNI Science and Engineering (1996).

Interpretation of results presented in this review indicate that annual average dust (total suspended solids) measurements are well below the indicated EPA annual criteria of 90μg/m^3 (EPA 1992a). Dust generation at the Karratha Station site are not caused by industrial activity. No measurements have been undertaken on the proposed Maitland site.

The outcome of the Government funded initiatives for air quality monitoring in the Pilbara region described in Section 3.7 will have implications on the management of dust.

The National Health and Medical Research Council (NHMRC, 1985) remains the primary reference for ambient atmospheric quality, pending the finalisation of a National Environmental Pollution Measure (NEPM) for air quality that will specify air quality goals for key pollutants.

The WA Environmental Protection Policy (Atmospheric Wastes) Kwinana (EPA 1992a) specifies an ambient dust limit (averaged over 24 hours) for land used predominantly for residential and rural purposes (Area C) of 150µg/m^3 with a standard (a concentration which is desirable not to exceed) of 90µg/m^3. Dust guidelines have been developed for and applied to development sites through Part V of the Act (DEP, 1996a).

The EPA has recently given approval for the implementation of a dust management programme at Finucane Island and Nelson Point, to address dust concerns at Port Headland (EPA, 1996).

DRD and LandCorp have made dust management commitments for site development activities to ensure contractors control dust emissions in accordance with DEP guidelines (Woodward-Clyde, 1994a). These measures include minimising the clearing of land, rehabilitation, wetting dusty surfaces and avoiding unnecessary machinery movements.

Individual industrial activities will be responsible for the management of potential dust sources on their premises. Best practice identifies avoidance of generation of dust and containment of dust sources as preferred strategies to dust suppression strategies.

Statutory requirements for controlling dust emissions are included in Part V of the *Environmental Protection Act 1986.*

Several submissions expressed concern about potential fugitive emissions of dust from stockpiles and conveyors.

Consideration

The area considered in the evaluation of this factor is the Estate area (see Figure 2). This is the area in which dust emissions have to be controlled to meet appropriate standards.

The EPA's objective in regard to this environmental factor is to protect the surrounding land users such that dust and particulate emissions will not adversely impact upon their welfare and amenity or cause health problems and that they meet Department of Environmental Protection (DEP) Guidelines for land development sites and impacts on air quality guidelines (DEP 1996a), and the Environmental Protection Policy (Atmospheric Wastes) Kwinana.

Further consideration will need to be given to the potential impact of both construction and operational dust on the adjoining Dampier Salt Pond Zero.

Whilst the poor implementation of this concept plan could lead to dust fall beyond the industrial core, it is likely that this could be managed to meet reasonable expectations through the application of best management practices and enforcement of statutory requirements.

The EPA notes the:

1. location of the site, nature of underlying soils and prevailing wind direction and strengths;
2. with the exception of the conveyor corridor adjacent to Dampier Salt's Pond Zero, a general conservative approach to dust nuisance through the establishment of an appropriate buffer zone;
3. requirement by any industry wishing to establish at the site to refer the project to the EPA pursuant to Part IV of the Act;
4. commitments made by LandCorp/DRD to establish an Industrial Estate Management Body; and
5. requirement for industries of a prescribed nature to apply for and if appropriate be issued an operating licence under Part V of the Act, subject to acceptable continuing performance.

In considering aspects of dust and particulate emissions, any future proposal should take account of, but not be limited to, the following:

Studies and further action to be undertaken by the Estate Manager:

1. establish, prior to implementation, the baseline data, and undertake monitoring of dust levels from the cumulative effects of the Estate's activities;

2. implement a dust management plan during construction phase;
3. determine the requirements for protection of mangroves and salt ponds;

Studies and further action to be undertaken by the Proponents:

4. dust management measures with particular emphasis on avoidance and best practice containment will need to be assessed on a case-by-case basis for individual industries by the EPA pursuant to Part IV and/or to Part V of the *Environmental Protection Act 1986* and demonstrate whether the EPA's objective will be achieved; and
5. consider and implement dust management measures, including the location of dust sources, to minimise dust impacts on mangroves.

Should the above occur, it is likely that implementation of the industrial estate concept plan is capable of being managed so as not to compromise the EPA's objective with regard to dust.

3.10 Noise and vibration

Aspects of Noise and vibration

The generation of noise from site development activities is described in AGC Woodward Clyde (1994a). No prediction of noise at the concept Estate area boundary has been made.

The Maitland Heavy Industrial Concept site is situated in a rural environment with low background noise levels. No noise level determinations have been reported for the concept area. The most significant noise is presently from traffic along the North-West Coastal Highway. Where this is not a dominant influence, night-time background noise levels under calm weather conditions are likely to be low.

Noise levels for projects within Western Australia are subject to the Noise Abatement (Neighbourhood Annoyance) Regulations 1979, which are at present the prescribed standard for noise under the Act . New Environmental Protection (Noise) Regulations are likely to be in force in the event that implementation of this industrial estate proceeds.

The maximum allowable noise levels during the most sensitive time for residences around the proposed industrial estate would be in the range 35 to 40 dB(A), dependent on additional adjustment for tonal components. Karratha Station is the nearest noise sensitive premises to the concept plan area is located more than 5 km the south east (see Figure 1). A 1 km offsite buffer area is proposed and is incorporated in the designated areas indicated in Figure 2.

In considering the more conservative proposed Environmental Protection (Noise) Regulations, more stringent noise criteria will be applied to proponents wishing to establish at the site.

Noise management will primarily be the responsibility of individual operators within the Concept Plan area. LandCorp and DRD have committed to, in consultation with the DEP and other relevant agencies, to design and implement an appropriate noise monitoring programme to monitor cumulative noise impacts in the estate development.

Notwithstanding the considerable separation to the nearest noise sensitive premises, the EPA endorses the adoption of best practice for noise management at this site.

Consideration

The area considered in the evaluation of this factor is the Estate area (see Figure 2),and surrounding areas including residences and outdoor recreation areas.

The EPA's objective in regard to this important factor is to protect the amenity of nearby residents from noise and vibration impacts by ensuring that noise and vibration meet criteria in the Noise Abatement (Neighbourhood Annoyance) Regulations 1979 and the new proposed Environmental Protection (Noise) Regulations (when promulgated).

The EPA notes the:

1. location of the site, wind strength, direction and prevailing meteorology;
2. establishment of an appropriate buffer zone;
3. requirement by any industry wishing to establish at the site to refer the project to the EPA pursuant to Part IV of the Act;
4. commitments made by LandCorp/DRD to establish an Industrial Estate Management Body; and
5. the requirement for industries of a prescribed nature to apply for and if appropriate be issued an operating licence under Part V of the Act subject to acceptable continuing performance.

In considering aspects of noise and vibration, any future proposal should take account of, but not be limited to, the following:

Studies and further action to be undertaken by the Estate Manager:

1. undertake additional noise emission modelling as input to the identification of and securing of the estate buffer;
2. develop and implement a programme of monitoring by the Estate Manager/Industry Management Body to assess cumulative noise impacts;

Studies and further action to be undertaken by the Proponents:

3. assess the noise from the industrial plant proposed for the industrial estate and demonstrate compliance with noise criteria; and
4. assess transport infrastructure including road, rail and bulk conveyors relevant to their proposal for environmental impacts and mitigate adverse effects; and
5. examine best practice management with respect to noise; and
6. comply with Environmental Protection (Noise) Regulations.

Should the above occur, it is likely that implementation of the industrial estate concept plan is capable of being managed so as not to compromise the EPA's objective with regard to noise and vibration.

3.11 Surface water, marine water and sediment quality

Aspects of surface water, marine water and sediment quality

Some surface run-off is inevitable within plant sites where the sandy soils are covered with impervious materials (buildings, bitumen pavement, etc).

Changing surface water drainage patterns and quality may impact on mangroves and marine water and sediment quality. Modifications will be made to the surface drainage such that there will be no direct discharge of drainage or wastewater to the Maitland River from the mainland industrial site. The discussion in Section 3.12 is also relevant to this factor.

The proposed mainland industrial estate is dissected by a number of small ephemeral streams, mostly running north west. The Maitland River is located approximately 1 km to the west of the site and, together with the ephemeral surface water channels that dissect the proposed mainland corridor route, flows following heavy rain. Small ephemeral streams are also a feature of the Burrup Peninsula site and offshore islands. Surface hydrological features are indicated in Figure 7 of AGC Woodward Clyde (1994a).

The surface drainage characteristics from the mainland industrial site have been reviewed by Jim Davies & Associates (1994). This review makes recommendations for the management of onsite drainage including:

- diversion of northern draining catchments from the southern low hills at the North West coastal highway to the Maitland River;
- diversion of the north-west draining creek from the industrial site to the north so as to reduce the potential for contamination to Dampier Salt's Pond Zero;
- construction of a levee, the characteristics of which will be determined by hydraulic backwater modelling, along the western site boundary to prevent stormwater from the Maitland River entering the mainland industrial site.

The subsequent surface drainage system installed at the mainland industrial site will include provision for capturing runoff and treating contaminated water onsite before discharge.

The surface drainage characteristics of the offshore islands in the Concept Plan area are described generally by AGC Woodward Clyde (1994a). Drainage catchments on the islands are small and there is little contribution to these catchments outside the nominated industrial sites.

The environmental values (beneficial uses) of the marine waters of the Dampier Archipelago are listed in AGC Woodward Clyde (1994a). The spatial application of these values has yet to be determined.

Water quality (including stormwater) which leaves the site should meet the ANZECC (1992) and Draft Western Australia Guidelines for Fresh and Marine Waters (EPA, 1993).

The Southern Metropolitan Coastal Waters Study, 1996 (DEP, 1996b) also specifies marine water and sediment quality criteria that protect environmental values of the marine environment.

LandCorp and DRD have committed to maintaining surface drainage features wherever practicable, however it is clear that significant drainage works will need to be undertaken.

The marine water quality in the Dampier locality is regarded as high, as is most of the Western Australian coast. However, the clarity of the water is affected through natural high turbidity to which the biota have adapted. Although there have not been any regional surveys of marine habitats in the area, localised surveys of specific sites have been undertaken by industry and researchers. An overview is presented in AGC Woodward Clyde (1994a).

The new harbour development can significantly affect the marine water quality through operational procedures and should accidental discharges, spillages or other incidents likely to cause water contamination occur.

Oil spills and accidental discharges from ships are the most likely means of water contamination, but these will be controlled through port authority regulations and the MARPOL Convention.

With regard to the management of oil spills, Australia has in operation a *National Plan to Combat Pollution of the Sea by Oil*, implemented through the Australian Maritime Safety Authority (AMSA) in association with respective port authorities. There are international arrangements also enabling access to additional equipment and expertise from overseas should a major oil spill incident arise (ANZECC 1996).

Local water quality in the concept area may be affected during the construction of a loading facilities and service corridors due to the need to construct berthing facilities and dredge the harbour basin or approach channels.

It is expected that any dredging either of the harbour basin or of a shipping channel, for whichever option is chosen, will be undertaken in accordance with the Draft Guidelines on the Disposal of Dredged and Excavated Material (ANZECC, 1997), refer section 3.12 below.

Should loading facilities be developed in the concept area, a requirement for the Port Authority will be to maintain the water and sediment quality within the harbour and to ensure that cargo handling is undertaken efficiently and cleanly through best practice. Issues relating to the introduction of marine organisms and ballast water management are presented in Section 3.3.

Individual industries will be responsible for the management of onsite drainage waters and wastewaters.

Statutory requirements for controlling pollution of waters are included in Part V of the *Environmental Protection Act 1986.*

Consideration

The areas considered in the evaluation of this factor is the Maitland Heavy Industrial Estate Study Area, catchments and adjacent near-shore marine environments to which they drain.

The EPA's objectives in regard to this environmental factor are:

- for marine, surface and wastewaters to meet the requirements of the Australian Water Quality Guidelines for Fresh and Marine Waters (ANZECC, 1992);
- in the longer term, to consider management of the port's waters and sediments based on the environmental quality objectives (EQO's) and environmental quality criteria (EQC's) from the Southern Metropolitan Coastal Waters Study (1996), as they arise;
- to ensure that alterations to surface water drainage do not adversely impact indigenous vegetation.

Although the EPA has not developed sediment criteria as yet, it recognises the need to develop criteria in the near future.

The development of a port in the waters of the concept area has the potential to significantly affect water quality. Any deterioration of water quality will effect the surrounding marine ecosystem. The designated Port Authority should be responsible for the management of the water column both within the port precinct and the adjacent designated waters.

The EPA notes the:

1. hydrological characteristics of the subject land;
2. surface management commitments of LandCorp/DRD;
3. requirement by any industry wishing to establish at the site to refer the project to the EPA pursuant to Part IV of the Act;
4. management of any associated port facility by a designated Port Authority;
5. commitments made by LandCorp to establish an Industrial Estate Management Body; and
6. the requirement for industries of a prescribed nature to apply for and if appropriate be issued an operating licence under Part V of the Act subject to acceptable continuing performance.

In considering aspects of surface waters, any future proposal should take account of, but not be limited to, the following:

Studies and further action required by Proponents:

1. demonstrate that the operation of an industry (with the potential to pollute surface water) will not have a significant impact on surface water, marine water or sediment quality, prior to approval being given. Appropriate management and monitoring will be required.

Studies and further action to be undertaken by the Estate Manager:

2. establish baseline marine water and sediment quality in the Concept Plan area and its surroundings prior to implementation of the Concept Plan;
3. determine the environmental values of potentially impacted floral and faunal communities, determine their spatial boundaries and regional representation, and how they will be affected by changes in the surface hydrology as a consequence of the implementation of the concept plan; and
4. refer agreed spatial arrangement of environmental values to the EPA for consideration.

Studies and further action to be undertaken by the Port Authority

5. collect baseline data on water and sediment quality in the port area;
6. develop and implement a Marine Management Plan which would provide details of and procedures for the regular monitoring of the harbour and surrounding waters and sediments.

Should the above occur, it is likely that implementation of the industrial estate concept plan is capable of being managed so as not to compromise the EPA's objective with regard to surface water.

3.12 Turbidity

Aspects of Turbidity

The turbidity characteristics of the Dampier Archipelago have been described by Forde (1985).

The proposed port facilities and service corridors are located in areas where marine biota are relatively tolerant to temporary increases in turbidity as a result of naturally occurring events such as river flooding or cyclones. The dispersion characteristics of the area are favourable given that the area is subject to tidal current movements (AGC Woodward Clyde, 1994a).

Sedimentation and turbidity increases can result from a number of activities associated with this project. These include:

- direct and indirect effects of dredging the harbour channel and turning circle;
- direct and indirect effects of construction of the loading facilities;
- indirect effects of ship movements during the operation phase of the project;
- dust spillage from the loading operations associated with the operating phase of the project; and
- increased turbidity of stream flow discharging into the near shore marine environment as a consequence of land disturbance associated with the construction phase of the project.

Dredging associated with the construction of port facilities is likely to result in temporary increases in turbidity and is likely to impact directly or indirectly on:

- benthic communities in deepwater areas that have a widespread distribution and consist of ephemeral and mobile fauna; and
- coral and algae habitats in shallow waters adjoining islands which are well represented through out the Dampier Archipelago and the region (Astron Environmental, 1994).

Studies conducted in relation to dredging undertaken in Mermaid Sound for the Woodside LPG Project have shown that sedimentation has a relatively minor effect on coral numbers and percentage cover (Dames and Moore 1995). These studies further indicated that rates of sedimentation returned to normal levels within three weeks of dredging being completed. Information obtained on coral health and mortality showed that short to mid term coral mortalities due to dredging plumes were minor and spatially limited to locations less than 1.5km from the dredging site.

Dredge spoil disposal will require Commonwealth approval. Port development options and channel dredging requirements will be subject to further investigation by the proponent prior to the finalisation of any firm development proposals may include a relatively short extension of the Hamersley Channel (AGC Woodward Clyde, 1996).

It is expected that any dredging either of the harbour basin or of a shipping channel, for whichever option is chosen, will be undertaken in accordance with the Draft Guidelines on the Disposal of Dredged and Excavated Material (ANZECC, 1997). In particular those guidelines

take their genesis from the Australian *Environment Protection (Sea Dumping) Act 1981*, which provides compliance within Australian waters to the International Dumping Convention 1972 (London Convention). Further, turbidity levels should meet agreed criteria suitable for the area (that protect agreed environmental values) in accordance with the methodology described in the Southern Metropolitan Coastal Waters Study (DEP, 1996b).

DRD and LandCorp have committed to:

- refer individual port proposals to EPA for assessment; and
- prepare an environmental management plan to minimise the impact of dredging.

Consideration

The area considered in the evaluation of this factor are both the marine water in and surrounding the Concept Plan area, and any additional spoil dumping ground identified for the purpose. This is the area within which turbidity must be controlled to acceptable standards.

The EPA's objective in regard to this factor, as outlined in the Southern Metropolitan Coastal Water Study, is to maintain turbidity levels from construction and operation of port activities to accepted criteria to protect agreed environmental values (DEP, 1996b).

The EPA notes:

1. that the marine biota are likely to be naturally adapted to temporary increases in turbidity;
2. that there may be a relatively small amount of dredging in a restricted area;
3. accordingly that there is likely to be a relatively small amount of marine habitat affected;
4. the commitments of LandCorp and DRD;
5. that proponents of port or other infrastructure proposals which may potentially increase turbidity in the marine environment, should detail such measures (together with the information below) in an environmental impact assessment under Part IV of the *Environmental Protection Act 1986*.; and
6. requirement for Commonwealth approval for spoil disposal to ensure compliance with the International Dumping Convention 1972.

In considering aspects of turbidity, any future proposal should take account of, but not be limited to, the following:

Studies and further action to be undertaken by the Estate Manager/Port Authority:

1. collect and analyse baseline water quality information;

Studies and further action to be undertaken by the Proponent/Port Authority

2. prepare a map of the marine habitats and their significance;
3. analyse the results of modelling of tidal flows and incorporate the implications for dredging management;
4. identify potential dredge spoil disposal areas and demonstrate their compliance with international requirements for spoil disposal through the Commonwealth approval process;
5. establish environmental quality objectives and relevant water and sediment quality criteria relevant to the local marine environment;
6. prepare an Environmental Management Programme outlining environmental management measures to achieve identified objectives; and
7. develop contingency plans when environmental water quality objectives may not be met.

Should the above occur, it is likely that implementation of the industrial estate concept plan is capable of being managed so as not to compromise the EPA's objective with regard to turbidity.

3.13 Liquid and solid wastes

Aspects of liquid and solid wastes

The information presented in Section 3.11 is also relevant to this factor.

Disposal of liquid and solid waste on site via any mechanism has the potential to pollute groundwater and to a lesser extent surface waters. A key environmental consideration will be the safe disposal of such materials.

The type of wastes that may be generated from site development are described in AGC Woodward Clyde (1994a). LandCorp and DRD have made commitments to ensure that wastes or hydrocarbon contaminated soil generated from site development activities, will be contained and removed for offsite disposal or recycled at approved locations. Onsite disposal of solid or liquid waste during construction will not be permitted.

The initial document submitted to the EPA indicates that each industry will be responsible for the management of wastes generated, although depending on the industries eventually accommodated, a centralised wastewater treatment facility may be considered.

The EPA is developing an Environmental Impact Assessment Policy with respect to waste management with the aim to minimise the quantity and hazard level of wastes produced and ensure that any waste that is produced is managed in a manner which prevents adverse environmental impacts. A hierarchal structure for waste management is endorsed, namely that proposals should deal with the management of wastes as described below:

- avoid the production of waste;
- minimise the quantity of waste produced;
- recycle waste whenever possible;
- treat wastes to produce useful materials or to reduce the level of hazard posed by a waste; and as a last option
- Dispose of any residual waste in a manner which prevents unacceptable environmental impacts.

Where solid waste cannot be recycled or treated on-site, the estate manager has indicated a preference to remove it to an industrial landfill. In this respect options may include the Shire of Roebourne's 7 Mile Waste Management Facility, which may accept sludges subject to chemical testing.

The DEP has advised that it may be possible for industries to dispose of all solid wastes at the 7 Mile facility in the short to medium term, however, investigations should be undertaken for long term solutions.

Accordingly the DEP is investigating several secure landfill opportunities in the Pilbara area and has already commissioned a report to this end. In the Pilbara region, a specific proposal to establish a secure landfill may result prior to the implementation of the concept plan.

The classification system and waste acceptance criteria for landfill disposal sites are described in a report titled *Waste Acceptance Criteria for Landfills in Western Australia* (DEP, 1996c).

Public submissions expressed concern about the hazards of onsite evaporation ponds.

Statutory requirements for controlling disposal of wastes are included in Part V of the *Environmental Protection Act 1986* and the *Health Act 1911-1979.*

Consideration

The area considered in the evaluation of this factor is the Concept Plan area and the surrounding region. This is the area within which wastes will require treatment and/or disposal.

The EPA's objective in regard to this environmental factor is to ensure wastes are managed in accordance with the waste management hierarchy (i.e. avoid, minimise, recycle, treat and dispose), and where this is not possible, are contained and isolated from ground and surface waters, and that discharges meet the requirements of ANZECC (1992) and Draft Western Australia Guidelines for Fresh and Marine Waters (EPA, 1993).

The application of waste minimisation practices is anticipated for all activities on the concept area.

The EPA cannot forecast the specific industries likely to establish in the Maitland Estate Concept area, and accordingly cannot predict liquid and solid waste disposal requirements.

The EPA notes:

1. that regional disposal facilities for solid wastes are limited in the long term;
2. the Government initiatives to identify and develop appropriate secure landfill sites in the region;
3. the requirement by any industry wishing to establish at the site to refer the project to the EPA pursuant to Part IV of the Act;
4. the commitments made by LandCorp/DRD to establish an Industrial Estate Management Body; and
5. the requirement for industries of a prescribed nature to apply for and if appropriate be issued an operating licence under Part V of the Act subject to acceptable continuing performance.

In considering aspects of liquid and solid waste, any future proposal should take account of, but not be limited to, the following:

Studies and further action to be undertaken by the Estate Manager:

1. consider in association with Government initiatives in the region, a liquid and solid waste management strategy for the industrial estate, for those industries requiring liquid and solid waste disposal;

Studies and further action to be undertaken by the Proponents

2. apply best practice waste management principles; and
3. develop a strategy for solid and liquid waste disposal, with resolution of this issue prior to the proponent establishing on the site.

Should the above occur, it is likely that implementation of the industrial estate concept plan is capable of being managed so as not to compromise the EPA's objective with regard to liquid and solid wastes.

3.14 Public health and safety

Aspects of public health and safety

The industries that may potentially establish in the Concept Plan area are described in AGC Woodward Clyde (1994a) and summarised in Chapter 2. There has been no risk assessment of the site.

The Concept Plan area is located more than 5km from the nearest residential premises and a 1km offsite buffer area is proposed.

In EPA Bulletins 611 and 627, the EPA has established management principles and acceptable criteria for off-site individual fatality risk (EPA, 1992b and 1992c) for new industrial developments with a potentially hazardous nature.

Although the EPA has not yet established any criteria for societal risk, it recognises the need to develop these criteria in the near future.

LandCorp and DRD in their initial document submitted to the EPA stated that it was unlikely that public risk would be of concern during the construction phase of the concept. As a location for heavy industry, Maitland should be capable of accommodating those industries classed as hazardous in terms of their operating processes.

Risk assessment will be required for specific industries of a hazardous nature wishing to establish in the industrial core. If the concept plan is implemented, ongoing safety will be maintained through management of operations of high risk industries in accordance with an approved Total Hazard Control Plan administered by the Department of Minerals and Energy (DME).

Risk assessments by individual industries will be complemented by ongoing cumulative risk assessments by the DME. This will provide the basis to ensure that both individual and cumulative impacts are contained within EPA criteria.

It is further anticipated that risk assessments will be carried out for storage facilities at the proposed Port.

The results of the risks and hazards assessment should be measured against EPA criteria relating to residential precincts (EPA, 1992b). Based on these criteria, suitable zones for high, medium and low risk industries within the Concept area could be determined, and used by the Estate Managers as a planning tool to enable suitable location of individual industries.

Public submissions indicated that this factor should have been addressed in detail in the original PER.

Consideration

The area considered in the evaluation of this factor is the Estate area and its surroundings. This is the area within which risk levels must be reduced to acceptable levels.

The EPA's objective in regard to this environmental factor is to ensure that public risk associated with implementation of the Concept are as low as is reasonably achievable and in compliance with the criteria detailed in EPA Bulletins 611 and 627. If the concept plan is implemented, societal risk evaluations should be undertaken for each hazardous industry seeking involvement. The assessment should follow the guidelines described in the report *Public risk criteria for the Kwinana Area* which was prepared by Technica Pty Ltd in 1990 for the EPA, or as modified from time to time.

In considering the impact of the proposed change in land use the EPA recognises that most heavy industrial estates generate some level of public risk. The EPA cannot forecast the specific industries which would propose to establish in the estate. It is therefore difficult to estimate the levels of risk which may be associated with those industries. However, the EPA has set down criteria for risks and hazards (EPA, 1992b) to protect surrounding residents and to ensure that industries do not significantly impact on each other.

The EPA notes the:

1. relative remote location of the concept plan site;
2. establishment of a buffer zone;
3. requirement by any industry wishing to establish at the site to refer the project to the EPA pursuant to Part IV of the Act; and
4. statutory requirement for hazardous industry to comply with the requirements of the DME.

In considering aspects of public health and safety, any future proposal should take account of, but not be limited to, the following:

Studies and further action to be undertaken by the Estate Manager:

1. coordinate a cumulative risk and hazard analysis for the Estate when each new industry, which has the potential to generate risk, is proposed, and develop and implement an on-going programme for the determination of cumulative risk and societal risk;

Studies and further action to be undertaken by the Proponents:

2. undertake a risk and hazard analysis for presentation to the EPA for each new industry which has potential to generate risk, when it is proposed; and
3. assess societal risk following accepted guidelines.

Should the above occur, it is likely that implementation of the industrial estate concept plan is capable of being managed so as not to compromise the EPA's objective with regard to public health and safety.

3.15 Cultural Surroundings

Aspects of cultural surroundings

- **Aboriginal Culture and Heritage**

Preliminary reviews of the Aboriginal heritage significance of the Maitland Heavy Industrial Estate area, comprising the mainland industrial site, the mainland service corridor, and West Intercourse Island were undertaken (MacDonald Hales and Associates 1994 a & b in Woodward-Clyde 1994a). Archival research identified that no systematic field research has been undertaken across most of the study area.

The archaeological investigations indicated that three previously recorded archaeological sites were located within the proposed mainland industrial estate consisting of quarry and artefact scatters and a 'tree'. A further 17 archaeological sties were found to be located within close proximity to the boundary of the mainland site.

The archaeological investigations did not identify any previously recorded sites along the service corridor. Woodward-Clyde (1994a) note that this may have been due to a lack of previous archaeological coverage.

The LandCorp/DRD document indicates that archaeological surveys of West Intercourse Island reported an engraving complex and engraving sites. More recent research undertaken by Bradshaw (MacDonald Hales and Associates 1994 a & b in Woodward-Clyde 1994a) has revealed the existence of two extensive mound midden complexes within the proposed development area on the northern and southern landmasses of the Island, and along the mangrove fringed flats, and these sites were unique and worthy of permanent reservation.

MacDonald Hales and Associates (1994 a & b) in Woodward Clyde (1994a) indicated that archaeological sites may exist in other areas of the industrial estate, however, a detailed and systematic survey would be required to confirm this possibility.

The Aboriginal people consulted during the preliminary investigations by MacDonald Hales and Associates (Woodward-Clyde, 1994a) did not know of any ethnographic sites in the mainland industrial area but did make some predictive comments about the possibility of archaeological sites. They also reported that the south west Burrup Peninsula and West Intercourse island contained numerous engravings some of which may have ethnographic significance.

The Aboriginal Affairs Department (AAD) has indicated that the Pilbara Coast and the Dampier Archipelago is rich in archaeological sites and the Burrup Peninsula is considered to be of international significance as a rock art province. The AAD has indicated that a comprehensive

survey of the study area has not been undertaken and that it is likely that many Aboriginal sites remain undocumented. The AAD recommended that the following work be undertaken in relation to Aboriginal heritage:

- detailed ethnographic and archaeological surveys;
- an evaluation of any sites proposed to be impacted, including consultation with Aboriginal custodians;
- detailed assessment of the likely effects of the development on such sites, including ground disturbance, chemical and water emissions, altered surface hydrology;
- proposals for avoiding or minimising impact to Aboriginal sites within and adjacent to the area be developed.

The AAD also recommended that consideration be given to the impact on sites from traffic associated with the industrial estate and during construction.

More recently, the Department of Resources Development and LandCorp have commissioned an Aboriginal heritage survey, through the Nanaga-Ngoona Moora-Joorga Land Council (NNMJ), of the mainland area, the south west Burrup Peninsula, all of Mid West Intercourse Island and part of West Intercourse Island. Fieldwork was completed last year, and the report is currently being finalised.

There are at present two claims before the National Native Title Tribunal (NNTT). A claim by the Ngaluma Injibandi (WC94/5) has been referred by the NNTT to the Federal Court for determination. A second claim (Karuma 2, WC 96/29) is currently being considered by the NNTT.

Public submissions expressed concern that further work needed to be undertaken with respect to Aboriginal heritage prior to any construction activities being undertaken on site, particularly in relation to heritage sites on West Intercourse Island and the south west Burrup.

- **European Heritage**

The initial document referred to the EPA indicates that the De Grey-Mullewa Stock route traverses the north west corner of the mainland industrial estate, however, this is no longer used and has been de-gazetted (AGC Woodward Clyde, 1994a; 1995).

Submissions indicate that a detailed survey for European heritage sites is required, particularly for West Intercourse Island, where at least two pearling sites and a European grave have been identified.

Consideration

The area considered in the evaluation of this environmental factor is the Industrial Estate Area (see Figure 2).

With respect to this environmental factor, the EPA's objectives are:

- to ensure that development complies with statutory requirements in relation to places and sites of heritage significance; and
- to ensure that the development does not result in changes to the physical and biological environment which adversely affect cultural associations with the area.

If implementation of the concept plan proceeds, the Estate area, and specific locations in particular, will require to be surveyed for both Aboriginal and European heritage.

The EPA notes:

1. that DRD/LandCorp have commissioned a detailed archaeological and ethnographic survey of the estate area;

2. the commitments by DRD/LandCorp to comply with the requirements of the Aboriginal Heritage Act;
3. the requirement for proponents to comply with the *Aboriginal Heritage, WA Heritage* and the *Native Title Acts.*

In considering aspects of heritage, any future proposal should consider, but not be limited to, the following:

Studies and further action to be undertaken by the Estate Manager

1. undertake archaeological and ethnographic surveys of the estate area for Aboriginal heritage sites;
2. consult with the AAD and local Aboriginal communities on Aboriginal cultural matters;
3. develop a Heritage Management Plan for the Estate, as required;
4. consult with the WA Heritage Council on European heritage and a heritage survey of relevant areas.

Should the above occur, and developments take into account the findings of the surveys ad consultations, then it is likely that implementation of the industrial estate concept plan is capable of being managed so as not to compromise the EPA's objective with regard to Aboriginal and European heritage.

4. Other Issues

4.1 Regional Planning

Aspects of Regional Planning

The Karratha area is currently the focus of major economic and resource development.

In 1992 Cabinet endorsed the Pilbara 21 Final Strategy which developed a number of recommendations for the Pilbara Region and Karratha area for the future.

These recommendations included the:

- establishment of suitable heavy industry sites near Karratha and Cape Lambert;
- preparation of the Pilbara Land Use Planning Strategy based upon multiple land use;
- preparation of the Burrup Peninsula Land Use Plan and Management Strategy.

The draft *Pilbara Land Use Strategy* (Sinclair Knight Mertz, 1996) has been made publicly available and is currently in the final drafting stage. The document presents a number of policies and strategies which address a broad range of potential land use impacts in recognition both of the region's importance as an important petroleum and iron ore producer and protection of environmental and heritage values.

The *Burrup Peninsula Land Use Plan and Management Strategy* (BPMAB, 1996) was released to both ensure the development needs of the state whilst preserving the regions natural and cultural resources.

There are three levels of land use planning in Western Australia, specifically State, regional and local. As an example of regional planning, the draft Karratha Area Development Strategy was developed to guide future development in the area and provide a framework for more detailed plans and was released for public comment in April 1997 (WAPC, 1997a). This Strategy compiles 30 different current studies and initiatives in the region and provides a composite strategy plan for land and water use proposals, with the option for conversion to a statutory planning scheme at a future date. The current and proposed land use designations of the Maitland Heavy Industrial Estate under these plans and strategies are summarised in Table 3.

Table 4: Current and proposed land use designation for the Maitland Heavy Industrial Estate Concept Area

ELEMENT	PROPOSED USES	SHIRE OF ROEBOURNE TOWN PLANNING SCHEME 7 *	KARRATHA AREA DEVELOPMENT STRATEGY	WAPC DRAFT STATE PLANNING STRATEGY
Karratha Station	Industrial site	Not covered under TPS Currently pastoral lease	Proposed Industry	Mineral Resource Province
Karratha Station	Buffer	Not covered under TPS Currently pastoral lease	Industry Buffer	Mineral Resource Province, and possibly part of CALM nature reserve
Burrup Industrial Site	Industrial site	Not covered under TPS Currently vacant crown land	Proposed Industry	Mineral Resource Province
West Intercourse Island	Industrial site Stockpile site Port facilities & pier options	Not covered under TPS Currently vacant crown land	Predominantly Proposed Industry with areas set aside as Vacant Crown Land including management of mangroves in coastal areas	Within Strategic Marine Environmental Amenity Area, land use not specified
Mid Intercourse Island	Stockpile site Port facilities & pier options	Not covered under TPS Currently vacant crown land	Predominantly Proposed Industry with areas set aside as Vacant Crown Land including management of mangroves in coastal areas	Within Strategic Marine Environmental Amenity Area, land use not specified
Intercourse Island	Tank farm Port facilities & pier option	Not covered under TPS Currently vacant crown land	Predominantly Proposed Industry with areas set aside as Vacant Crown Land including management of mangroves in coastal areas	Within Strategic Marine Environmental Amenity Area, land use not specified

* Roebourne Shire Council is currently in the process of developing Town Planning Scheme 8 which is likely to include the area identified for the Maitland Heavy Industry Estate Concept Area. A Land Use Planning Policy Manual is also being prepared which will deal with land use within buffer zones.

Proposed recommendations from the draft Karratha Area Development Strategy related to, amongst others:

- environmental protection and conservation of both marine and land environments;
- industrial development;
- sub-regional infrastructure.

In relation to industrial development, recommendations were made to finalise the structure planning arrangement of the Maitland industrial estate, associated service corridors and port areas, together with the identification and securing of adequate buffers around industrial estates from incompatible land uses. In the recommendations for sub-regional infrastructure, a recommendation was made to redetermine the Dampier Port Authority's boundaries to ensure they are integrated with other proposals.

AGC Woodward Clyde (1994a) note that both the mainland portion of the industrial estate and the offshore islands are not incorporated in an existing Town Planning Scheme. Preliminary drafting has commenced on the Shire of Roebourne Town Planning Scheme 8 which will include these areas.

Government agencies are undertaking a range of investigations to provide information for the regional planning process.

Consideration

In relation to the Maitland Heavy Industrial Estate, the investigations for this site have been completed and this report forms the EPA's review and advice to the Minister for the Environment, under Section 16(e) of the Environmental Protection Act, and provides preliminary advice of the environmental constraints for the industrial area, together with EPA's considered view of further information required.

This further information needs to be compiled in a manner which will enable the identification of the areas of environmental significance that must be avoided or managed in such a way that their integrity remains intact. If subsequent implementation of this concept plan takes into account the areas of environmental significance as described above, and puts in place good planning procedures to address the changes that will result as a consequence of this development, then implementation of the Maitland Heavy Industrial Estate Concept Plan is capable of being managed to meet the EPA's objectives for this review.

With respect to the importance of sound planning in the Roebourne region, the Minister should note the potential for conflict in the resolution of land and water uses which are being experienced, specifically on the Burrup Peninsula, offshore islands and adjacent waters of the Dampier Archipelago. WAPC (1997a) in its draft strategy notes the competing land uses for industry, fishing, tourism, recreation, heritage protection and conservation, notes the need to consider the area's sensitivity, economic significance and appropriate planning and management.

Accordingly, the EPA endorses the implementation of the plans and strategies such as have been outlined in the advice provided in the draft WAPC strategy document (WAPC, 1997a) as an important factor in resolving conflict.

4.2 Port

Aspects of Port Facilities

The Port of Dampier is the largest volume tonnage port in Australia and one of three in the Pilbara. A Port Capacity Study is nearing completion and will soon be reported (WAPC 1997a). The port boundary extends to but does not include all of West Intercourse Island (see

Figure 5). The proposal to modify the boundary of the Port area to include those shore based and nearshore marine areas identified within this concept plan is currently under consideration.

Should implementation of the concept proceed, it is likely the Dampier Port Authority would assume the role of management of the extended Port area. The Port Authority would be expected to make a commitment to maintain and protect the environment and prevent pollution. Potential impacts associated with port development as a function of the Maitland Heavy Industry Estate are addressed within the factors presented in sections 3.2 to 3.15 inclusive.

Consideration

The Minister for the Environment should note that, given the potential impacts of port development on the near shore marine environment, the likely need for channel and turning basin dredging and resulting dredge spoil disposal, and potential operational impacts on endangered fauna such as Dugong and Green Turtle, any proposal will need to be referred to the EPA for consideration.

The Port Authority will be responsible for the port's environmental management, and would be expected to prepare and implement an Environmental Management Plan (EMP) in a manner which supported the EPA objectives identified in this advice.

Issues which will need to be considered in the EMP include but should not be limited to matters relating to:

- quarantine;
- ballast water management;
- introduction and management of foreign organisms;
- dredging and channel maintenance;
- ship's sullage;
- management of stockpiles and port related conveyors;
- baseline and ongoing environmental monitoring;
- oil spill response; and
- risk.

4.3 Infrastructure

Aspects of infrastructure

The anticipated expansion in the resource sector and downstream processing that would stimulate the development of the Maitland Heavy Industrial Estate will likely result in strong regional population growth. Cultural issues have been addressed in Section 3.15.

Planning for the expansion of accommodation and services in the Karratha sub-region is well advanced as evidenced by the number and quality of planning studies recently completed or currently under way. These include the *Draft Pilbara Land Use Strategy* (Sinclair Knight Mertz, 1996), *Burrup Peninsula Land Use and Management Strategy* (BPMAB, 1996), and *Karratha Area Development Study* (WAPC, 1997a) released for public comment. A comprehensive list of reports and studies completed or under way relevant to planning in the Karratha sub-region are presented in WAPC (1997a).

The brief review of the existing infrastructure relevant to the Maitland Heavy Industrial Estate is presented in Woodward Clyde (1994a). Limited further detail is given in the *Karratha Land Development Program* (WAPC, 1997b).

In summary:

- sub-regional **water supply** is from the West Pilbara Water Supply Scheme which receives water from either the Millstream Aquifer or Harding River Dam. A recent review of the Millstream area has resulted in a reduction in the conjunctive abstraction licence. Based on existing major consumer agreements, existing resources are fully committed, although not at present fully utilised (Water and Rivers Commission, 1996).
- **power generation and transmission** requirements to service the Karratha sub- region are derived from Western Power's Interconnected North West Power System.
- **gas** requirements for industry wishing to establish in the region are readily addressed.
- the supply of **basic raw materials** is currently the subject of a study being coordinated by DRD. The outcome of this study is anticipated shortly.

Consideration

These factors were beyond the scope of this advice. Infrastructure requirements for the establishment of the Maitland Heavy Industrial Estate can be supplied from existing services. Further reconsideration of issues such as:

- transport infrastructure including road, rail and air;
- both short term and long term housing;
- and the provision of services such as sewage treatment

will need to be further considered with any proposal to establish heavy industry within the Maitland Heavy Industrial Estate.

Proposals for major industry requiring significant water or electrical power requirements are likely to require the identification and development of significant additional supply.

The Minister for the Environment is advised that major infrastructure proposals which have the potential to impact on the environment will need to be referred to the EPA for consideration.

5. Environmental Management and Related Studies

LandCorp/DRD in their initial document identified a management structure to be put in place for the industrial estate if implemented.

LandCorp/DRD will undertake the role of the Estate Manager until such a body is formally designated.

In their initial document, LandCorp/DRD made a number of commitments with regards to the management of the Industrial Estate if implemented (AGC Woodward Clyde 1994a Section 7). These commitments relate to a wider range of issues than those reflected in the relevant factors presented in this advice.

Management commitments which specifically relate to the relevant factors referred to in this advice are provided in section 5.3 below. Additional studies to:

- enhance the knowledge base (input data) for subsequent proposals;
- confirm assumptions made for the provision of this advice

are also included.

5.1 Environmental Management System

Estate Manager and proponent plans should adopt environmental management principles (such as those adopted in the voluntary interim Australian Standards ISO 14001 and 14004) with appropriate monitoring and auditing to ensure compliance with conditions of approval.

The EMS should include an environmental management plan as described in section 5.2 below.

5.2 Environmental Management Plan

The EPA is of the opinion that initially LandCorp/DRD, and subsequently the Estate Manager/Industrial Management Body should prepare, review, implement and report on an overall Environmental Management Plan for the Concept Plan area. This plan should document all the environmental strategies, programmes and commitments in this section and forms part of a more extensive Environmental Management System which describes the procedures to implement the proposal.

Proponents for industries that are accommodated in the Concept Plan area should prepare and implement Environmental Management Plans and procedures to ensure EPA objectives are met.

5.3 Summary of Suggested Environmental Management Initiatives and related Studies/Actions

The responsibilities and structure for environmental management in the Concept Plan area will differ for the concept development, construction and operational phases of the estate. Consequently the roles of LandCorp/DRD, the Estate Manager and the Port Authority will vary according to these phases. The suggested studies and further actions to be undertaken by the Estate Manager, proponents, and the Port Authority were outlined for each environmental factor in Section 3 and are summaried below.

Concept Development Phase

Studies and further action to be undertaken by the Estate Manager.

Where applicable, the Estate Manager should undertake at least the following actions to further develop the environmental management of the proposed Industrial Estate.

Mangroves

1. ensure that mangrove assemblages of special value have been avoided;
2. comply with any future mangroves policy prepared by the EPA.

Marine fauna and threatened and priority fauna

1. undertake detailed studies into the physical and biological characterisation of the coast, including accretion, erosion, longshore sediment transport and fauna such as utilisation of the area by dugong and turtle populations;
2. prepare a causeway option design study including a comprehensive analysis of environmental effects;
3. prepare a port design option study including a study of dredging spoil disposal and a comprehensive analysis of environmental effects.

System 8 area

1. identify conservation values for offshore islands appropriate to meet System 8 recommendations;
2. demonstrate, for proposals affecting these islands, that areas of conservation significance have been avoided and all practicable measures have been taken to minimise impacts on conservation values established for the concept area, through an

environmental impact assessment under Part IV of the *Environmental Protection Act 1986.*

Terrestrial declared rare and priority flora and vegetation communities

1. develop and implement a programme to control the introduction of weeds onto the estate;
2. rehabilitate areas disturbed during the construction phase;

Turbidity

1. collect and analyse baseline water quality information.

Air quality

1. develop a dispersion model, verified for local conditions, to model likely impacts from proposals and continually assess the impact of new industries wishing to establish on site to maintain air quality in the core industrial area, buffer zones and adjacent land;

Gaseous emissions

1. Support or undertake (as applicable) the design and implementation of air quality management plan which will monitor air quality parameters outside the industrial park, including impacts on vegetation, and that it be utilised to secure an adequate buffer around the proposed site;
2. design and implement a monitoring system for cumulative impacts which is sufficient to protect the environment and human health and establish the capacity of the local air shed to accommodate air emissions.

Dust

1. establish, prior to implementation, the baseline data and undertake monitoring of dust levels from the cumulative effects of the Estate's activities.

Noise and vibration

1. undertake additional noise emission modelling as input to the identification of and securing of the estate buffer.

Surface waters, marine water and sediment quality

1. establish baseline marine water and sediment quality in the Concept Plan area and its surroundings prior to implementation of the Concept Plan;
2. determine the environmental values of potentially impacted floral and faunal communities, determine their spatial boundaries and regional representation, and how they will be affected by changes in the surface hydrology as a consequence of the implementation of the concept plan.;
3. refer agreed spatial arrangement of environmental values to the EPA for consideration.

Public health and safety

1. coordinate a cumulative risk and hazard analysis for the Estate when each new industry, which has the potential to generate risk, is proposed.

Cultural surroundings

1. undertake archaeological and ethnographic surveys of the estate area for Aboriginal heritage sites;
2. consult with the AAD and local Aboriginal communities on Aboriginal cultural matters;
3. develop of a Heritage Management Plan for the Estate, as required;

4. consult with the WA Heritage Council on European heritage and undertake a heritage survey of relevant areas.

Studies and further action to be undertaken by the Proponent of each industry.

Where applicable, the Proponent should undertake at least the following actions when a new proposal is proposed:

Mangroves

1. ensure that mangrove assemblages of special value have been avoided;
2. comply with any future mangroves policy prepared by the EPA.

System 8 area

1. demonstrate, for proposals affecting islands in the Dampier Archipelago, that all practicable measures have been taken to minimise impacts on conservation values, through an environmental impact assessment under Part IV of the *Environmental Protection Act 1986.*

Turbidity

1. prepare a map of the marine habitats and their significance;
2. analyse the results of modelling of tidal flows and incorporate the implications for dredging management;
3. identify potential dredge spoil disposal areas and demonstrate their compliance with international requirements for spoil disposal through the Commonwealth approval process;
4. establish environmental quality objectives and relevant water and sediment quality criteria relevant to the local marine environment.

Terrestrial declared rare and priority flora and vegetation communities

1. demonstrate how the results of the detailed flora surveys have been accommodated in project proposals;
2. commit to protecting within the concept area, or otherwise replacing, terrestrial declared rare and priority flora and vegetation communities.

Terrestrial fauna and threatened and priority fauna

1. avoid Bridal Tern nesting areas;
2. conduct detailed faunal surveys of the areas affected;
3. commit to avoid areas of significant value, protect them within the concept area, or otherwise replace or relocate terrestrial fauna and threatened and priority fauna.

Dust

1. develop dust management measures with particular emphasis on best practice containment on a case-by-case basis for individual industries by the EPA pursuant to Part IV and/or the DEP pursuant to Part V of the *Environmental Protection Act 1986* and demonstrate whether the EPA's objective will be achieved.

Noise and vibration

1. assess the noise from industrial plant proposed for the industrial estate and demonstrate compliance with noise criteria;
2. assess transport infrastructure including road, rail and bulk conveyors relevant to their proposal for environmental impacts and mitigate adverse effects.

Surface waters

1. demonstrate that the operation of an industry (with the potential to pollute surface water) will not have a significant impact on surface water, prior to approval being given. Appropriate management and monitoring will be required.

Liquid and solid waste

1. apply best practice waste management principles to the implementation of the proposal;
2. develop a strategy for solid and liquid waste disposal, with resolution of this issue prior to the proponent establishing on the site.

Studies and further action to be undertaken by the Port Authority

Where applicable, the Port Authority should undertake at least the following actions prior to the implementation of the concept:

Marine fauna and threatened and priority fauna

1. undertake detailed studies into the physical and biological characterisation of the coast, including accretion, erosion, longshore sediment transport and fauna such as utilisation of the area by dugong and turtle populations;
2. prepare a causeway option design study in association with the Estate Manager;
3. prepare a port design option study in association with the Estate Manager.

Turbidity

1. collect baseline water quality information;
2. prepare a detailed map of the marine habitats and their significance;
3. analyse the results of modelling of tidal flows and determine their implications for dredging management;
4. identify potential dredge spoil disposal areas and demonstrate their compliance with international requirements for spoil disposal through the Commonwealth approval process;
5. establish environmental quality objectives and relevant water and sediment quality criteria relevant to the local marine environment.

Surface waters

1. collect baseline data on water and sediment quality in the port area.
2. develop and implement a Marine Management Plan which would provide details of and procedures for the regular monitoring of the harbour and surrounding waters and sediments;

Construction Phase

The Estate Manager will be responsible for site development works, including the coordination of estate servicing.

Studies and further action to be undertaken by the Estate Manager.

Where applicable, the Estate Manager should undertake at least the following actions during construction:

Mangroves

1. undertake detailed studies and design of infrastructure corridors such that the area of mangrove impact will be minimised.

Marine fauna and threatened and priority fauna

1. prepare a Coastal Management Plan incorporating consideration of the above studies.

Studies and further action to be undertaken by the Proponent of each industry

Where applicable, the proponent should undertake at least the following actions:

Mangroves

1. undertake detailed studies and design of infrastructure corridors such that the area of mangrove impact will be minimised.

Terrestrial fauna and threatened and priority fauna

1. special attention to be given to retain Pilbara Olive Python habitat on West Intercourse Island

Turbidity

1. prepare an Environmental Management Programme outlining environmental management measures to achieve identified objectives;
2. develop contingency plans when environmental water quality objectives may not be met.

Terrestrial declared rare and priority flora and vegetation communities

1. ensure that all practicable measures will be taken to avoid impacts on vegetation communities;
2. demonstrate that rare or priority flora can be protected in accordance with the provisions of the *Wildlife Conservation Act 1950.*

Terrestrial fauna and threatened and priority fauna

1. demonstrate that threatened or priority fauna can be protected in accordance with the provisions of the *Wildlife Conservation Act 1950.*

Studies and further action to be undertaken by the Port Authority

Where applicable, the Port Authority should undertake at least the following actions:

Marine fauna and threatened and priority fauna

1. prepare a Coastal Management Plan.

Turbidity

1. prepare an Environmental Management Programme outlining environmental management measures to achieve identified objectives;
2. develop contingency plans when environmental water quality objectives may not be met.

Operation Phase

Each industry will be responsible for gaining relevant approvals from agencies for their operations and these procedures will be the principle mechanism by which environmental management is imposed. The estate Management Body will be responsible for the overall coordination of environmental management of the Concept Plan area.

Studies and further action to be undertaken by the Estate Manager.

Where applicable, Estate Manager should undertake at least the following actions:

Mangroves

1. replace mangroves that may be lost;
2. prevent dust and spillage impacts on mangroves.

Marine fauna and threatened and priority fauna

1. prepare a Port Management Plan including provision for the regular monitoring for introduced marine organisms.

Gaseous emissions

1. Support or undertake, as applicable, the design and implementation of air quality management plan which will monitor air quality parameters outside the industrial park, including impacts on vegetation, and that it be utilised to secure an adequate buffer around the proposed site;
2. design and implement cumulative impacts monitoring sufficient to protect the environment and human health and establish the capacity of the local air shed to accommodate air emissions.

Noise and vibration

1. develop and implement a programme of monitoring to assess cumulative noise impacts.

Liquid and solid waste

1. consider in association with Government initiatives in the region, a liquid and solid waste management strategy for the industrial estate, for those industries requiring liquid and solid waste disposal.

Public health and safety

1. maintain an on-going programme for the determination of cumulative risk.

Studies and further action to be undertaken by the Proponent of each industry.

Where applicable, the Proponent of a new proposal should undertake at least the following actions:

Mangroves

1. undertake detailed studies and design of infrastructure corridors such that the area of mangrove impact will be minimised;
2. replace mangroves that may be lost;
3. prevent dust and spillage impacts on mangroves.

Greenhouse gas emissions

1. determine the quantity of greenhouse gases produced and identify measures adopted to limit greenhouse gas emissions from the project;
2. during operation and using the generally accepted methods, report greenhouse gas emissions associated with their proposal to the DEP;
3. report on the comparative greenhouse gas efficiency of the proposal (per unit of product and/or other agreed performance indicators) with the efficiency of other comparable projects producing a similar product.

Gaseous emissions

1. monitor and report on air emissions from individual plants;

Dust

1. consider and implement dust management measures, including the location of dust sources, to minimise dust impacts on mangroves.

Noise and vibration

1. assess the noise from industrial plant proposed for the industrial estate and demonstrate compliance with noise criteria.

Public health and safety

1. assess societal risk following accepted guidelines.

Studies and further action to be undertaken by the Port Authority

Where applicable, the Port Authority should undertake at least the following actions:

Mangroves

1. replace mangroves that may be lost;
2. prevent dust and spillage impacts on mangroves.

Marine fauna and threatened and priority fauna

1. prepare a Port Management Plan including provision for the regular monitoring for introduced marine organisms.

Surface waters

1. develop and implement a Marine Management Plan;
2. undertake the regular monitoring of the harbour and the surrounding waters in accordance with the Marine Management Plan.

5.4 Other Matters

Buffers

The management of environmental issues includes the incorporation of an adequate buffer to mitigate environmental impacts.

The EPA endorses the view of LandCorp/DRD's that this buffer zone needs to be formally recognised and designated in planning provision for the estate.

Communication (with proponents and community on estate management)

The EPA considers that effective communication between the Estate Manager, proponents and the community is an important element of modern and well managed industrial estates. The EPA considers that it would be appropriate for the Estate Manager and the Industry Management Body to establish mechanisms for providing information and liaison with potential proponents and the community on significant environmental aspects associated with estate.

Decommissioning

Proponents intending to cease operations of established industries within the proposed estate should be required to carry out satisfactory decommissioning of their respective projects, removal of installations and appropriate rehabilitation of the relevant sites and their environs. At least six months prior to decommissioning, proponents should prepare a decommissioning and rehabilitation plan.

Infrastructure

Port and port access development, wastewater treatment facilities, issues related to the provision of water and power supply (gas and electricity), together with transport infrastructure requirements such as road, rail and conveyor transport have not been considered as part of the present advice. The provision of basic building and site development materials and social infrastructure are similarly beyond the scope of this advice.

The environmental consequences of the unregulated provision of this infrastructure has the potential to exceed those attributable to the implementation of the industrial estate proper.

It is the EPA's view that the provision of infrastructure support for the industrial estate concept should be considered through separate referral under section 38 of the Act.

The EPA advises that the status of buffers proposed for the concept area should be considered in forthcoming scheme amendments.

6. Advice to the Minister for the Environment

The EPA offers the following advice:

Recommendation 1

That the Minister for the Environment notes the environmental factors, the EPA's objective for each factor as set out in Section 3 of this report, and the studies suggested to gain further information.

Recommendation 2

That the Minister for the Environment notes the EPA's advice on meeting EPA objectives for the important environmental factors, estate management, environmental management considerations and suggested studies (Section 3). In particular note the responsibilities of the Estate Manager (or council), the Port Authority or individual industries in environmental protection as set out in summary form in Section 5.3.

Recommendation 3

That the Minister for the Environment notes that infrastructure requirements to the Maitland Heavy Industrial Estate Concept area have not been considered in this advice, and that such matters should be referred to the EPA for consideration as either formal referrals or Scheme Amendments under Part IV of the *Environmental Protection Act 1986*.

Recommendation 4

That the Minister for the Environment notes that industries with the potential to significantly impact on the environment and wishing to establish in the Maitland Heavy Industrial Estate Concept area would be subject to assessment under Part IV of the *Environmental Protection Act 1986*.

TABLE 5: RELEVANT FACTORS, EPA OBJECTIVES, MANAGEMENT COMMITMENTS & ADVICE TO THE MINISTER

RELEVANT FACTOR	RELEVANT AREA	EPA OBJECTIVES	CONCEPT PLAN CHARACTERISTICS	MANAGEMENT COMMITMENTS	ADVICE TO MINISTER ON EPA OBJECTIVES AND ENVIRONMENTAL MANAGEMENT
Mangroves	Maitland Delta and West Intercourse Island	To maintain biodiversity, abundance, geographical distribution, productivity and community assemblages of mangroves	Mangroves include assemblages of special interest. The area has been previously designated for potential industrial land uses.	• Design structure across channel between mainland and West Intercourse Island and causeway aligned as close as possible to Dampier Salt Pond Zero to minimise disruption to sedimentation and tidal flux. • Conduct hydrodynamic studies. • Minimise dust emissions during construction.	It is likely that implementation of the industrial estate concept plan is capable of being managed so as not to compromise the EPA's objective with regard to mangroves if the following steps are undertaken. The Government is formulating a policy for the protection of mangroves in the arid Pilbara zone biome. ***Estate Manager*** •undertake detailed studies and design of infrastructure corridors such that the area of mangrove impact will be minimised; •ensure that mangrove assemblages of special value are taken into account such that impacts are minimised or avoided; •replace mangroves that may be lost or as appropriate to meet future policy; •prevent dust and spillage impacts on mangroves; •comply with any present or future mangroves policy prepared by Government. ***Proponents*** •demonstrate through Part IV impact assessment process that impacts are minimised and areas of special value avoided.
Marine fauna and threatened and priority fauna	Marine waters in Concept Plan	•To maintain the abundance, species diversity and geographic distribution of marine fauna. •To protect threatened and priority fauna in accordance with the provisions of the *Wildlife Conservation Act 1950* •minimise the risk of introduction of unwanted marine organisms.	Green turtle nesting area on West Intercourse Island. Minor seagrass/algae beds may support temporary or very small population of Dugong.	• Preparation of environmental management plan to minimise impacts of dredging and port construction. • Further investigation into the usage and significance of turtle nesting areas as part of specific port development proposals.	It is likely that implementation of the industrial estate concept plan is capable of being managed so as not to compromise the EPA's objective with regard to marine fauna and threatened and priority fauna if the appropriate steps are taken. The EPA advises that proponents of port or infrastructure proposals that may have the potential to impact on the marine environment will need to be referred to the Authority under s38 of the Act. ***Estate Manager/Port Authority*** •undertake detailed studies into the physical and biological characterisation of the coast, including accretion, erosion, longshore sediment transport and fauna such as utilisation of the area by dugong and turtle populations; •prepare a causeway option design study including a comprehensive analysis of environmental effects; •prepare a port design option study including a study of dredging spoil disposal and a comprehensive analysis of environmental effects; •prepare a Coastal Management Plan incorporating consideration of the above studies; •prepare a Port Management Plan including provision for the regular monitoring for introduced marine organisms; ***Proponents*** •demonstrate through Part IV impact assessment process that EPA's objectives can be met and impacts on marine fauna minimised.
System 8 Area (8.5 Dampier Archipelago)	Islands of Dampier Archipelago which are within Concept Plan.	to ensure that the EPA System 8 recommendations, as modified by the Government, are not compromised	EPA system 8 recommendation 8.5 has been modified by Government decision to allow for industrial utilisation but with recognition of conservation values.		It is likely that implementation of the industrial estate concept plan is capable of being managed so as not to compromise the EPA's objective with regard to System 8 Area 8.5 if the following steps are undertaken. ***Estate Manager*** •in consultation with CALM, determine the conservation status of wildlife representative of the Dampier Archipelago ***Proponents*** •demonstrate through Part IV impact assessment process that all practicable measures have been taken to minimise impacts on conservation values.

RELEVANT FACTOR	RELEVANT AREA	EPA OBJECTIVES	CONCEPT PLAN CHARACTERISTICS	MANAGEMENT COMMITMENTS	ADVICE TO MINISTER ON EPA OBJECTIVES AND ENVIRONMENTAL MANAGEMENT
Terrestrial declared rare and priority flora and vegetation communities	Islands and south west Burrup Peninsula in Concept Plan	• To protect rare and priority flora, consistent with the provisions of the *Wildlife Conservation Act 1950*. • to maintain the abundance, diversity, geographic distribution and productivity of locally present vegetation communities.	Mainland industrial site has been extensively degraded by grazing. Vegetation on the islands and south west Burrup Peninsula is in good condition. Two priority flora species are present on West Intercourse Island and south west Burrup Peninsula	• Preparation of an environmental management plan to minimise impacts on priority species. • Preparation of management guidelines for contractors • Weed, pest and disease control and removal.	It is likely that implementation of the industrial estate concept plan is capable of being managed so as not to compromise the EPA's objective with regard to terrestrial vegetation communities and rare and priority flora if the proponent undertakes the following. ***Estate Manager*** •develop and implement a programme to control the introduction of weeds onto the estate; •rehabilitate areas disturbed during the construction phase. ***Proponents*** •demonstrate through Part IV impact assessment process that rare flora are protected and impacts on vegetation are minimised on the Islands; •undertake detailed flora surveys and demonstrate how the survey results have been accommodated in project proposals; •take all practicable measures to avoid impacts on vegetation communities; •ensure that rare or priority flora can be protected in accordance with the provisions of the *Wildlife Conservation Act 1950*; •make a commitment to protect within the concept area, or otherwise replace terrestrial declared rare and priority flora and vegetation communities.
Terrestrial fauna and threatened and priority fauna	Islands and south west Burrup Peninsula in Concept Plan	•to protect threatened and priority terrestrial fauna consistent with the provisions of the *Wildlife Conservation Act 1950*; and •to maintain the abundance, diversity and geographical distribution of terrestrial fauna. •to meet Australia's international agreements on migratory birds.	Mainland industrial site has been extensively degraded by grazing. Habitats on the islands and south west Burrup Peninsula is in good condition. Bridle Tern subject of international protection agreements nests on Intercourse and Haycock Islands. Pilbara Olive Python is likely to be present on West Intercourse and south west Burrup Peninsula.	• Preparation of management guidelines for contractors • Weed, pest and disease control and removal.	Implementation of the Concept Plan may achieve EPA's objective if Bridal Tern nesting areas are avoided, threatened and priority species are protected and obligations are met with regard to international agreements for migratory wading birds. ***Estate Manager*** •minimise impacts on faunal habitats. ***Proponents*** •avoid Bridal Tern nesting areas; •conduct detailed faunal surveys of the areas affected; •make a commitment to protect within the concept area, or otherwise replace terrestrial threatened and priority fauna and fauna. •ensure that rare or priority flora can be protected in accordance with the provisions of the *Wildlife Conservation Act 1950*; •give special attention to retaining Pilbara Olive Python habitat on West Intercourse Island.
Air quality (including odours and particulates	The area considered in the evaluation of this factor is the Concept Plan (including buffer area) and surrounding land uses.	To ensure that emissions of gases, particulates and odours conform with agreed standards and criteria and does not cause health, amenity or environmental problems	Potentially substantial emissions of NOx, SO_2 and other gases from industrial sites. Offsite buffer on mainland.	• Monitor and manage cumulative impacts. • Air monitoring program. • Maintain public comments register. • Require contractors to use emission control equipment as required by EPA guidelines for vehicular emissions.	It is likely that implementation of the industrial estate concept plan is capable of being managed so as not to compromise the EPA's objective with regard to air quality if the following steps are undertaken. ***Estate Manager*** •design and implement air quality management plan; •establish the capacity to model air emissions from the Estate; •design and implement cumulative impacts monitoring sufficient to protect the environment and human health and establish the capacity of the local air shed to accommodate air emissions. ***Proponents*** •apply best practice environmental management and all reasonable and practicable means to minimise emissions; •monitor and report on air emissions from individual plants; •comply with NHMRC guidelines for NOx, Kwinana EPP for SO_2 and particulates, DEP ground level concentration guidelines. ***DEP*** •proceed with preparation of EPP for Karratha region as a priority.

TABLE 3(cont.): RELEVANT FACTORS, EPA OBJECTIVES, MANAGEMENT COMMITMENTS AND ADVICE TO THE MINISTER

RELEVANT FACTOR	RELEVANT AREA	EPA OBJECTIVES	CONCEPT PLAN CHARACTERISTICS	MANAGEMENT COMMITMENTS	ADVICE TO MINISTER ON EPA OBJECTIVES AND ENVIRONMENTAL MANAGEMENT
Greenhouse gases	Industrial sites	To ensure that greenhouse gas emissions are reduced as far as practicable and comply with EPA policy.	The industries that may establish in the Concept Plan area may emit significant quantities of greenhouse gases.		It is likely that implementation of the industrial estate concept plan is capable of being managed so as not to compromise the EPA's objective with regard to greenhouse gases if the proponent undertakes the following. ***Proponents*** •determine the quantity of greenhouse gases produced and identify measures adopted to limit greenhouse gas emissions from the project; •during operation and using the generally accepted methods, report greenhouse gas emissions associated with their proposal to the DEP; •report on the comparative greenhouse gas efficiency of the proposal (per unit of product and/or other agreed performance indicators) with the efficiency of other comparable projects producing a similar product; •reduce greenhouse gas emissions as far as practicable; •consider entering an agreement under the Greenhouse Challenge.
Dust	Industrial sites and offsite buffer on mainland	To protect the surrounding land users such that dust emissions will not adversely impact upon their welfare and amenity or cause health problems and meet EPA Guidelines for the Assessment and Control of Dust and Windborne Material from Land Development Sites, Environmental Protection Policy (Atmospheric Wastes) (Kwinana).	Site development, ship loading and conveyors are potentially significant dust sources. Offsite buffer on mainland.	• Dust management plan to be prepared. • Dust contingency measures to be applied by contractors.	It is likely that implementation of the industrial estate concept plan is capable of being managed so as not to compromise the EPA's objective with regard to dust if appropriate steps are taken. dust management measures with particular emphasis on best practice containment will need to be assessed on a case-by-case basis for individual industries by the EPA pursuant to Part IV and/or the DEP pursuant to Part V of the *Environmental Protection Act 1986* as to whether the EPA's objective will be achieved ***Estate Manager*** •establish baseline data and undertake monitoring of cumulative emissions prior to implementation; •implement a dust management plan during construction phase; •determine the requirements for protection of mangroves and salt ponds. ***Proponents*** •assess dust management through Part IV or Part V procedures. •comply with EPA guidelines •avoid dust impacts on mangroves
Noise and vibration.	Industrial sites and offsite buffer on mainland.	to protect the amenity of nearby residents from noise and vibration impacts by ensuring that noise and vibration meet criteria in the Noise Abatement (Neighbourhood Annoyance) Regulations 1979 and the new proposed Environmental Protection (Noise) Regulation (when promulgated).	Noise emissions from industry are likely to be substantial. Offsite buffer on mainland.	Monitor and manage cumulative impacts.	Implementation of the Concept Plan has the potential to achieve EPA's objectives with regard to noise and vibration subject to assessment of individual proposals. ***Estate Manager*** •undertake additional noise emission modelling as input to the identification of and acquisition of the estate buffer; •develop and implement a programme of monitoring assess cumulative noise impacts; ***Proponents*** •assess likely noise levels due to industrial plant proposed for the Industrial Estate •assess transport infrastructure including road, rail and bulk conveyors for impacts on the noise environment; •apply best practice environmental management.
Surface drainage, marine water and sediment quality	Industrial sites and surrounding marine waters	•for marine, surface and wastewaters, to meet the requirements of the Australian Water Quality Guidelines for Fresh and Marine Waters (ANZECC, 1992); •In the longer term, to consider management of the port's waters and sediments based on the environmental quality objectives (EQO's) and environmental quality criteria (EQC's) from the Southern Metropolitan Coastal Waters Study (1996), as they arise; •to ensure that alterations to surface water drainage do not adversely impact indigenous vegetation	Site works and industries may alter drainage pattern. Potential for contaminated runoff from industrial areas.	Management guidelines - retain as far as practicable existing drainage features.	It is likely that implementation of the industrial estate concept plan is capable of being managed so as not to compromise the EPA's objective with regard to surface drainage, marine water and sediment quality if the following steps are undertaken. ***Estate Manager*** •establish baseline marine water and sediment quality in the Concept Plan area and its surroundings prior to implementation of the Concept Plan; •determine the spatial arrangement of environmental values to be protected in the Concept Plan and surrounding areas in conjunction with the DEP; •refer agreed spatial arrangement of environmental values to the EPA for consideration. ***Proponents*** •demonstrate through Part IV impact assessment process that operation will not have a significant impact on surface water; •implement management and monitoring ***Port Authority*** •develop and implement a Marine Management Plan; •regular monitoring of the harbour and the surrounding waters in accordance with the Marine Management Plan; and •collect baseline data on water and sediment quality in the port area.

TABLE 3(cont.): RELEVANT FACTORS, EPA OBJECTIVES, MANAGEMENT COMMITMENTS AND ADVICE TO THE MINISTER

RELEVANT FACTOR	RELEVANT AREA	EPA OBJECTIVES	CONCEPT PLAN CHARACTERISTICS	MANAGEMENT COMMITMENTS	ADVICE TO MINISTER ON EPA OBJECTIVES AND ENVIRONMENTAL MANAGEMENT
Turbidity	Marine waters in and surrounding Concept Plan	to maintain turbidity levels from construction and operation of port activates to accepted criteria to protect agreed environmental values (Southern Metropolitan Coastal Water Study, 1996).	Dredging likely to lead to temporary increase in turbidity. Marine biota may be relatively tolerant to temporary increases in turbidity.	• Preparation of environmental management plan to minimise impacts of dredging and port construction.	It is likely that implementation of the industrial estate concept plan is capable of being managed so as not to compromise the EPA's objective with regard to turbidity if the following steps are undertaken. ***Estate Manager/Port Authority*** •collect and analyse baseline water quality information; ***Proponents/Port Authority*** •demonstrate through Part IV impact assessment process the application of appropriate management measures. •produce a detailed map of the marine habitats and their significance; •analyse the results of modelling of tidal flows and incorporate the implications for dredging management; •identify potential dredge spoil disposal areas and demonstrate their compliance with international requirements for spoil disposal through the Commonwealth approval process; •meet environmental quality objectives and relevant water and sediment quality criteria relevant to the local marine environment; •develop an Environmental Management Program outlining environmental management measures to achieve identified objectives; •develop contingency plans when environmental water quality objectives may not be met.
Liquid and solid waste disposal	Industrial sites and offsite buffer on mainland.	The EPA's objective in regard to this environmental factor is to ensure wastes are managed in accordance with the waste management hierachy, and where this is not possible, are contained and isolated from ground and surface waters, and that discharges meet the requirements of ANZECC (1992) and Draft Western Australia Guidelines for Fresh and Marine Waters (EPA, 1993)	Each industry is to responsible for the treatment and safe disposal of wastes. Onsite disposal of wastes from construction phase will not be permitted. Shire of Roebourne Waste Management Facility has sufficient capacity to receive solid waste over the medium term and acceptable sludges		It is likely that implementation of the industrial estate concept plan is capable of being managed so as not to compromise the EPA's objective with regard to liquid and solid waste disposal if the following steps are undertaken. ***Estate Manager*** •consider in association with Government initiatives in the region, a liquid and solid waste management strategy for the industrial estate, for those industries requiring liquid and solid waste disposal; ***Proponents*** •apply best practice waste management principles; •resolve the issue of liquid and solid waste disposal for each individual industry prior to establishing on the site.
Public health and safety.	Industrial sites and offsite buffer on mainland.	• To ensure that risk is a s low as reasonably achievable and complies with acceptable standards, and meets criteria in EPA Bulletins 611 and 627.	Industry may give rise to significant risk. Offsite buffer on mainland.		It is likely that implementation of the industrial estate concept plan is capable of being managed so as not to compromise the EPA's objective with regard to public health and safety if the following steps are undertaken. ***Estate Manager*** •coordinate a cumulative risk and hazard analysis for the Estate when each new industry, which has the potential to generate risk, is proposed, and develop and implement an on-going programme for the determination of cumulative risk and societal risk; ***Proponents*** •demonstrate through a risk and hazard analysis during Part IV impact assessment process that risk complies with EPA's risk criteria if new industry has potential to generate risk, when it is proposed; •assess societal risk following accepted guidelines.
Cultural surroundings	Industrial sites and offsite buffer on mainland	To ensure that development complies with statutory requirements in relation to places and sites of heritage significance. To ensure that the development does not result in changes to the physical and biological environment which adversely affects cultural associations with the area.	Aboriginal heritage survey of proposed Maitland Heavy Industry Estate site currently being finalised		At this strategic stage, it is likely that implementation of the estate concept plan is capable of being managed so as not to compromise the EPA's objective with regard to cultural surroundings. Any proposal which represents the implementation of the Industrial Estate Concept would be expected to comply with relevant statutory requirements for significant sites and may need to implement a Heritage Management Plan. ***Estate Manager*** •undertake archaeological and ethnographic surveys of the estate area for Aboriginal heritage sites; •consult the AAD and local Aboriginal communities on Aboriginal cultural matters; •develop a Heritage Management Plan for the Estate, as required; •consult the WA Heritage Council on European heritage and a heritage survey of relevant areas.

TABLE 5(cont.): RELEVANT FACTORS, EPA OBJECTIVES, MANAGEMENT COMMITMENTS AND ADVICE TO THE MINISTER

Appendix 1

Figures

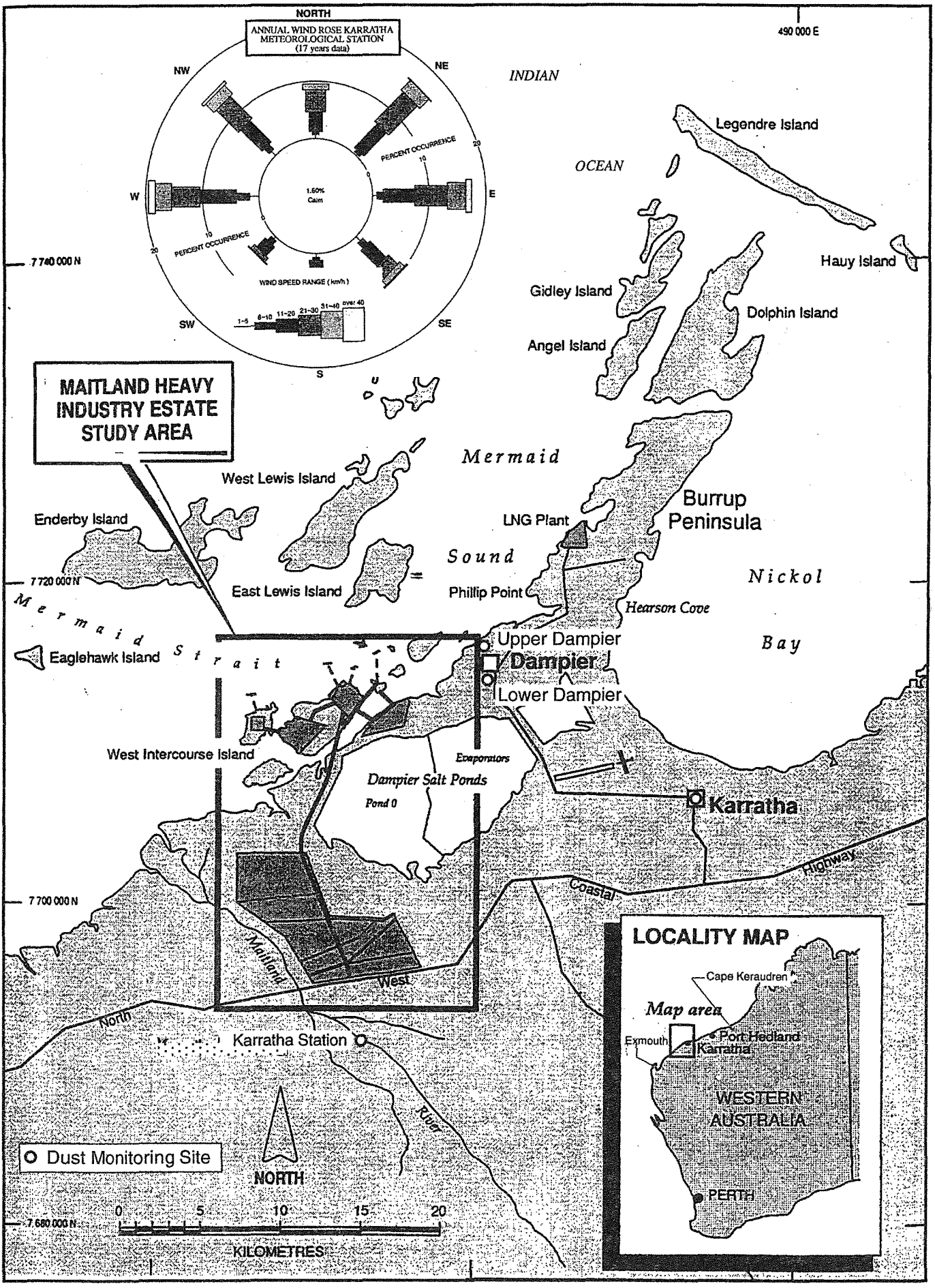

Figure 1. Regional location — Maitland Heavy Industrial Estate Concept (Modified from Woodward Clyde 1994a Maitland Heavy Industrial Estate Karratha PER Fig. 1).

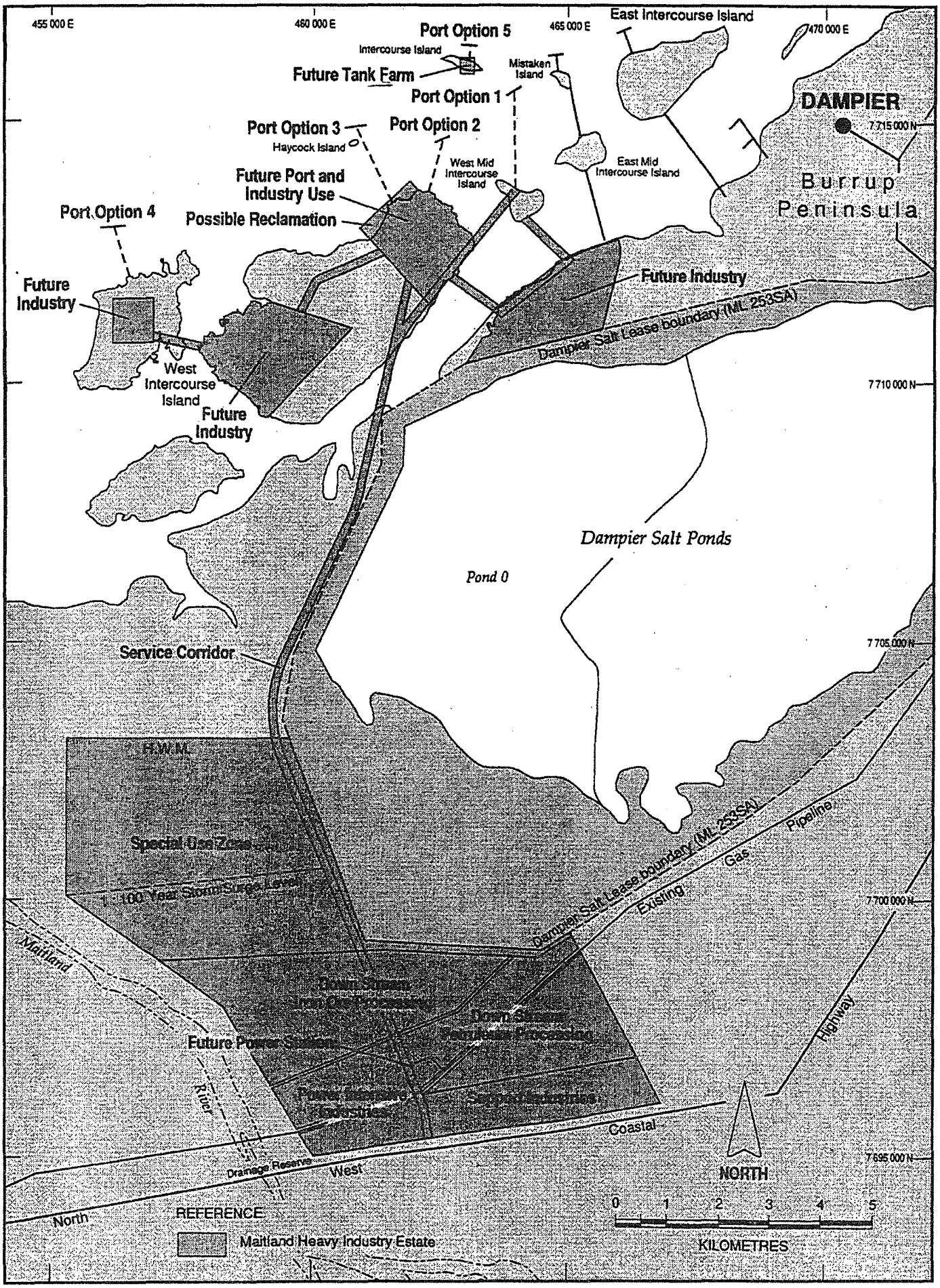

Figure 2. Proposed Maitland Heavy Industrial Estate (Source: Woodward Clyde 1994a Maitland Heavy Industrial Estate Karratha PER Fig. 2).

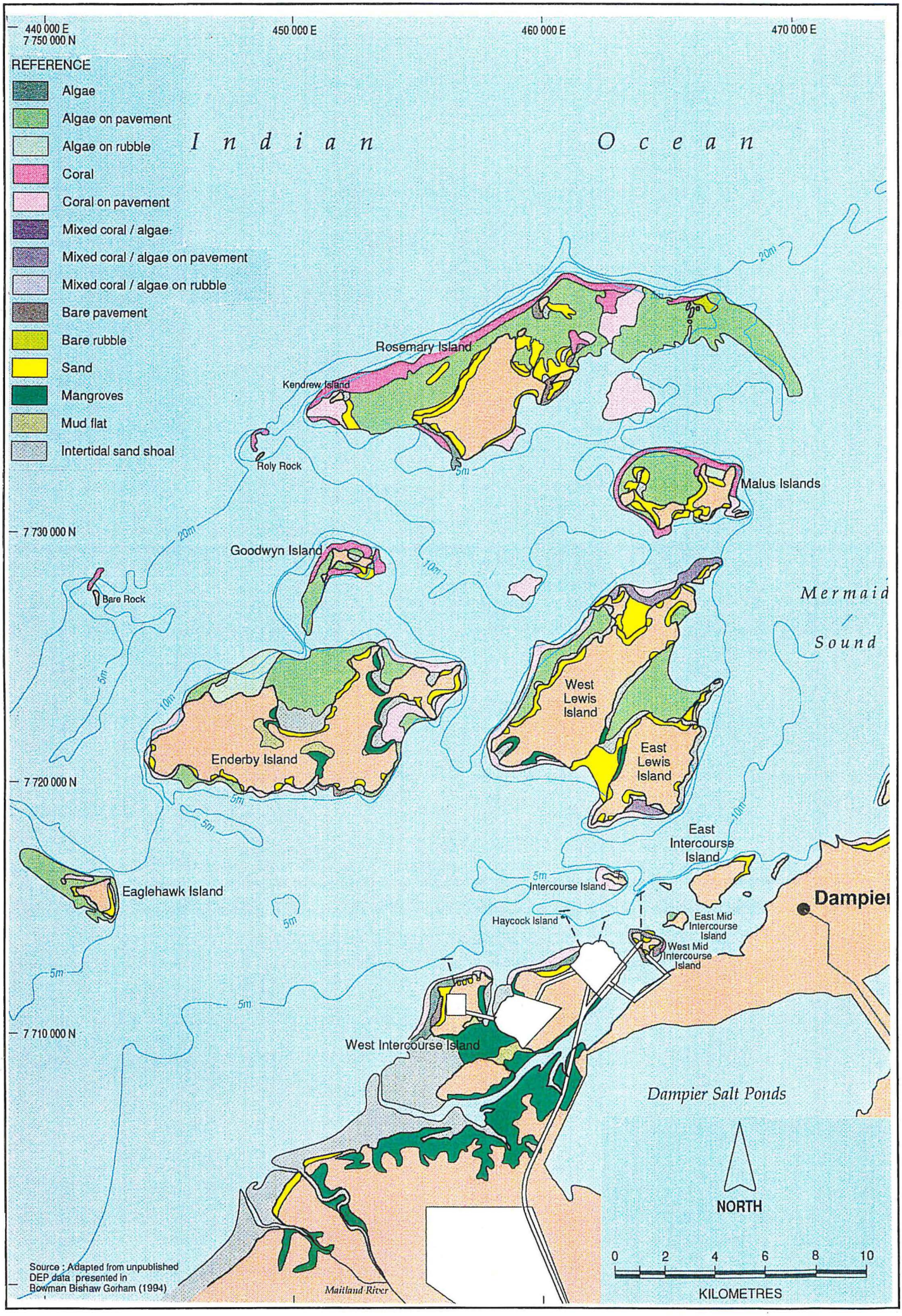

Figure 3. Potentially affected shallow marine habitats (Source: Woodward Clyde 1994a Maitland Heavy Industrial Estate Karratha PER Fig.10).

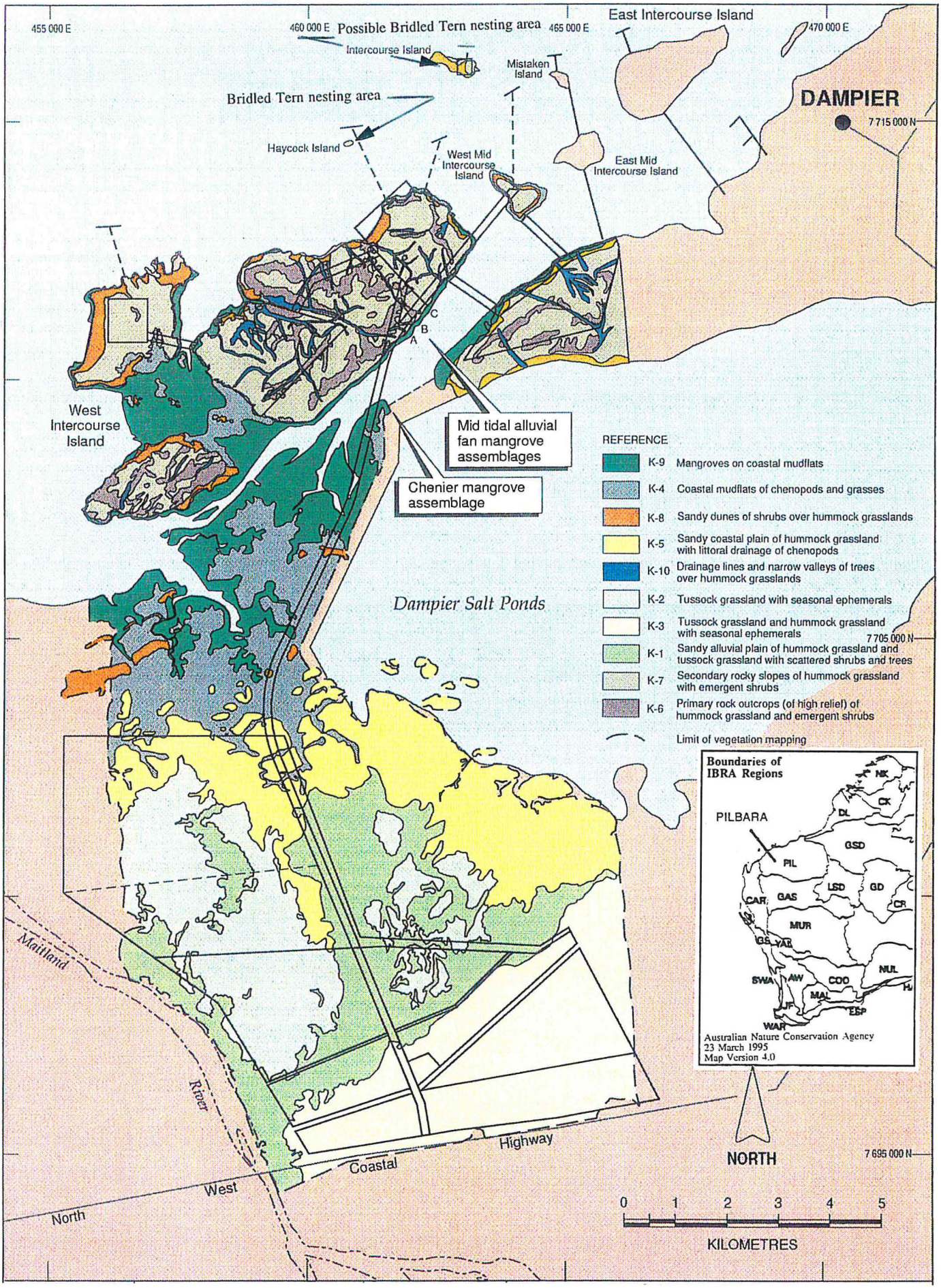

Figure 4. Study area vegetation and biogeographic areas (Modified from Woodward Clyde 1994a Maitland Heavy Industrial Estate Karratha PER Fig. 9).

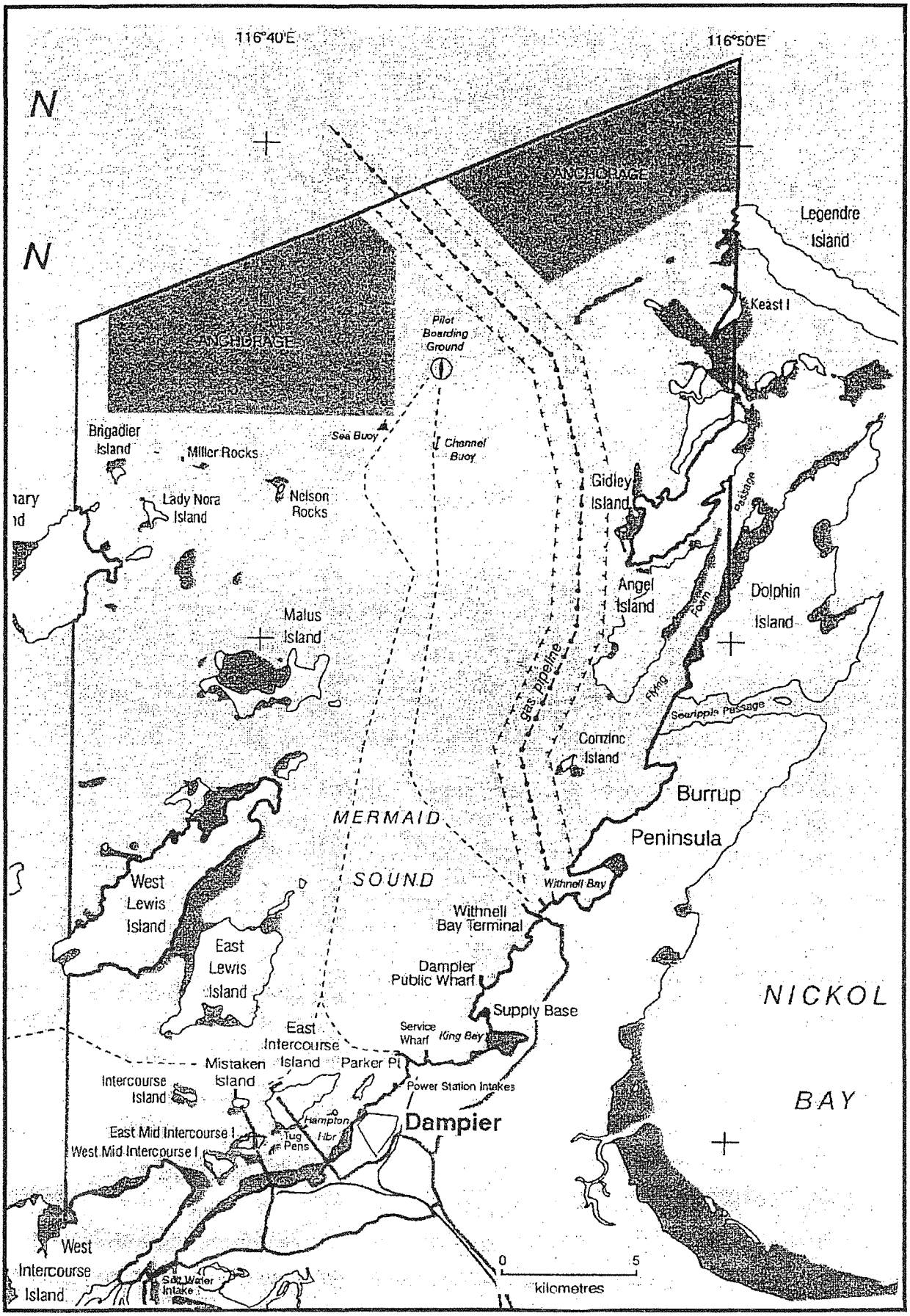

Figure 5. Dampier Port Authority boundaries.
(Source: Dampier Port Atuhority Annual Report 1995/96)

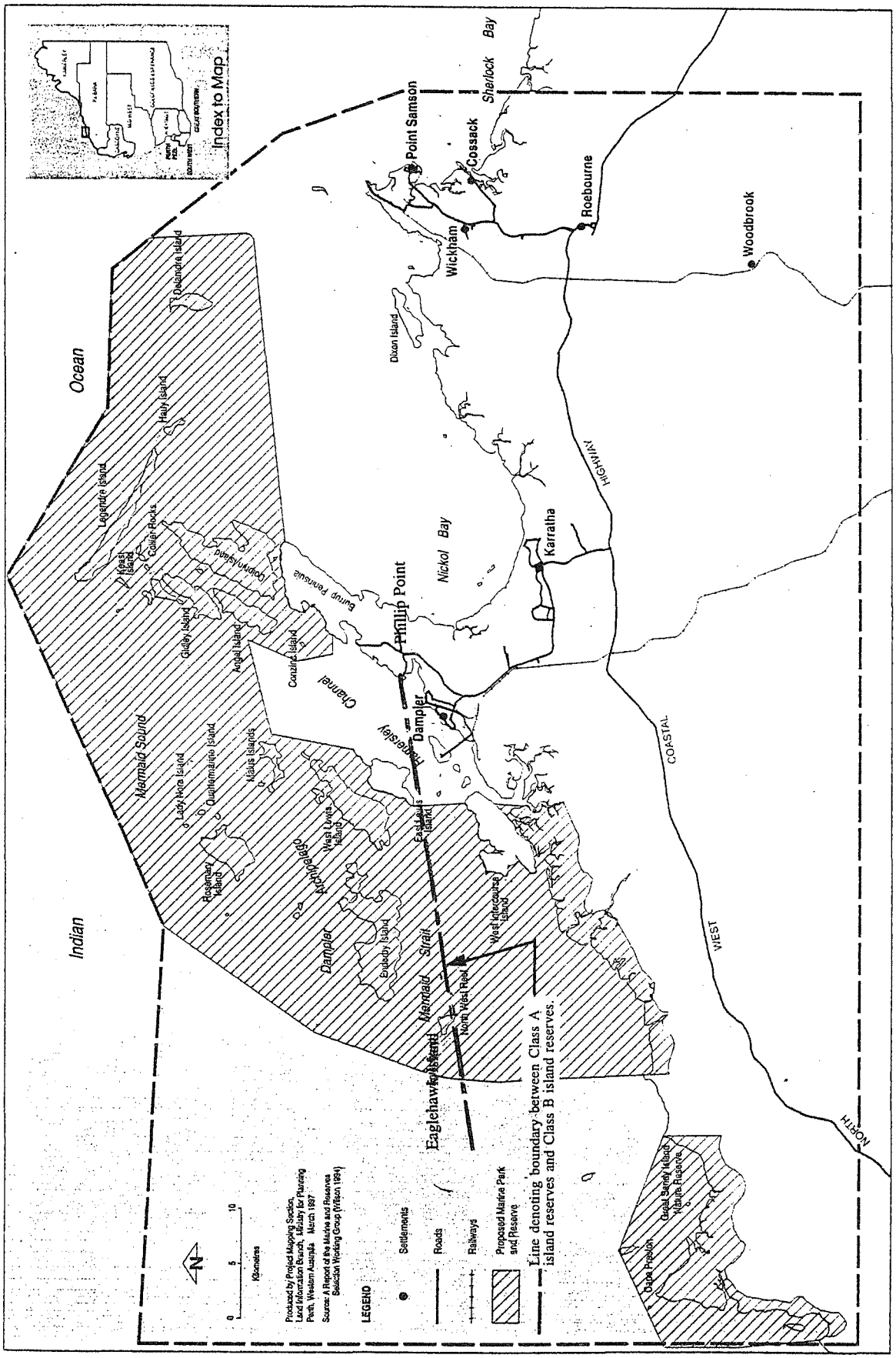

Figure 6. Proposed Marine Reserves (Modified from the WAPC 1997 Draft Karratha Land Development Strategy).

Appendix 2

List of people and organisations that made submissions

State Government

- Aboriginal Affairs Department
- Department of Conservation and Land Management
- Department of Minerals and Energy
- Ministry for Planning
- Dampier Port Authority

Industries

- Dampier Salt Limited

Others

- Conservation Council of WA
- Friends of the Burrup Peninsula and Dampier Archipelago
- Karratha Heavy Industry Site Community Liaison Committee
- Ngaluma and Injibandi People
- Ms E Bradshaw
- Mr R Hooper

Appendix 3

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