Boodarie Resource Processing Estate, Port Hedland

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 resource processing estate at Boodarie. The Government has requested early advice on the environmental matters associated with establishing such an estate in this location to assist in detailed planning for the region. To facilitate the process of regional planning, the Minister for the Environment has sought the Environmental Protection Authority's (EPA's) advice on the resource processing estate concept, pursuant to Section 16(e) of the *Environmental Protection Act 1986*.

This report provides the EPA's environmental advice to the Minister for the Environment regarding a concept to establish the Boodarie Resource Processing Estate, as detailed in LandCorp-DRD's Environmental Report of May 1996 and subsequent documentation, on the Boodarie Pastoral Lease, approximately 11 km south west of Port Hedland and 5 km west of South Hedland.

This report considers the resource processing estate concept in a regional context, environmental issues likely to be important, additional aspects of the concept, further studies and actions required, and environmental management and procedures.

- **Issues**

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 issues:

(a) terrestrial flora and fauna;

(b) marine environment, water quality and fauna;

(c) surface hydrology, drainage and flood mitigation;

(d) groundwater and surface water quality;

(e) air quality;

(f) greenhouse gases;

(g) dust and particulate emissions;

(h) noise and vibration;

(i) public health and safety;

(j) liquid and solid wastes;

(k) cultural, heritage and social surroundings; and

(l) water supply.

Other issues which the EPA believes should be considered are:

(a) site selection;

(b) buffer distances;

(c) infrastructure requirements;

(d) planning and additional facilities in the Port Hedland region; and

(e) estate management.

- **Management and Studies**

A set of environmental objectives has been established against each of the environmental issues. Considerable attention must be paid to environmental management if the concept plan 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.

Advice to the Minister for the Environment

The EPA has provided the environmental advice contained in this report on the Boodarie Estate concept to assist LandCorp and DRD in its further planning and development of the area, and to assist individual proponents who may desire to operate on the site. The report also draws attention to some external matters such as the development of the associated port facilities and the water supply.

There are a number of environmental matters associated with the site which will require special management consideration, but there are no overriding reasons why the site should not be developed as an industrial estate. Matters such as liquid and solid waste disposal, drainage and flood mitigation will need to be given special attention in the planning process so that the environmental impacts are managed to produce a satisfactory outcome. Including part of the land to the south west, ie. part of area 7 in the LandCorp-DRD's environmental document (Woodward-Clyde, 1996) may have some environmental benefits through providing greater flexibility in siting. If LandCorp-DRD consider extending into this area there may be some matters requiring further consideration, but the EPA is of the opinion the recommendations in this report would largely carry over.

The major issues which the EPA considers will require careful management for the Boodarie Resource Processing Estate include:

a) buffer area;

b) liquid and solid waste disposal;

c) drainage; and

d) external issues.

These issues are briefly outlined below, and are discussed more fully in the body of this report.

Buffer area

With regard to the issue of buffer area for the estate, a number of factors associated with industrial processes contribute to a requirement for separation from residential or sensitive areas. Atmospheric emissions, noise and public risk need to be carefully managed in order to ensure that appropriate standards and criteria are met.

The buffer area for the Boodarie Resource Processing Estate was initially as shown in Appendix 1, Figure 2, but has since been extended as shown in Figure 6. Preliminary air quality studies indicated that the buffer area originally proposed for the Boodarie Resource Processing Estate concept plan had limitations if the estate were to be fully developed. Noise modelling also indicated that a larger buffer may be necessary for a fully developed estate, and the buffer was extended in accordance with recommendations made in the noise modelling report. This extension also reduces the concern of atmospheric emissions limiting development of the estate. Risk modelling for the estate site (excluding the port area) indicated that public individual risk levels are able to meet EPA criteria if the estate is fully developed.

The EPA believes that the issues of atmospheric emissions, noise and risk can be managed with the extended buffer and adopting best environmental management practices, but will require ongoing management to ensure that industries are located within the estate such that cumulative effects from the estate as a whole fall within EPA criteria outside the buffer area. Studies of meteorological conditions for the Region will provide good quality data for use in dispersion modelling. A cumulative air quality model should be developed as new industries propose to establish on the site to ensure that ambient air quality is maintained. Proposed industries with the potential to emit high noise levels should be located further from populated areas than industries with lower noise levels, and a cumulative risk model should be developed and used to ensure that both individual and societal risk from the estate as a whole remain within EPA criteria.

Liquid and solid waste disposal

The consideration of the Boodarie Resource Processing Estate concept area has identified limitations of the site for disposal of liquid and solid wastes due to the proximity of the water table to the ground surface, and the potential for flooding in some areas of the estate. LandCorp-DRD have indicated that solid waste disposal facilities will not be located on the site, but that evaporation ponds may be placed on site. Suitable studies, and appropriate design of drainage systems and evaporation ponds (if used) should reduce concerns regarding contamination of soils, surface water and groundwater. Such systems will require separate referral to the EPA for consideration under Part IV of the *Environmental Protection Act 1986*.

Drainage

Drainage systems will also require careful management for this site, as a balance must be found between maintaining the integrity of natural drainage systems, ensuring that indigenous vegetation is not adversely impacted by alterations to surface water drainage, and reducing the impact of flooding and storm surge on the estate and surrounding areas. Site drainage systems will need to be carefully designed, taking these three objectives into consideration.

External issues

Implementation of the Boodarie Resource Processing Estate would have implications for areas and resources external to the estate itself. Demand for port facilities would likely increase as industries established on site, associated with this will be increased shipping and possible impacts on the marine environment. Off site service corridors and infrastructure, including sources of construction materials, solid waste disposal sites and particularly water supply will require investigation of potential environmental impacts. These issues have been briefly discussed in LandCorp-DRD's Environmental Report (Woodward-Clyde, 1996), and within this advice, with suggested further studies included in the relevant sections. Once again, proposals for extensions of port facilities and other infrastructure related to the estate will need to be referred to the EPA for consideration under Part IV of the *Environmental Protection Act 1986*.

This advice considers the potential impacts of the development of a resource processing estate at Boodarie in isolation. The EPA cannot forecast what type of specific industries are likely to establish in the estate. The combined impact of possible industries, infrastructure requirements including rail development, associated port facilities and matters relating to the siting and operation of quarries to provide raw materials to allow implementation of the project to proceed, will require future evaluation.

The EPA endorses the identification and establishment of a Boodarie Resource Processing Estate Management Body to facilitate the investigation and management of cumulative site impacts and off-site servicing impacts. Proponents for individual proposals would be required to refer proposals under Section 38 of the *Environmental Protection Act 1986*.

Preliminary advice on appropriate environmental criteria to apply to the site in relation to issues such as ambient air quality, noise levels, and marine water and sediment quality have been provided. However in each case these criteria are being developed through statutory processes which are still to be finalised.

It is the EPA's view that the provision of infrastructure support for the resource processing estate concept should be considered through separate referral under Section 38 of the *Environmental Protection Act 1986*, or as a function of the consideration of the Scheme Amendment that will precede implementation.

Recommendations to the Minister for the Environment

Recommendation 1

That the Minister for the Environment notes that the EPA has provided environmental advice in this report on the Boodarie Estate concept to assist LandCorp and the Department of Resources Development in their further planning and development of the area, and to assist individual proponents who may desire to operate on the site.

Recommendation 2

That the Minister for the Environment notes that the EPA advice covers issues of terrestrial flora and fauna, marine environment, surface hydrology, drainage and flood mitigation, groundwater and surface water quality, air quality, greenhouse gases, dust and particulate emissions, noise and vibration, public health and safety, liquid and solid wastes, cultural, heritage and social surroundings, water supply, site selection, buffers, planning and additional facilities in the Port Hedland region and infrastructure requirements.

Recommendation 3

That the Minister for the Environment notes the EPA has included advice that a series of studies and further actions should be undertaken, as identified in Section 4 for each issue, and summarised in Section 6.3, so that relevant information is available when individual proposals are presented to the EPA for assessment and also to assist in continuous improvement in environmental management.

Recommendation 4

That the Minister for the Environment notes that the establishment of a Boodarie Estate Resource Processing Estate Management Body is proposed and that this will facilitate the investigation and management of cumulative site impacts and off-site servicing impacts.

Recommendation 5

That the Minister for the Environment notes that infrastructure requirements of the Boodarie Resource Processing Estate 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 6

That the Minister for the Environment notes that industries with the potential to significantly impact on the environment of the Boodarie Resource Processing Estate Concept Area would be subject to assessment under Part IV of the *Environmental Protection Act.*

Recommendation 7

That the Minister for the Environment endorses the EPA advice contained in this report, and in transmitting that advice to the Minister for Resources Development and the Minister for Lands advises them that there are some matters, such as liquid and solid waste disposal, drainage and flood mitigation, which may constrain full development of the site and which will need to be given special attention in the planning process so that the environmental impacts are managed to produce a satisfactory outcome.

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Appendices

1. Introduction

LandCorp and the Department of Resources Development (DRD) have referred a concept plan for the Boodarie Resource Processing Estate as part of a strategic review of industrial land for the Pilbara Region. The Government has requested early advice on the environmental considerations associated with the Boodarie Resource Processing Estate concept plan to assist in detailed planning for the concept and to assist the process of planning for the region. The Minister for the Environment has sought the EPA's advice on the Boodarie Resource Processing 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 resource processing estate concept plan at Boodarie be implemented, it will:

- allow earlier definition of environmental issues;
- identify environmental studies that should be completed;
- 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 Definition of 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 in May 1996, has requested environmental advice on the concept of a resource processing estate on the Boodarie Pastoral Lease, west of South Hedland.

1.2 The Environmental Report

The Boodarie Resource Processing Estate Environmental Report (Woodward-Clyde, 1996) was originally prepared as a Consultative Environmental Review document under Part IV of the *Environmental Protection Act 1986.*

Following on from the Supreme Court decision of 27 April 1995 (number 1879 of 1994), it was determined that planning proposals could not be assessed formally under Part IV of the Act because it was not a "proposal" within the meaning of the Section 38 of the Act. As it was concluded that the Boodarie Resource Processing Estate assessment fell outside this definition, the formal assessment could not be completed. This report provides the EPA's advice under Section 16(e) of the Act.

Nevertheless, the Environmental Report prepared by Woodward-Clyde for LandCorp-DRD was released for public and agency comment, with submissions received from various state and Commonwealth government agencies and from industry and response to submissions from LandCorp-DRD. A list of people and organisations who commented on the Environmental Report is included in Appendix 2.

1.3 Limitations of this report

Information gathered for the Environmental Report (Woodward-Clyde, 1996) and comments received from Government agencies and interested parties 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 specific proposal within the Boodarie Resource Processing Estate.

1.4 Definitions

The following explicit definitions are used in this report:

Boodarie Resource Processing Estate	Boodarie Resource Processing Estate area indicated in Appendix 1, Figures 1 and 2, including industrial core of main estate, support industries area, buffer and service corridors.
Boodarie Resource Processing Estate Management Body	For the purposes of this report is has been assumed that the Boodarie Resource Processing Estate Management Body, possibly comprising a representative from each of the industries within the park, 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.
Concept Area	Land occupied by Boodarie Resource Processing Estate Concept Plan (including service corridors)
Concept Plan	Indicative plan for development of the Boodarie Resource Processing Estate.
Environmental Management Programme	A programme designed to achieve the objectives and targets of the organisation; it includes environmental management plans to address specific issues, and procedures to implement the plans.
Environmental Management System	The part of the overall management system that includes organisational structure, planning activities, responsibilities, practices, procedures, processes and resources for achieving and maintaining the environmental policy. System components include those described in AS/NZS ISO 14001; key components include: policy, resources, environmental management programme, training, monitoring, corrective action, periodic system audit and management feedback.
Estate Manager	For the purpose of this report it has been assumed that the resource processing estate will be managed by the Boodarie Resource Processing Estate Management Body. Until the appointment and/or incorporation of such a body, this role will be assumed by LandCorp-DRD.
Industrial core	That part of the Boodarie Resource Processing Estate intended for heavy industry use.
Proponent (for future industrial developments)	In relation to a proposal, means person who or organisation 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 (for future industrial developments)	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.

2. The Boodarie Resource Processing Estate Concept Plan

2.1 Site selection process

LandCorp and DRD are jointly planning the development of the Boodarie Resource Processing Estate near Port Hedland (Appendix 1, Figure 1) to accommodate major industries based on processing resources in the Pilbara region.

The preparation of this "Concept Plan" follows from the recommendations of the *Pilbara 21 Study*, 1992. A site selection process was undertaken which involved the evaluation of eight options in the Port Hedland area. These options are also shown in Appendix 1, Figure 1. The Boodarie Resource Processing Estate was identified as a preferred option after consultations with State and Local Government and Industry.

Key criteria considered in the identification of the eight options included access to road and rail, and proximity to power, gas and water supplies and deep water port facilities.

Environmental concerns were considered mainly with regard to proximity to towns and settlements, and more detailed studies of environmental issues were only carried out for the selected Boodarie site.

Detailed consideration of matters relating to infrastructure requirements were also undertaken only for the selected Boodarie site. Earthworks, water supply, electricity and gas, telecommunications, roads, rail, drainage and port facilities were considered, along with possible limitations, in the Engineering and Environmental Assessment undertaken by BHP Engineering and Woodward-Clyde (BHP Engineering/Woodward-Clyde, 1994), and have been discussed in the Environmental Report (Woodward-Clyde, 1996).

The provision of infrastructure support for the resource processing estate concept will be subject to separate referral to the EPA, or through Scheme amendments to install appropriate land zoning.

2.2 Description of Concept Plan characteristics

The Concept Plan, shown in Appendix 1, Figure 2, involves an area of approx 3500 hectares on the Boodarie Pastoral Lease. Two associated service corridors run north to the southern limit of the Port Hedland Port Authority land (land tenures are shown in Appendix 1, Figure 3). The industrial core of the estate extends from the southern boundary of the BHP Direct Reduced Iron (BHP DRI Pty Ltd) Plant approximately 8 km to the south, with a western boundary running parallel to the Turner River East Branch and protective long dunes, and bounded to the east by a service corridor and the Great Northern Highway. An associated Support Industry area lies on the eastern side of South West Creek, bounded by the Great Northern Highway and the Port Hedland - Goldsworthy Railway.

Also included in the Concept Plan is a buffer, the boundary of which lies 3 km from the western and southern industrial core boundaries and which approximates the Boodarie lease boundary to the north. Originally the eastern boundary of the buffer area approximated the Town of Port Hedland boundary (as shown in Appendix 1, Figure 1). However after undertaking noise modelling the buffer area for the Concept Plan was extended to South Creek as shown in Appendix 1, Figure 6.

The BHP DRI Pty Ltd Plant and the Pilbara Energy Pty Ltd (PEPL) power station do not form part of the Concept Plan. Details of alterations to port facilities and the extension of service corridors into Port Hedland Port Authority land have also not been included in the Concept Plan, and have been given brief consideration only.

The features of the land within the concept area for each of these elements are summarised in Table 1 below.

Table 1: Elements of the Boodarie Resource Processing Estate Concept Plan (refer Appendix 1, Figure 1)

Element	Location	Comments
Industrial Core	Boodarie pastoral station.	Located on coastal plain typified by low relief with silty loose red-brown fine to medium grained sand. Some high level sands in the west of the estate. Eastern area is subject to 100 year Average Recurrence Interval storm surge along South West Creek. (see Figure 4)
Service Industry Area	Boodarie pastoral station.	Located to the east of the Boodarie Resource Processing Estate and east of South West Creek on red-brown silty sands. Proposed access road from Highway to industrial core may run through this area. Part of the area is subject to 100 year Average Recurrence Interval flooding along South West Creek as well as 1:100 storm surge extent.
Buffer Area	Boodarie pastoral station.	Generally red-brown silty sands, with some tidal plain sediments to the north, and dune limestone and lime cemented beach conglomerate along creek beds.
Service Corridors	Boodarie pastoral station.	Generally red-brown silty sands, with some tidal plain sediments to the north, and dune limestone and lime cemented beach conglomerate at creek bed crossings. Both corridors may be subject to 100 year Average Recurrence Interval storm surge along South West Creek.
Drainage Reserves	Within industrial core.	Includes one reserve along western boundary of the industrial core, one along the boundary with the Great Northern Highway, and a central drainage reserve. Generally red-brown silty sands, and some high level sands in the west.
Other Reserves	Within industrial core.	Pilbara Energy Pty Ltd Karratha - Port Hedland gas pipeline; Power and water reserve. Generally located on red-brown silty sands, and some high level sands in the west.

Table 2 summarises the regional aspects of the estate.

Table 2 †: Boodarie Resource Processing Estate

Characteristic	Site
Area	Industrial core: 35 km^2 * Estate area including buffer: 154 km^2 *
Hydrology Drainage	Northward broadsheet flow towards South West Creek (no incised channels) after crossing Great Northern Highway at a series of floodways.
Storm surge	1:100 year storm surge level reaches the northern boundary of the estate, and extends approximately halfway into the support industries area.
Floodplain	Eastern part of estate lies within the 1 in 100 year flood plain of South West Creek
Groundwater	Depth of water table ranges from around 4 m below the ground surface in the north of the estate to around 7 m on the coastal plain.
Geology	Silty loose red-brown fine to medium grained sand and some high level sands in the west of the estate.
Winds: (direction to urban centres) annual % occurrence of critical direction	~4% South Westerly (towards Port Hedland) ~7% Westerly (towards South Hedland) ~16% Easterly (towards Boodarie Homestead)
Wind proximity: (distance and critical wind direction to) Port Hedland South Hedland Boodarie Homestead	 11 km SW 5 km W 4 km E
Services: (direct distance to existing services) Rail	4 km to Goldsworthy rail reserve.
Transport	Proposed access road 2.5 km from Great Northern Highway.
Port	10 km from north of estate to Port Hedland Port. Service corridors through Port land not addressed in Environmental Report (Woodward-Clyde, 1996).
Gas pipeline	Pilbara Energy Pty Ltd (PEPL) gas pipeline does not have capacity for industrial users other than PEPL power station.
Water supply	Spare (licensed) capacity of De Grey aquifer to be utilised by BHP HBI. Studies indicate that utilisation of this aquifer is capable of expansion. Total water supply requirements of estate not known.
Solid waste facilities	Unlikely to be established on site. Suitable facility to be developed in Pilbara according to demand.

† distances are derived from the Environmental Report (Woodward-Clyde, 1996), are approximate only and given from the edge of the estate area to the closest part of the population area.

* Approximate only

Industry types that may establish within the Estate include:

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

Typical industry profiles for each of these industry groups are presented in Tables 3.1 to 3.3 inclusive in Woodward-Clyde (1996).

The area approximately 1 km east of the estate between Goldsworthy railway and the Great Northern Highway (see Figure 2 in Appendix 1) is nominated for support industries related to the estate.

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 service, industrial and commercial land.

It is intended that a Boodarie Resource Processing Estate Management Body be established during the operational phase of the concept. This body may comprise 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 and 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, DRD and the Town of Port Hedland.

3. Regional context of Concept Plan

3.1 Strategic environmental assessment

As mentioned in Section 1.1 above, the Minister for the Environment has requested environmental advice on the concept of a resource processing estate on the Boodarie Pastoral Lease. This advice differs from an environmental assessment by the EPA in two important respects.

Firstly, as no specific development is proposed, this advice is much more broad ranging and general in its scope, also highlighting regional implications of development. Suitability of the site for the proposed use is considered rather than impacts from specific designs, structures and processes on the surrounding environment. Design criteria for subsequent proposals are indicated where possible.

Secondly, the advice indicates further studies which will be required by future proponents, or by LandCorp-DRD before the site is considered by the EPA to be suitable for use as a resource processing estate.

3.2 Regional environmental context

The Pilbara Development Commission, in consultation with interested agencies, community groups and industries, has formulated a Pilbara Land Use Strategy to develop objectives for land use in the Pilbara, such that various land uses are able to be accommodated and planned for.

One outcome of the preparation phase of the strategy was that more information was shown to be required to define the environmental resources of the region (Pilbara Development Commission, 1997).

Detailed studies in the region are generally associated with specific proposals, and those relating to the Boodarie Resource Processing Estate will be expanded upon in Section 4 of this report.

Development of heavy industry in the Pilbara may potentially be limited unless adequate water supplies can be identified. Costs associated with establishment and extension of borefields, and infrastructure escalate as more distant sources are developed.

Water supply for the Port Hedland region is currently from the De Grey and Yule aquifers. The De Grey aquifer, approximately 70 km east of the estate concept area has a currently licensed capacity of 7 GL/a. There is the potential for significant additional resources in the De Grey aquifer, with drilling programme results currently being assessed by the Water Corporation. The currently licensed capacity of the Yule borefield is 6.5 GL/a.

The Water and Rivers Commission report, Hydrogeology Report No HR 61 (Wright, 1997) indicates that the present demand is 5.9 GL/a, expected to increase to a total of 15 GL/a when the BHP DRI Pty Ltd Hot Briquetted Iron plant reaches full production. The Water and Rivers Commission Report further predicts the total available ground water supply from the Yule and De Grey aquifers to be 24 GL/a, based on a desktop review of data held by the Geological Survey of Western Australia and the then Water Authority of Western Australia. However studies into the sustainability of extracting this volume of resource have not been undertaken at this stage. If such resources are available then some potential exists for industries establishing within the Boodarie Resource Processing Estate to utilise these supplies in the medium term.

Definition of total water requirements for the Boodarie Resource Processing Estate is not possible at this time as the industries which will establish on site are not known, and because the level of use of groundwater in preference to alternative sources such as seawater and recycling is also unknown. Demand for water is also related to the industry type, with some industries able to use second class supplies, and some requiring potable water. Tables 3-1 to 3-3 in the Environmental Report (Woodward-Clyde, 1996) indicate the water demand for various industry types which may establish in the estate.

Sites for port development are another problem in the region. Suitably sheltered coastal sites are relatively rare, and impacts on arid zone mangroves are of concern. Anderson Point, within the Port Hedland harbour has scientifically significant alluvial fan mangroves (Semeniuk, 1994) and environmental impacts on these communities must be addressed prior to extensions to this port. While development of further port facilities on Finucane Island would be likely only to have local to medium scale effects on mangroves, studies into these impacts would also be required, and any impacts minimised.

Results of public risk modelling, described further in Section 4.10, also place limitations on activities within the port if the Boodarie Resource Processing Estate is to be established. While detailed consideration of Downes Island as an alternative port development site has not yet been undertaken, Downes Island (along with most coastal islands in the Pilbara) is subject to EPA System 8 recommendations (EPA, 1975).

Development of industrial processing plants in the Pilbara Region has implications for air quality. Meteorological conditions of an area need to be well defined (preferably by monitoring conditions for a minimum of two years prior to development) in order to assess buffer requirements and likely impacts of a proposal. A Government funded initiative to undertake studies in various parts of the Pilbara is now underway.

3.3 Regional planning context

The Pilbara Land Use Strategy developed by the Pilbara Development Commission outlines a number of strategies aimed at achieving objectives for economic development in the Pilbara. The strategy has been developed in response to recommendations of the Pilbara 21 Study of 1992. The format of the strategy is such that specific areas are not identified for particular uses, but broad principles, objectives and strategies that should apply to land use decisions have been developed.

The Pilbara Land Use Strategy outlines the objective in relation to industrial development and industry sites in the area as being to "protect options for ports development and ensure the availability of appropriately located sites for resource purposes, to maximise the economic

benefits to the region and the State". Planning of the Boodarie Resource Processing Estate and associated infrastructure forms part of the strategy for meeting this objective.

Part of the objective outlined for Infrastructure Development is to "ensure sufficient water is available for all purposes, including environmental flows for ecosystem maintenance, at an acceptable cost". Defining sustainable water supplies, and developing water management plans and investigating alternative supplies form part of the strategy for meeting this objective.

The environment and conservation objective outlined in the Plan is to "protect the important environmental resources of the Pilbara". The strategies outlined in the plan include undertaking an environmental resource inventory of the Pilbara biogeographic zones, concentrating initially on areas likely to be subject to the greatest development pressures, protecting biodiversity, habitat protection and weed control.

Broadly speaking, land uses identified in the Pilbara Land Use Strategy document include industrial development, mining, tourism, pastoral use and urban and infrastructure development, balanced with heritage and cultural, environment and conservation issues. A strong emphasis is placed upon multiple land use.

3.4 Local environment

While Section 3.2 above outlines issues of a regional nature which may need to be considered, a definition of the local environment of the Concept Plan is outlined below.

Land

The area nominated for the Boodarie Resource Processing Estate is on the coastal plain characterised by low relief and consisting of red brown flood plain alluvium comprising silty sand, clayey sands and some fine gravels.

The Boodarie Resource Processing Estate Concept Area is in a region subject to cyclonic activity, with unreliable and highly variable rainfall. This means that extreme events must be considered in site design and drainage measures.

The Turner River, Beebingarra Creek, South West Creek and South Creek are the main surface water channels in the vicinity (Appendix 1, Figure 1). Brief flow in the creeks and rivers follows heavy rainfall, and the South West Creek has inundated the site on past occasions. The eastern part of the estate lies within the 1 in 100 year flood plain for South West Creek. Broadsheet flow runoff from a catchment to the south of the site flows in a northerly direction across the site to South West Creek, after crossing the Great Northern Highway at a series of floodways (Woodward-Clyde, 1996

There is a lack of data relating to the flood levels due to the Turner River East Branch which lies to the west of the Concept Area (Woodward-Clyde, 1996). This makes judgement of the relative merits of the Concept Plan difficult to gauge in comparison with other nearby sites which may also have been suitable for consideration for establishment of a resource processing estate.

The Boodarie Resource Processing Estate Concept Area lies within the Pilbara Biogeographical Region This is a defined ecological region with similarities in climate, landforms, geology, soils and vegetation. The distribution of plant communities is shown in Figure 9 of the Environmental Report (Woodward-Clyde, 1996).

The conservation value of the area has been degraded by grazing, however there remains further potential for the introduction of weeds, pests and diseases into the area where disturbance occurs.

Water

The water table ranges from 4 to 7 metres below the ground surface in the Boodarie Resource Processing Estate Concept Area.

The main surface water expressions in the area include the Turner River, Beebingarra Creek, South West Creek and South Creek

As the site drains to mangals north of the nominated site, any surface water contamination has the potential to impact on these communities.

Semeniuk has indicated that there is limited scope for contaminants to reach mangrove areas via groundwater as the terrain is not a Holocene or late Pleistocene delta which may channel contaminants to the coast (Semeniuk, 1994).

Salinity of the coastal plain on which the Boodarie Resource Processing Estate Concept Plan lies is between 1000 and 2000 mg/L total dissolved salts (TDS) on the coastal plain (Woodward-Clyde, 1996). In the tidal flat region (generally north of the northern buffer boundary) salinity is between 4000 and 6000 mg/L TDS. A number of wells exist on the concept area site and in surrounding areas. Water from these low yield wells is generally used for stock watering.

Liquid and solid waste are of regional concern, as outlined in Section 3.2 above. Site specific concerns relate to flooding which has the potential to interfere with evaporation ponds and landfills. If waste water is to be disposed of via outfall to the ocean, an appropriate site and corridors will need to be selected.

The Boodarie Resource Processing Estate has the potential to impact on a number of elements of the marine environment. In the short term the major impact is likely to be on the nearshore marine environment during construction of service corridors. Port expansion and increased shipping activities related to the concept may have impacts at a later stage. Expansion of the existing port facilities does not form part of the Boodarie Resource Processing Estate Concept Plan, however an increase in shipping activities as industries establish on the site is likely to generate a need for expansion. Any consequent environmental impact must be carefully assessed.

Air

The Concept Plan for the resource processing estate includes provision for a 3 km buffer on all sides to protect sensitive premises form potential impacts of emissions, dust, noise and risk.

Prevailing winds in Summer are variable in the morning (generally south easterly and westerly), shifting to north to north westerly in the afternoon. East to south easterly winds dominate in the morning in Winter, and shift to northerly in the afternoon (BHP Engineering & Woodward-Clyde, 1994). Westerly and south westerly winds, which would tend to carry emissions from the Boodarie Resource Processing Estate towards South Hedland and Port Hedland tend to be less common occurring approximately 8% of the time. A wind rose for Port Hedland is shown in Appendix 1, Figure 1.

Nearest residences to the estate concept area are Boodarie Homestead, 4 km west of the industrial core boundary, the Bosna Lodge buildings, 4.6 km south east of the industrial core boundary, and at South Hedland, approximately 5 km from the industrial core boundary.

The industry types likely to establish in the Boodarie Resource Processing Estate, based on the resources present in the region, include downstream iron ore processing, downstream petroleum processing and power intensive industries. The air emissions which may occur due to these industry types are outlined in LandCorp-DRD's Environmental Report and include sulphur dioxide, nitrogen oxides, hydrogen sulfide and fine particulates (Woodward-Clyde, 1996).

Details of the meteorology of the area are not well understood, as comprehensive studies have not been undertaken. Likelihood, frequency of occurrence, and extent of shoreline fumigation episodes, for example, require definition.

Greenhouse gases will also be generated by the types of industries likely to establish on the site, however the impacts of greenhouse gases are of a global scale and are not restricted to the local or regional environment.

Dust has historically been a major issue in the Port Hedland area due to the operations associated with conveyors and ship loading facilities at Finucane Island. There is concern that increasing the volume of materials handled in the area will cause higher dust levels than desirable.

Social surroundings

The Boodarie Resource Processing Estate site is situated in a rural environment with low background noise levels. The industrial core of the estate is located 4 km from the nearest noise sensitive premises, Boodarie Homestead (see Figure 1 in Appendix 1). A 3 km buffer area around the industrial core is intended, and will extend to a minimum of 4 km on the eastern side encompassing South Creek.

Primary access to the Boodarie Resource Processing Estate is expected to be along the Great Northern Highway. There is also the possibility of a rail link to the Goldsworthy Railway line. In areas where these noise sources do not have a significant influence, night time background levels under calm weather conditions are likely to be low.

As the industries considered likely to establish on the estate have the potential to impact on public health and safety, risk modelling was undertaken using generic industries and typical ship loading scenarios. The outcome identified problems with importation of crude oil at Stanley Point, an area within the Port Hedland harbour which is under consideration for extension of current Port facilities. This will be discussed in more detail in Section 4.10.

The historical and cultural surroundings in the Port Hedland area are outlined in Section 4.12 of the Environmental Report (Woodward-Clyde, 1996). Aspects considered include Aboriginal and European heritage, and the nearby population centres.

The EPA seeks to protect social aspects of the environment in addition to biological and physical aspects.

Infrastructure

The Pilbara 21 Report, released in 1992 (Pilbara 21 Steering Committee, 1992) identified a need to establish suitable sites in the Pilbara Region for the establishment of resource processing industries (Woodward-Clyde, 1996). The Port Hedland area was seen as a suitable centre for such development, due to its proximity to raw material and its well established port facilities.

Although integral to the development of the Boodarie Resource Processing Estate, a number of issues remain which were not addressed in the Environmental Report (Woodward-Clyde, 1996). Service corridors and anticipated expansion of the existing port have not been thoroughly addressed and would need to be referred separately under Section 38 of the *Environmental Protection Act 1986*. Risk assessment indicated problems with import of crude oil, and it was considered that new port facilities may be required at Downes Island. Further study of environmental impacts on this EPA System 8 area, and definition of possible service corridors is not included in the Environmental Report (Woodward-Clyde, 1996).

4. Environmental issues likely to be important

4.1 Important environmental issues

In the EPA's opinion, and having regard for the views of the government agencies and interested parties indicated in Appendix 2, and other relevant information identified in the text and referenced in Appendix 4, the following are the environmental issues likely to be of importance in the development of a resource processing estate at Boodarie:

(a) terrestrial flora and fauna;

(b) marine environment, water quality and fauna;

(c) surface hydrology, drainage and flood mitigation;

(d) groundwater and surface water quality;

(e) air quality;

(f) greenhouse gases;

(g) dust and particulate emissions;

(h) noise and vibration;

(i) public health and safety;

(j) liquid and solid wastes;

(k) cultural, heritage and social surroundings; and

(l) water supply.

These environmental issues are discussed in Sections 4.2 to 4.13 of this report.

Other issues which the EPA believes should be considered are:

(a) site selection;

(b) buffer distances;

(c) infrastructure requirements;

(d) planning and additional facilities in the Port Hedland region; and

(e) estate management.

These environmental issues are discussed in Section 5 of this report.

The environmental issues which require further investigation are identified. It should be noted that this assessment is not of individual proposals but of 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 Section 38 of the *Environmental Protection Act 1986*, or during the Planning Scheme amendment stage.

4.2 Terrestrial flora and fauna

Aspects

Field surveys of the Port Hedland Region were undertaken as part of the Environmental Report by Mattiske Consulting Pty Ltd in September 1994. The surveys covered flora and fauna species found on the Boodarie Pastoral Lease, and the Port sites and service corridors.

Details of the species found in the area are given in Chapter 4 of the Environmental Report (Woodward-Clyde, 1996). Priority Three vascular plant species *Acacia glaucocaesia* and Priority One plant species *Ptilotus appendiculatus* var. *minor* are known to occur in the Port Hedland/South Hedland region, and may be found associated with certain plant communities occurring on the Boodarie Resource Processing Estate (Woodward-Clyde, 1996). The Engineering and Environmental Assessment undertaken by BHP Engineering and AGC Woodward-Clyde also notes that Priority species *Triumgetta appendiculata* was found on the concept area site, and that Priority species *Acacia glaucocaesia*, *Euphorbia clementii* and *Ptilotus appendiculatus* var *minor* are considered very likely to occur in the region (BHP Engineering/AGC Woodward-Clyde, 1994). The presence or otherwise of these species in the Concept area would need to be confirmed prior to development proceeding.

Submissions from the Australian Nature Conservation Agency (ANCA, now the Biodiversity Unit of Environment Australia) suggest that the Vulnerable mammal species *Dasycercus cristicauda* (Mulgara) should also be specifically targeted by further studies. LandCorp-DRD has indicated that CALM has advised that this species would not be expected to occur on alluvial sands, but that specific targeting of the species during more detailed studies in the future can occur. Future proponents would be required to report the location of any Endangered Species, including *Dasycercus cristicauda* (Mulgara), to the Endangered Species Unit of the Biodiversity Group at Environment Australia, along with proposed action toward its conservation.

Mangrove communities (mangals) were also surveyed by Mattiske Consulting Pty Ltd, and are found in the intertidal zone of the study area. Mangrove communities will require consideration in the extension or establishment of port facilities. Seven main mangrove species are present in

the Port Hedland area. Mangals provide habitat for marine fauna and wading birds and a nutrient source for marine ecosystems, as well as protecting coastline from erosion during storms (Woodward-Clyde, 1996). Field surveys of mangals have been undertaken by Semeniuk (1983, 1994) and Semeniuk, Kenneally and Wilson (1978).

The mangroves of the region are considered to be of regional or state importance for ecological reasons pertaining to productivity, feeding grounds and fish nurseries (Semeniuk, 1994).

In the event that port development is to occur, site specific environmental management measures will be required to protect species rich assemblages from adverse impacts associated with construction works, site drainage and operations within the service corridors (Woodward-Clyde, 1996).

The major consideration with respect to flora and fauna is land clearing and subsequent loss of vegetation communities and habitats. At this stage the major potential impact on mangroves is from water runoff from the estate, but any expansion of port facilities or proposals for a new port, which may also have an impact, will be subject to separate assessment by the EPA.

If port expansion is required in the future, DRD and the Port Hedland Port Authority have committed to undertake further studies into the impacts this may have on mangrove communities.

LandCorp-DRD has committed to reducing potential impacts by staging landform modification works and vegetation clearing and to protecting declared rare and priority flora species. Initiatives, including monitoring, will be introduced to control pests and weeds.

Submissions from Government agencies raised concerns that a number of significant vegetation and fauna species may be present in the area under consideration for the Boodarie Resource Processing Estate and that more detailed surveys must be undertaken before any development occurs.

Consideration

The area considered for evaluation of this issue is the Boodarie Resource Processing Estate, service corridors and Port Hedland Port Authority area, within the broader Pilbara Biogeographical Region (Woodward-Clyde, 1996).

The EPA's objectives in regard to this issue are:

- to protect declared rare and priority flora and Specially Protected (Threatened) fauna consistent with the provisions of the *Wildlife Conservation Act 1950*;
- to maintain the abundance, diversity, geographic distribution and productivity of vegetation communities and terrestrial fauna;
- to maintain the ecological function, abundance, species diversity and geographic distribution of mangroves; and
- to meet Australia's international agreements on migratory birds.

LandCorp-DRD have indicated that more detailed surveys of flora and fauna will be undertaken by proponents. LandCorp-DRD will be required to submit future estate development plans including infrastructure corridors and port expansion plans to the EPA for assessment pursuant to Part IV of the *Environmental Protection Act 1986*.

The EPA notes:

1. the limitations of flora surveys carried out to date;
2. commitments made by LandCorp-DRD;
3. requirement for any industry wishing to establish on-site to refer the project to the EPA pursuant to Part IV of the Act; and
4. 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 flora and fauna, the following studies and further actions should be undertaken:

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

1. undertake a full survey of areas to be disturbed by construction activities for threatened or endangered species of flora and fauna, including specific targeting of the vulnerable fauna species *Dasycercus cristicauda* (Mulgara) in hummock grassland, and Priority One flora species *Ptilotus appendiculatus* var. *minor*;
2. implement a management plan, including a monitoring programme and control strategy, to control introduced pests and weeds; and
3. identify the area affected by service corridors accessing the port, and potential impacts on mangroves in the area.

Studies and further actions to be undertaken by the Estate Manager / Proponent:

1. undertake full surveys of the proposal area for threatened or endangered species of flora and fauna, including specific targeting of the vulnerable fauna species *Dasycercus cristicauda* (Mulgara) in hummock grassland, and Priority One flora species *Ptilotus appendiculatus* var. *minor;*
2. undertake further studies into the impacts port development may have on mangrove communities;
3. minimise disturbance to fauna habitats and vegetation communities during construction; and
4. notify the Endangered Species Unit of the Biodiversity Group at Environment Australia in the event that any endangered species are located on a development site, and propose action towards their protection.

4.3 Marine water quality and fauna

Aspects

The potential impacts of the Boodarie Resource Processing Estate on the marine environment include:

- nearshore impacts from construction of service corridors and possible port expansion;
- contamination of the marine environment or mangal communities in the vicinity of Anderson Point from untreated runoff from the resource processing estate;
- increased environmental risk associated with spills and leaks into the marine environment due to increased shipping activities (Woodward-Clyde, 1996); and
- the impact of increased shipping on threatened species such as dugong, whale species and turtle species likely to inhabit the area.

The Port Hedland Port Authority is responsible for managing shipping activities at Port Hedland, and for ensuring that port development is carried out in an environmentally sensitive manner (Woodward-Clyde, 1996). Any future expansion of the port facilities at Port Hedland or at an alternative site (as outlined in Section 4.10), will be required to undergo separate assessment under Part IV of the *Environmental Protection Act 1986*.

Any deterioration of water quality leaving the Boodarie Resource Processing Estate has the potential to affect the surrounding marine ecosystem, which includes the mangrove assemblages in the Port Hedland harbour. Water quality monitoring will be required by the Estate Manager for surface water runoff and groundwater. This will be discussed further in Section 4.5, Groundwater and surface water quality.

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

The marine water quality in the Port Hedland locality is regarded as high, as is most of the Western Australian coast. Marine habitat surveys in the region have been limited and have tended to take the form of localised surveys of specific sites undertaken by industry and researchers. The localised surveys have been summarised in a report by Halpern Glick Maunsell for the BHP DRI Pty Ltd Hot Briquetted Iron Project (Halpern Glick Maunsell, 1993 in BHP, 1994). As industrial development in the Pilbara Region is expected to continue, a wider ranging regional marine study may be appropriate.

The report of the Marine Parks and Reserves Selection Working Group *A Representative Marine Reserve System for Western Australia* (CALM, 1994) reviews the significance of marine areas along the entire Western Australian coast. The report does not include recommendations for the establishment of marine reserves in the waters around Port Hedland and Boodarie. The report does note the presence of a Flatback Turtle rookery on Cowrie Beach approximately 50 km west of Port Hedland.

The Port Hedland Port Authority has formal responsibility for water and sediment quality within the Port Hedland harbour. The Port Hedland Port Authority area is shown in Appendix 1, Figure 5.

Development of a new port, or expansion of existing port facilities has the potential to significantly affect marine water quality both during normal operations and in the event of accidental discharges, spills or other incidents.

Accidental spills of oil and other discharges, routine discharge of ballast water and contamination of water due to antifouling paints containing Tributyltin (TBT) all have the potential to impact on marine water quality.

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 International Convention for the Prevention of Pollution by Ships 1973/78, known as 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).

In addition the Port Hedland Port Authority has a Port Emergency Plan 1995 to deal with spills.

A concern related to an increase in shipping associated with development in the Pilbara 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.

Introduced marine species including the barnacles, *Megabalanus tintinnabulum* and *Megabalanus rosa*, and the green algae *Caulerpa taxifolia* have been found in the Port Hedland area (Furlani, 1996).

To reduce the risk of exotic organisms being introduced when ballast water is discharged in the vicinity of port areas, the Australian Quarantine and Inspection Service (AQIS) has established an Australian Ballast Water Management Strategy which is being introduced through all Australian ports with voluntary compliance by operators of foreign-going vessels.

It is anticipated that the spread of exotic plants and animals from marine sources will be controlled under Australian Quarantine Inspection Service Notice - Barrier Co-ordination 92/2 (1992).

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). As shipping in the area increases it may be necessary to further consider options for the treatment of ballast waters from overseas vessels.

Tributyltin (TBT) is used in antifouling paint on large ships and is a further concern with regard to marine water quality due to its impacts on marine organisms. Currently large ships use TBT in preference to safer alternatives as it is a longer lasting antifoulant. TBT monitoring within the Port Hedland Harbour is undertaken by the Port Hedland Port Authority.

In discussing options for expansion of port facilities, likely impacts on the nearshore marine environment have been foreshadowed. Assessment of impacts on the marine environment due to port expansion, new port development or from increased shipping will occur as proposals are referred to the EPA pursuant to Part IV of the *Environmental Protection Act 1986.*

Monitoring to be undertaken of surface and ground water quality (described in Section 4.5) is relevant to maintaining marine water quality, particularly as drainage from the estate discharges to mangal communities, and has the potential to affect the many species associated with such areas .

Submissions received from other agencies raised the concern that an increase in shipping activities (and the related increase in the risk of spills) will impact on the habitat of threatened species, including the dugong, blue whale, humpback whale, leathery turtle, hawkesbill turtle, green turtle, loggerhead turtle and the little tern. The impact of increased shipping, and potential spills, on the Leslie (Port Hedland) Saltfields System 30 km east north east of Port Hedland should also be addressed, as the system is an internationally important wetland for migratory birds.

Proponents of developments likely to impact on the habitats of protected species will need to be aware of their obligations under various legislation.

Consideration

The area considered for evaluation of this issue includes, the nearshore marine environment and the Port Hedland Port Authority area.

The EPA's objectives in regard to this issue are to:

- meet the requirements of the Australian Water Quality Guidelines for Fresh and Marine Waters (ANZECC, 1992);
- in the longer term, to adopt and implement the Environmental Quality Objectives (EQO's) and Environmental Quality Criteria (EQCs), to maintain or improve water and sediment quality, as developed for the Southern Metropolitan Coastal Waters Study (DEP, 1996a); and
- protect Specially Protected (Threatened) Fauna, consistent with the provisions of the *Wildlife Conservation Act 1950.*

The EPA notes the:

1. commitment made by LandCorp-DRD to monitor surface runoff and groundwater quality leaving the resource processing estate;
2. management of any port facility associated with the Boodarie Resource Processing Estate by a designated Port Authority;
3. requirement for proposals to expand the existing Port Hedland port facilities or establish a new port to be referred to the EPA pursuant to Part IV of the Act;
4. requirement for any industry wishing to establish on-site to refer the project to the EPA pursuant to Part IV of the Act; 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 the marine environment any future proposal should undertake, but not be limited to, the following studies and further actions:

Studies and further actions to be undertaken by the Estate Manager/Proponent:

1. undertake, if appropriate, a regional survey of marine habitats;
2. undertake a baseline survey of water quality;
3. develop and implement an environmental management programme to minimise damage to the nearshore marine environment during construction of service corridors;
4. monitor the quality of water leaving the estate when it may have the potential to impact on the marine environment;
5. develop and implement procedures to prevent spills; and
6. adhere to requirements of treaties and legislation dealing with threatened marine species.

4.4 Surface hydrology, drainage and flood mitigation

Aspects

The siting of the Boodarie Resource Processing Estate Concept Plan is such that the possibility of inundation must be considered. The site is situated on the coastal plain, characterised by low relief. The 1 in 100 year storm surge level reaches close to the northern boundary of the estate. In addition, portions of the east of the site lie in the 1 in 100 year Average Recurrence Interval (ARI) flood plain for South West Creek (refer Appendix 1, Figure 4). This has been defined by Jim Davies and Associates (Jim Davies and Associates, 1994 in BHP Engineering/Woodward-Clyde, 1994) by considering the combination of high rainfall and high tidal levels which may occur during a cyclone.

Careful environmental management is required with regard to surface drainage to minimise the impact of development on existing surface hydrology, land forms, catchments and river systems, and potential contamination of ground and surface water. The depth of the water table ranges from 4 m to 7 m below the ground surface for most of the concept area, with depth increasing with distance from the coast (Woodward-Clyde, 1996). Issues of groundwater quality are covered more fully in section 4.5 of this advice, but are related to drainage as there is the potential for contaminated runoff to reach South West Creek and then coastal mangroves.

Some surface runoff is inevitable within plant sites where the sandy soils are covered with impervious materials (buildings, bitumen pavement etc). Potential for transfer of silt via surface drainage is another concern.

Investigation of surface hydrology, drainage and flooding was undertaken by Jim Davies and Associates to address concerns with respect to flooding of the Concept Area. Surface drainage recommendations are presented in Chapter 3 (section 3.4.10) of LandCorp-DRD's Environmental Report (Woodward-Clyde, 1996). In summary the recommendations were as follows:

- construction of a bund and drain parallel to the Great Northern Highway and discharging into South West Creek diverting the northerly broad sheet flow across the site. The drain would have the capacity to divert a five year flood, while more extreme floods would be contained by the bund;
- installation of drainage reserves to carry treated stormwater from industrial sites to South West Creek;
- flood protection mechanisms should be determined to prevent inundation of the site due to overflow of South West Creek or Turner River East Branch;
- probability of site inundation from the Turner River East Branch should be defined using survey cross sections and hydraulic backwater analysis;
- flood levels and flows to be monitored by installing flood markers in the South West Creek and Turner River East Branch.

LandCorp-DRD have indicated that they intend to limit the potential for inundation of the site by raising low areas subject to inundation, and developing drainage easements which make provision for local and regional drainage. The drains at the Estate boundaries will also act as interception drains for overland flows entering the area. This site drainage plan, and excavation of material required for fill will need to be referred to the EPA for consideration under Part IV of the *Environmental Protection Act 1986*. Figure 4 in Appendix 1 shows that the area intended for fill extends from the floodway of South West Creek to the 1 in 100 year flood limit level. Intended drainage easements are also shown.

The EPA considers that site drainage systems should be designed such that impact on existing surface hydrology is minimised, and that flood waters are controlled to mitigate damage to property and to the environment. These issues, and the issue of identifying sources of fill required, will need to be considered at the design stage, and will require assessment by the EPA.

LandCorp-DRD have committed to minimise topsoil disturbance and impacts on surface hydrology, and to ensure contractors undertake drainage control through contour banks during construction of service corridors and roadworks (Woodward-Clyde, 1996). LandCorp-DRD have committed to minimising topsoil loss by not constructing during the cyclone season.

The EPA further considers that site drainage systems should be designed such that no untreated or potentially contaminated waste water is allowed to enter surface or groundwater systems. All proponents should adopt latest industry best practice environmental management to prevent contamination of soil and groundwater (DEP, 1997). Groundwater and surface water drainage discharge into mangals areas to the north of the estate (BHP Engineering/Woodward-Clyde, 1994).

Submissions from Government agencies expressed concern that surface drainage systems associated with the Boodarie Resource Processing Estate be assessed to ensure that the risk of flooding of the surrounding areas was not increased in the event of tidal surges and cyclonic conditions. Submissions suggested diverting catchment flows may cause a risk of inundation of areas external to the site. LandCorp has indicated that studies undertaken by Jim Davies and Associates in 1995 define the estate area west of South West Creek as flood fringe and will not result in a rise of more than 0.15 m of the 100 year ARI if filled.

Consideration

The area considered for evaluation of this issue includes the Boodarie Resource Processing Estate Concept Area, associated natural drainage systems, adjacent river systems and catchment areas.

The EPA's objectives in regard to this issue are:

- to maintain the integrity, functions and environmental values of the natural drainage systems;
- to ensure that alterations to surface water drainage do not adversely impact on indigenous vegetation; and
- to reduce the impact of flooding and storm surge on surrounding areas as far as possible.

The EPA notes the:

1. unreliability and variability of rainfall in the Pilbara and the impacts on surface hydrology including flooding;
2. hydrological characteristics of the subject land;
3. commitments made by LandCorp-DRD ; and
4. requirement for proposals with the potential to impact on surface hydrological features to undergo separate assessment under Part IV of the *Environmental Protection Act 1986*.

In considering aspects of surface hydrology, drainage and flood mitigation any future proposal should undertake, but not be limited to, the following studies and further actions:

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

1. undertake studies prior to implementing the recommendations relating to drainage constructions outlined in the report by Jim Davies and Associates to ensure that the EPA's objective with regard to flood mitigation can be balanced with the objectives for maintaining natural drainage systems and indigenous vegetation for this site;
2. determine the probability of site inundation from the Turner River East Branch as recommended by Jim Davies and Associates;
3. assess the effect of infrastructure elements such as roads, pipelines and conveyors on local drainage, particularly in the south and east of the site; and
4. monitor flood levels and flows by installing flood markers in South West Creek and Turner River East Branch as recommended by Jim Davies and Associates.

Studies and further actions to be undertaken by the Proponent:

1. design and implement appropriate drainage control measures.

4.5 Groundwater and surface water quality

Aspects

Aspects covered in Section 4.4, Surface Hydrology, Drainage and Flood Mitigation, and Section 4.11, Liquid and Solid Wastes are also relevant here.

Investigations of drainage systems were undertaken by Jim Davies and Associates as outlined in Section 4.4.

Potential surface water contaminants may include petroleum products and suspended material from soil erosion, while groundwater contamination may occur from infiltration of petroleum products and soluble compounds.

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

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

LandCorp-DRD have committed to establishing cumulative impact monitoring of surface and groundwater quality, including an initial baseline study of water quality, and managing water quality during the construction phase by introducing procedures for machinery maintenance and refuelling.

Submissions received from government agencies were concerned with contamination of surface runoff from industrial areas including stockpiles and service corridors, with baseline studies and monitoring of site soils, surface and subsurface flows to be undertaken. The Estate Manager must ensure that no untreated or potentially contaminated waste water is allowed to enter surface water systems.

Consideration

The area considered for evaluation of this issue is the Boodarie Resource Processing Estate Concept Area and adjacent groundwater and surface water systems.

The EPA's objective in regard to this issue is to maintain or improve the quality of surface water and groundwater to ensure that existing and potential uses, including ecosystem maintenance are protected, consistent with the draft *WA Guidelines for Fresh and Marine Waters* (EPA, 1993).

The EPA notes:

1. potential for impact on mangrove communities;
2. commitments made by LandCorp-DRD;
3. requirement for any industry wishing to establish on-site to refer the project to the EPA pursuant to Part IV of the Act
4. 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 groundwater and surface water quality, any future proposal should undertake, but not be limited to, the following studies and further actions:

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

1. undertake a baseline study of water quality of surface and groundwater;
2. implement mechanisms to contain potential spills during the construction phase;
3. coordinate drainage systems from all industries establishing on-site to ensure that untreated waste water and runoff does not enter adjacent water systems;
4. establish a cumulative groundwater and surface water quality monitoring programme for the estate as a whole; and
5. undertake remedial action in the event that contaminants are detected so that impact on mangrove communities is minimal;

Studies and further actions to be undertaken by the Proponent:

1. design and implement drainage systems and waste water treatment initiatives;
2. contain potential spills during construction;
3. manage operations to minimise the potential for ground or surface water contamination to occur; and
4. establish a groundwater and surface water quality monitoring programme for the proposal site.

4.6 Air quality

Aspects

Current meteorological monitoring within the Port Hedland region includes the Bureau of Meteorology Automatic Weather Station and Sondes at the Airport north east of South Hedland (see Appendix 1, Figure 2). BHP DRI Pty Ltd also have a meteorological monitor east of South West Creek, but LandCorp-DRD will need to come to an agreement with BHP DRI Pty Ltd if they wish to utilise the data collected.

The Western Australian Government has provided funding through the Department of Environmental Protection (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 areas nominated for the Maitland Industrial Estate and Boodarie Resource Processing Estate. 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 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 in surrounding areas;
- 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.

LandCorp and DRD have indicated that they may provide funding in the short term to the Pilbara Air Quality Studies to be undertaken by the DEP, subject to availability of funds.

The EPA endorses a prescriptive approach to determine acceptable impact 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. In the future this prescriptive approach may involve setting ambient standards and limits for various pollutants.

As odour from certain chemicals can often be detected by humans at levels too low to be measured, modelling must be used to demonstrate compliance with acceptable odour standards and criteria for these substances. Hydrogen sulphide is one such gas.

The National Environment Protection Council (NEPC) is currently finalising a series of national environment protection measures (NEPMs) for air quality which will specify ambient air quality goals for key pollutants.

POLLUTANT	MAXIMUM CONCENTRATION	AVERAGING TIME	ALLOWED EXCEEDENCES (DAYS PER YEAR)
Carbon monoxide	9.0 ppm	8 hours	1 day a year
Nitrogen dioxide	0.125 ppm	1 hour	1 day a year
	0.03 ppm	1 year	none
Photochemical oxidants (as ozone)	0.10 ppm	1 hour	1 day a year
	0.08 ppm	4 hours	1 day a year
Sulphur dioxide	0.20 ppm	1 hour	1 day a year
	0.08 ppm	24 hours	1 day a year
	0.02 ppm	1 year	none
Lead (as TSP)	0.5 $\mu g/m^3$	3 months (1 year)	none
Particles (as PM_{10})	50.0 $\mu g/m^3$	24 hours	1 day per year (5 days a year)

Figures in parentheses indicate proposed goals in the Draft National Environment Protection Measure and Impact Statement for Ambient Air Quality document of October 1997.

The above table indicates project team recommendations released in June 1997 for the pollutants likely to be included in the scope of the NEPM guidelines. The table has been adapted from *Towards a National Environment Protection Measure for Ambient Air Quality: A National Environment Protection Council Committee Paper on Ambient Air Quality*, June 1997 (NEPC, 1997).

The primary reference for control of emissions of air pollutants remains the National Health and Medical Research Council National Guidelines (NHMRC, 1985). However, both the NHMRC emissions criteria and proposed NEPM ambient measures, relate to the protection of human health and separate consideration is needed in relation to deleterious impacts on plants or fauna.

Industries establishing on the site will be responsible for air quality and odour emission control. Strategies for managing air emissions include:

- use of best practical emission control equipment;
- use of cleaner production plant design.

These measures, along with good housekeeping, statutory controls and off-site buffers would be required to be undertaken both by individual operators and by the Estate Manager.

Further, in assessing the acceptability of emissions to the atmosphere, the EPA uses the following principles in its consideration:

- preventing pollution;
- minimising discharges;
- adoption of continuous improvement; and
- agreed emission levels and ground level concentration criteria. (DEP, 1996b)

The adequacy of the buffer area associated with the Boodarie Resource Processing Estate was investigated by performing dispersion modelling using generic industry types to predict the location of the contour corresponding to 350 $\mu g/m^3$ with results presented in the Environmental Report. Ambient air quality criteria currently used in Western Australia in assessing new proposals were taken from the Kwinana Environmental Protection Policy (EPA, 1992a). The 350 $\mu g/m^3$ standard corresponds approximately to 0.12 ppm. It was predicted that the 350 $\mu g/m^3$ sulphur dioxide (SO_2) contour extends beyond the boundary of the original buffer to the east of the estate (Woodward-Clyde, 1996) but falls within the new proposed buffer as shown in Appendix 1, Figure 6.

LandCorp and DRD have concluded from air quality modelling results that tall stacks should not be aligned in an east-west orientation, as this configuration is most likely to cause impacts on the residential area of South Hedland (Woodward-Clyde, 1996).

The DEP has recommended that LandCorp-DRD establish a cumulative impacts monitoring programme, beginning with a baseline study prior to the establishment of any industries on the Concept Plan site. Baseline data will need to be viewed in the context of whether the BHP DRI Pty Ltd plant has begun production when monitoring begins. It is preferable for monitoring to begin prior to any major industrial operations which have the potential to contribute to ambient levels.

A cumulative air quality model should be developed and used as new industries propose to establish on the site to ensure that ambient air quality is maintained. Care will also need to be taken to ensure that new industries are adopting good engineering practice in limiting gaseous and particulate emissions.

Fine particulates which may be produced by some industry types likely to establish in the estate will require management. Dust and particulates are discussed in more detail in section 4.8 of this advice.

Consideration

The area considered in the evaluation of this issue is the Boodarie Resource Processing Estate Concept Area (including buffer) and surrounding areas. This is the area in which emissions have to be controlled to meet ambient air quality guidelines.

The EPA's objective with regard to air quality is to ensure that emissions of gases, particulates and odours conform with agreed standards and criteria and do not cause health, amenity or environmental problems.

Achievement of these objectives will require constraints on point source emissions (including volume, buoyancy and content) as well as on ground level concentrations of gaseous emissions. This approach is used to maintain air quality in the Kwinana Industrial Area.

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

Where possible, the Estate Manager should facilitate the use of waste products of one industry as primary feedstock by other industries, where this offers an alternative to release of wastes to the atmosphere, when optimising the location of industries.

The EPA notes the:

1. commitments made by LandCorp and DRD to contribute funding to the DEP's investigation of meteorology in the Pilbara;
2. limitations of the dispersion modelling carried out due to uncertainties in meteorological data;
3. intention to establish a buffer zone based on modelling results;
4. commitments made by LandCorp and DRD to establish an Estate Manager and undertake cumulative air quality modelling;
5. requirement for any industry wishing to establish at the site to refer the project to the EPA pursuant to Part IV of the Act;
6. 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 continuing acceptable performance;

In considering aspects of air quality, any future development proposal should undertake, but not be limited to, the following studies and further actions, some of which will be required to adequately define the required buffer area prior to development beginning:

Studies and further actions to be undertaken by Estate Manager:

1. support investigations into Pilbara air quality and perform a baseline air quality study prior to establishment of industries on-site;
2. undertake further modelling using more detailed information on regional meteorology, and modify buffer allocation as appropriate;
3. develop an Air Quality Management Plan which will include continuous monitoring of cumulative impacts of the resource processing estate including impacts on vegetation to protect the environment and human health and modelling to establish the capacity of the local air shed to accommodate air emissions;
4. use air quality modelling results to ensure that the configuration of industries within the resource processing estate reduces the likelihood of excursions of gaseous and particulate emissions above set standards and criteria;
5. locate industries within the resource processing estate such that the use of waste products as primary feedstock by suitable industries is encouraged; and
6. maintain a database of meteorological and air quality information for use in the appropriate placement of new proponents in the estate;

Studies and further actions to be undertaken by Proponents:

1. design facilities to minimise gaseous emissions;
2. adopt best practice management environmental principles;
3. monitor and report on air emissions from individual plants.

The EPA brings to the attention of the Government the need for a thorough knowledge of meteorological processes in the Port Hedland area before impacts of gaseous emissions can be confidently predicted.

4.7 Greenhouse gases

Aspects

The potential air emissions from industries that may establish in the estate area are described in general terms in Woodward-Clyde (1996). 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 cooperative 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 than 2% of the world's anthropogenic greenhouse gas emissions, is one of the biggest emitters on a per capita basis.

The 1997 ICESD 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 of the ICESD Strategy include that Australia's greenhouse inventories reflect best available, 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 greenhouse gases are of a global scale and are not restricted to the local or regional environment.

The EPA's objective in regard to this issue is to ensure that greenhouse gas emissions meet acceptable standards and requirements of Section 51 of the *Environmental Protection Act 1986* (all reasonable and practicable measures are taken to minimise greenhouse gas discharge).

The EPA notes:

1. Australia's obligations under international agreements;
2. the significant potential for greenhouse emissions from the estate;
3. the requirement for any industry wishing to establish at the site, or any associated port or infrastructure works that may potentially impact on greenhouse emissions, to refer the project to the EPA pursuant to Part IV of the *Environmental Protection Act 1986*, describing the likely impact together with the information below.

In considering aspects of greenhouse gas emissions, any future proposal should undertake, but not be limited to the following further studies and actions:

Studies and further actions 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. 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; and

3. report greenhouse gas emissions associated with their proposal to the DEP during operation, using the generally accepted methods.

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.

4.8 Dust and particulate emissions

Aspects

There are two distinct sources of dust and particulates which must be addressed during construction and operation of the Boodarie Resource Processing Estate.

Firstly, dust emissions may arise from construction activities due to topsoil disturbance and clearing of vegetation. During operation of the Estate, dust may be generated from loading, conveying, stockpiling and transport of dusty materials.

Secondly, process emissions of fine particulates from plant operations must be addressed by proponents establishing within the estate as an aspect of air quality. The information provided in Section 4.6 is also relevant to this issue.

Dust and particulate management standards include DEP guidelines which have been developed for and applied to development sites through Part V of the Act (DEP, 1996c).

The EPA has promulgated two Environmental Protection Policies (EPP's) for atmospheric pollutants for the Kwinana and Kalgoorlie areas, applicable during the operational phase. The EPA uses the Kwinana EPP standards and limits as guidelines for the assessment of new industrial projects (where there are no existing sources) and for existing industrial plants which are seeking approval for modifications (EPA, 1992a).

A limit is defined as a "concentration not to be exceeded", and a standard is defined as a "concentration which it is desirable not to exceed". The standard is interpreted as the value which the ground level concentration must be below for 99.9% of the time.

The ambient limit for total suspended particulates (TSP) (averaged over 24 hours), for land used predominantly for residential and rural purposes, is 150 $\mu g/m^3$, and the standard is 90 $\mu g/m^3$ in Area C of the area covered in the EPP.

Proposed NEPM criteria (as discussed in Section 4.6 above) apply to particulate matter of mean diameter of 10 μm or less (expressed as PM10), rather than total suspended particulates, as PM10 has been studied in association with human health effects and mortality. NEPM measures do not consider impacts on other aspects of the environment.

Dust has historically caused problems in the Port Hedland area, particularly from ship loading facilities in the port area.

BHP DRI Pty Ltd runs a dust monitoring programme consisting of a number of high volume and real-time dust monitors in the Port Hedland and South Hedland region. High volume monitors are located at the northern edge of South Hedland, west of Wedgefield, on Spinifex Hill in Port Hedland, at the Port Hedland Hospital and in the Town Centre (see Appendix 1, Figure 1) (BHP Iron Ore, 1996).

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

Dust monitoring results provided by BHP Iron Ore are summarised in Table 3 below. Note that the value of 260 $\mu g/m^3$ is the total suspended particulate (TSP) limit for Areas A and B in the Kwinana EPP. Area A contains heavy industry while Area B is the buffer area surrounding

industry, plus other outlying land zoned for industrial use. Exceedences of the standard and limit TSP for residential areas (90 μg/m^3 and 150 μg/m^3 respectively) were not provided in the report.

These results illustrate the improvement in the Port Hedland town area since 1994, but also that dust levels remain relatively high in the area.

Further information on possible impacts from industrial development at Boodarie, and potential increases at South Hedland will result from the results of Government funded initiatives for air quality monitoring in the Pilbara region described in Section 4.6.

Table 3: Measured annual dust concentrations as TSP and annualised exceedences of 260 μg/m^3 level from 1994 to 30 June 1997.

Location	Annual Average (μg/m^3) [1]				Annualised Exceedences of 260 μg/m^3 [2]			
	1994 #	1995	1996	1997	1994	1995	1996	1997
Port Hedland Town Centre	158	140	121	97 [3]	25	16	11	0
Hospital	142	103	86	80 [3]	29	8	0	1
Spinifex Hill	53	44	41	NA	0	1	0	NA
South Hedland *	NA	36	39	NA	NA	0	0	0
Boodarie **	NA	25	33	NA	NA	0	0	NA

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 of 150 μg/m^3 with a standard (a concentration which is desirable not to exceed) of 90μg/m^3.
2. The *WA Environmental Protection Policy (Atmospheric Wastes) Kwinana* (EPA, 1992a) specifies an ambient dust limit (averaged over 24 hours) for land zoned industrial of 260 μg/m^3 with a standard (a concentration which is desirable not to exceed) of 150μg/m^3.
3. Rolling 12 month average to 30 June 1997.

\# Not to Australian Standard 2724.3 - 1984

* Monitoring commenced March 1995

** Monitoring commenced April 1995

NA Not available

With regard to the Boodarie Resource Processing Estate, the most significant potential environmental impacts of dust emissions are on the township of South Hedland in the event of north westerly and westerly winds lifting dust during the construction phase or of the high dust levels in Port Hedland with port activity associated with the estate. Shoreline fumigation events, while not understood in detail for the area, are also likely to cause high dust levels in the Port Hedland area.

LandCorp and DRD have indicated that they will require dust contingency arrangements to be implemented by contractors and occupiers of sites within the Estate to minimise dust generation. These would include:

- minimising land clearing;
- promptly and progressively rehabilitating or stabilising disturbed surfaces;
- avoiding unnecessary machinery movements; and
- damping down with water trucks or sprays as necessary.

Dust control plans are to be developed by LandCorp-DRD in consultation with the DEP.

Individual industrial operators will be responsible for the management of potential dust sources on their premises. Best practice environmental principles identify containment as preferred to dust suppression.

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

As fine particulates are released through many industrial processes likely to establish in the Boodarie Resource Processing Estate, comments received from the DEP indicated that the issue of fine particulate matter needs closer examination. Fine particulates have become a key health concern in recent years and must form part of air quality management in the Boodarie Resource Processing Estate.

Consideration

The area considered in the evaluation of this environmental issue is the Boodarie Resource Processing Estate and surrounding areas (see Appendix 1, Figure 1). This is the area in which dust emissions must be controlled to meet appropriate standards.

The EPA's objective in regard to this environmental issue 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 DEP guidelines for land development sites and impacts on air quality (DEP, 1996c) and Environmental Protection Policy (Atmospheric Wastes) Kwinana.

Whilst poor industrial practices and planning 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. Dust from sources external to the industrial core (such as from conveyors within service corridors) will require careful management.

The EPA notes the:

1. location of the site, nature of underlying soils and prevailing wind direction and strengths;
2. establishment of a buffer zone around the estate;
3. commitments made by LandCorp-DRD to establish dust control plans to be administered by the Estate Manager;
4. requirement for any industry wishing to establish at the site to refer the project to the EPA pursuant to Part IV of the Act; 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 undertake, but not be limited to, the following studies and further actions:

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

1. undertake baseline dust monitoring programme prior to implementation of the estate and relate to findings of meteorological investigations;
2. evaluate cumulative dust impacts using baseline data and results of meteorological studies;
3. implement a Dust Management Programme encompassing construction activities, materials handling and industrial discharges. The programme should incorporate best available dust management practices;
4. locate industries within the resource processing estate such that the likelihood that excursions of particulate emissions and dust above set standards and criteria will occur is minimised; and

Studies and further actions to be undertaken by Proponents:

1. assess cumulative impact of proposal on dust levels as part of environmental impact assessment process;
2. implement dust management measures with particular emphasis on best available containment.

4.9 Noise and vibration

Aspects

Noise associated with the Boodarie Resource Processing Estate may be generated by individual industries establishing on-site, construction activities, traffic noise or noise from conveyors and other infrastructure.

Noise level predictions at the Estate buffer boundary were not presented in the Environmental Report, however noise modelling was undertaken after the release of the report to identify potential constraints on the development of the site. The results and recommendations are presented in a report by SVT Engineering Consultants (SVT Engineering Consultants, 1997).

Modelling of generic industry types was conducted, and included down stream iron ore processing, down stream petroleum processing, power intensive industries and a power station, as well as the existing BHP DRI Pty Ltd Hot Briquetted Iron plant and associated conveyors, and the Pilbara Energy Pty Ltd (PEPL) power station. The report places constraints on where industries should locate within the estate, and on the levels of noise appropriate for each to ensure that noise levels do not exceed 35 dB_{LA10} at the buffer boundary.

The report recommends extending the buffer area to South Creek, as shown in Appendix 1, Figure 6. This recommendation has subsequently been acted upon by LandCorp-DRD with the new buffer area adopted as part of the Concept Plan. Further recommendations include suggestions regarding the management of cumulative impacts. Transport noise was not modelled for the report (SVT Engineering consultants, 1997).

Noise prediction modelling indicated that the 34 dB(A) contour, corresponding to the expected L_{A10} assigned noise level for the area, extended approximately 5 km from the site. Noise modelling included the service corridor to Finucane Island.

Background noise level measurements were performed during the Consultative Environmental Review for the BHP DRI Pty Ltd Hot Briquetted Iron Project (BHP, 1994), located to the north of the Boodarie Resource Processing Estate concept area. These measurements indicated that noise levels in South Hedland ranged from 30 - 35 $dB_{LA90,15\ minute}$ between 10 pm and 7 am (BHP, 1994).

Noise levels for projects within Western Australia are subject to the new *Environmental Protection (Noise) Regulations, 1997* (promulgated on 31 October 1997). The new regulations are summarised in Table 4 below.

The calculation of assigned noise levels based on the *Environmental Protection (Noise) Regulations 1997* during the most sensitive periods for residences around the resource processing estate concept may be as low as 35 dB(A), dependent on additional adjustment for tonal components.

In order to control cumulative noise levels from the estate, reduction of noise levels allowed from individual industries may be necessary to allow for the presence of a number of potentially noisy industries in close proximity.

Table 4: Summary of Environmental Protection (Noise) Regulations for noise sensitive premises.

Time of day	Assigned level (dB)		
	$L_{A\ 10}$	$L_{A\ 1}$	$L_{A\ max}$
0700 to 1900 hours Monday to Saturday	45 + IF *	55 + IF	65 + IF
0900 to 1900 hours Sunday and public holidays	40 + IF	50 + IF	65 + IF
1900 to 2200 hours all days	40 + IF	50 + IF	55 + IF
2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and public holidays	35 + IF	45 + IF	55 + IF

* IF is the influencing factor calculated for each noise sensitive premises receiving noise. It takes into account the amount of industrial and commercial land and the presence of major roads within a 450 metre radius around the noise receiver. In South Hedland IF is likely to be zero for most areas except those closest to railway lines and major roads.

The Estate Manager will be expected to take noise levels into consideration when determining the appropriate location of new industries within the resource processing estate. Guidelines and recommendations for this are given in the Noise Assessment Report (SVT Engineering Consultants, 1997). These include:

- sound power level restrictions on individual industries, possibly based proportionally on area;
- restrictions on tonal noise at buffer boundary;
- sound power level restrictions placed on industries based on control of sound emissions under upset or abnormal process conditions.

Noise management will primarily be the responsibility of individual operators within the Estate area. Individual industries will need to ensure that the noise levels outlined in the SVT report can be met. The EPA endorses the adoption of best industry practice for noise management at this site.

DEP comments raised the concern that transport associated with the estate as it develops and its impact on neighbouring noise sensitive premises needs to be determined, both in modelling and in the allocation of buffers around road and rail corridors. The cumulative impact of a number of noisy industries must also be taken into account when determining the allowed noise level for any particular industry.

Consideration

The area considered in the evaluation of this issue is the Boodarie Resource Processing Estate Concept Area (see Appendix 1, Figure 1), and surrounding areas including residences and outdoor recreation areas.

The EPA's objective in regard to this issue is to protect the amenity of nearby residents from noise and vibration impacts by ensuring that noise and vibration meet criteria in the *Environmental Protection (Noise) Regulations* (promulgated on 31 October 1997).

The EPA notes the:

1. location of the site, wind strength, direction and prevailing meteorology;
2. area of the intended buffer zone;

3. results of the environmental noise impact assessment indicating restrictions on sound levels in various areas of the estate, and extension of buffer to South Creek;
4. commitments made by LandCorp and DRD to designate an Estate Manager;
5. requirement for any industry wishing to establish at the site to refer the project to the EPA pursuant to Part IV of the Act; 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 noise and vibration, any future proposal should take account of, but not be limited to, the following studies and further actions:

Studies and further actions to be undertaken by Estate Manager:

1. utilise the results of additional noise emission modelling for placement and allocation of maximum noise levels for industries proposing to establish on the estate;
2. take cumulative impacts into account, including infrastructure, when optimising location for new industries wishing to establish within the resource processing estate;
3. identify a process to address the issue of cumulative noise impacts, possibly by setting limits on individual operators such that noise levels from the entire estate do not exceed allowable levels; and
4. develop and implement a programme of monitoring to assess cumulative impacts;

Studies and further actions to be undertaken by Proponents:

1. assess noise from industrial plant proposed for the resource processing estate;
2. assess transport infrastructure including road, rail and bulk conveyors for each industry locating on the estate and using that mode of transport;
3. undertake noise monitoring of noisy activities during construction;
4. adopt best industry practice noise management approaches.

4.10 Public health and safety

Aspects

The types of industries which may establish on the Boodarie Resource Processing Estate are described in the Environmental Report (Woodward-Clyde, 1996). Estimates of risk were obtained by modelling generic industries within the concept area and undertaking quantitative risk assessments for various scenarios.

Modelling resulted in greater definition of the high, medium and low risk zones within the industrial core of the estate. A further result of modelling was that importation of crude oil at Stanley Point (see Appendix 1, Figure 1) is precluded if LPG and ammonia are to be imported. It is considered appropriate that a hazardous cargo jetty be developed to the north west of the estate, possibly off Downes Island (Woodward-Clyde, 1996). Such a proposal would be subject to separate assessment by the EPA, and will involve further service corridors not presented in the Environmental Report (Woodward-Clyde, 1996).

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. The criteria are as follows:

(a) a risk of fatality of one in a million per year or less in residential zones;

(b) a risk of fatality between one half and one in a million per year in "sensitive developments" such as hospitals, schools, child care facilities and aged care housing developments;

(c) risk of fatality for industrial facilities not exceeding a target of fifty in a million per year at the site boundary for each individual industry, and the cumulative risk level imposed upon an industry not exceeding a target of fatality risk one hundred in a million per year; and

(d) a risk of fatality of ten in a million per year or lower for any non-industrial activity located in buffer zones between industrial facilities and residential zones.

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

The EPA's management principle is that risks should be reduced to a practicable minimum.

When shipping scenarios are altered to exclude crude oil importation at Stanley Point, the levels of risk fall within EPA criteria as outlined in EPA Bulletins 611 and 627 (EPA, 1992b and 1992c).

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 a risk assessment model administered by the Estate Manager.

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

A 500 m separation distance between the heavy industrial core and the support industries area (see Appendix 1, Figure 2) will be established initially. The requirement for this separation will be reviewed from time to time with respect to facilitating emergency response.

Consideration

The area considered for evaluation of this issue is the Boodarie Resource Processing Estate and its surroundings, existing and potential infrastructure corridors, and existing and potential port facilities. This is the area within which risk levels must be reduced to acceptable levels.

The EPA's objective in regard to this issue is to ensure that public risk associated with implementation of the concept are as low as 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 proposing to establish in the area. Cumulative risk levels for the estate as a whole also need to be determined with each new proposal for a hazardous industry.

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 has set down criteria for risks and hazards (EPA, 1992b and 1992c) to protect surrounding residents and to ensure that industries do not significantly impact on each other.

The EPA notes the:

1. intention to establish a buffer to minimise public risk;
2. requirement for any industry wishing to establish at the site to refer the project to the EPA pursuant to Part IV of the Act; and
3. 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 undertake, but not be limited to, the following studies and further actions:

Studies and further actions to be undertaken by Estate Manager:

1. use risk modelling to determine appropriate location of new industries establishing on-site, and adequacy of internal buffers; and
2. implement an ongoing programme for the determination of cumulative risk, both individual and societal;

Studies and further actions to be undertaken by Proponents:

1. prepare a risk and hazard analysis for new, potentially hazardous facilities; and
2. assess societal risk following accepted guidelines.

4.11 Liquid and solid wastes

Aspects

Wastes which may potentially be generated on the Boodarie Resource Processing Estate include process tailings, contaminated water, slag, spent electrodes and other industrial waste as well as domestic waste and sewerage (Woodward-Clyde, 1996).

Disposal of liquid and solid waste on-site via any mechanism has the potential to pollute groundwater and surface waters. Storm surge characteristics in the area make some northern sections of the site less suitable for waste disposal facilities. Acceptable engineering practices, as indicated at the BHP DRI development, can be adopted to allow the development of waste disposal facilities in the storm surge area. A key environmental consideration will be the safe disposal of waste.

It is not intended to establish a solid waste facility on the estate, but a centralised liquid waste facility for sewage may be considered. It is likely that liquid and solid waste produced by industries establishing on-site will be treated by the individual operators.

Any centralised waste treatment or disposal facilities as well as those which form a part of specific proposals will undergo assessment by the EPA under Part IV of the *Environmental Protection Act 1986.*

While the South Hedland tip site was suggested as a suitable waste disposal site in the Environmental Report (Woodward-Clyde, 1996), the site is not generally considered suitable to accept the Class IV waste which may be generated by operations on-site. Accordingly, LandCorp and DRD in cooperation with the DEP have investigated alternative sites for the establishment of a secure landfill in the Pilbara. The DEP commissioned Rust PPK to undertake a study and the report was finalised in November 1996. The study identified that sites will be required at both Karratha and Port Hedland to accommodate forecast waste levels over the next 25 years. Suitability of sites is to be reviewed by appropriate Government agencies including DEP, LandCorp and DRD.

In the short term, the Shire of Roebourne's 7 Mile Waste Management Facility, near Karratha, may accept sludges subject to chemical testing.

The Department of Environmental Protection position paper on contaminated sites, released in May 1997 (DEP, 1997), states that contamination of land or groundwater should be prevented by industry best practice environmental management.

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 hierarchical 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, and
- dispose of any residual waste in a manner which prevents unacceptable environmental impacts.

The EPA is also supportive of minimising waste from industrial complexes by the use of process wastes as primary feedstocks by other industries. This should form part of the

planning process for the Estate Manager in optimising location of industries wishing to establish on site.

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, 1996d).

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

LandCorp has committed to a waste management plan during the construction phase whereby construction contractors will be required to:

- remove all waste off-site for disposal or recycling;
- confine vehicle and machinery servicing and refuelling to designated areas where drainage is contained; and
- remove all soil contaminated with hydrocarbons after construction is completed.

The Pollution Prevention Division of the DEP has indicated that if treated liquid waste is to be discharged to the ocean, this should take place from the area offshore from Finucane or Downes Island rather than into confined harbours and creeks, to facilitate mixing.

Evaporation ponds are generally considered an appropriate method of dealing with liquid waste in the Pilbara climate, notwithstanding possible complications due to flood events, and the desirability of recycling waste water for reuse within the estate and the occasional storm surge levels in the area. Service corridors for ocean outfall pipes do not form part of the Concept Plan as presented in the Environmental Report (Woodward-Clyde, 1996).

While centralised waste water treatment facilities and tailings dams may be considered in the future as proposals are received, these have not been considered as part of the Environmental Report (Woodward-Clyde, 1996).

Submissions from other agencies indicated that surface drainage systems should be designed to capture runoff for processing (with potentially contaminated water) on-site, as surface and subsurface drainage may impact on mangal communities to the north of the estate. Stormwater from industrial sites will drain to South West Creek along the central and eastern drainage reserves nominated for the estate.

Consideration

The area considered for evaluation of this issue is the Boodarie Resource Processing Estate Concept Area and the surrounding region. This is the area within which wastes will require treatment and/or disposal.

The EPA's objectives in regard to this issue are to ensure wastes are managed in accordance with the waste management hierarchy (namely to avoid, minimise, recycle, treat and dispose of waste), 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 Australian Guidelines for Fresh and Marine Waters (EPA, 1993). Objectives with regard to protection of mangroves and the marine environment are also applicable.

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

The EPA cannot forecast what type of specific industries are likely to establish in the Boodarie Resource Processing Estate and is thus unable to predict specific liquid and solid waste disposal requirements.

The EPA notes:

1. that regional disposal facilities for solid wastes are inadequate to accept Class IV waste in the long term;
2. the northern portion of the site is less suited to the disposal of solid and liquid wastes due to the potential for storm surge and flooding impacts;

3. the design and engineering works undertaken at the BHP DRI development to accommodate storm surge and flooding in the disposal of solid and liquid wastes;
4. the Concept Plan has made no provision for an outfall to the ocean;
5. LandCorp and DRD cooperation with Government initiatives to identify and develop appropriate secure landfill sites in the region;
6. commitments made by LandCorp to establish an Estate Manager;
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; and
8. 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 actions:

Studies and further actions to be undertaken by Estate Manager:

1. identify an outfall site and associated service corridor location;
2. identify a suitable location for evaporation ponds if intended;
3. identify a strategy for liquid and solid waste disposal for industries proposing to establish in the estate, in parallel with Government initiatives in the region;
4. locate industries within the resource processing estate such that the use of waste products as primary feedstock by suitable industries is encouraged;

Studies and further actions to be undertaken by Proponents

1. apply best practice waste management principles; and
2. resolve the issue of solid and liquid waste disposal, prior to establishing on the site.

4.12 Cultural, heritage and social surroundings

Aspects

- **Aboriginal Culture and Heritage**

Preliminary ethnographic consultation and a desktop study of Aboriginal heritage, was undertaken by McDonald, Hales and Associates (McDonald Hales and Associates, 1994 in Woodward-Clyde, 1996). A number of previously recorded archaeological sites exist in the Port Hedland area, and archaeological sites have recently been found along South West Creek. Some of these sites fall within one of the nominated service corridors.

The Aboriginal people consulted did not know of any ethnographic sites in the resource processing estate concept area, however, based on previous experience, they made predictive statements concerning the possibility of archaeological sites. The people consulted stated that they believed that a number of archaeological sites associated with camping would be found in South West Creek. In addition, they stated that a number of important engraving sites and possibly a soak well exist at the end of the track leading north from Six Mile Well and that a main camping place associated with a soak well and a fish *Thalu* (misspelt in the Environmental Report) exists at Boodarie Landing, shown on Appendix 1, Figure 1 (Woodward-Clyde, 1996).

Consistent with Government agency submissions, further detailed archaeological research will be necessary before any development is undertaken. Surveys will be undertaken either by LandCorp-DRD for the entire area of the Boodarie Resource Processing Estate, or by individual proponents as part of their approval process.

Known sites with the greatest potential to be adversely affected by a proposal are those at Boodarie Landing (south east of Downes Island), and those adjacent to South West Creek. The

Estate concept area itself does not contain any known areas of significance to Aboriginal culture and heritage.

LandCorp-DRD have committed to complying with the *Aboriginal Heritage Act 1972-1980,* and obtaining necessary approvals, in the event that archaeological evidence or material of Aboriginal origin is revealed during the construction phase (Woodward-Clyde, 1996). The EPA considers that all practicable efforts be made in determining likely archaeological sites, and avoiding their disturbance where possible.

- **European Culture and Heritage**

The Boodarie Resource Processing Estate concept area is traversed by the De Grey - Mullewa Stock Route. The stock route is no longer used, but has historical connections. The portion of the route that crosses the site is reserved.

The Boodarie station homestead is outside the nominated buffer area for the estate.

The proponents will be required to comply with the WA *Heritage Act* by determining whether any part of the Concept Plan is subject to a Heritage Agreement and liaising with the WA Heritage Commission on management requirements.

- **Population Centres**

The combined population of Port Hedland and South Hedland was approximately 12000 in 1991. There is predicted to be a 28% increase in the population of the Pilbara region from the year 1991 to 2021 (Australian Bureau of Statistics, 1991 in Woodward-Clyde, 1996).

Infrastructure in the area includes a domestic airport, the second largest port in the Pilbara, water and gas supplies and a regional hospital and Royal Flying Doctor Service base.

Much of the workforce is employed in the minerals sector, or in support industries, and commercial and administrative services. The development of the Boodarie Resource Processing Estate Concept Plan is not inconsistent with current social surroundings.

Consideration

The area considered for evaluation of this issue is the Boodarie Resource Processing Estate and its surrounding areas.

The EPA's objectives in regard to this issue are:

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

The EPA notes:

1. that further archaeological and ethnographic surveys of the estate area will be required prior to development of the area;
2. the commitments by LandCorp-DRD to comply with the requirements of the Aboriginal Heritage Act; and
3. the requirement for proponents to comply with the *Aboriginal Heritage*, *Heritage* and the *Native Title Acts*.

In considering aspects of cultural, heritage and social surroundings any future proposal should undertake, but not be limited to, the following studies and further actions:

Studies and further actions to be undertaken by the Estate Manager/Proponent:

1. undertake detailed ethnographic and archaeological study of the proposed development area for Aboriginal heritage sites;
2. consult local Aboriginal communities and the Aboriginal Affairs Department on Aboriginal cultural matters;

3. develop a Heritage Management Plan for the Estate; and
4. consult the WA Heritage Council on a heritage survey of relevant areas.

4.13 Water supply

Aspects

Total water requirements for the Boodarie Resource Processing Estate cannot be defined precisely at this time, as the industries which will establish on site are not known. Water quality demanded by industries varies according to uses, with some industry types able to use 2nd class supplies, and some requiring potable water. Tables 3-1 to 3-3 in the Environmental Report (Woodward-Clyde, 1996) indicate the water demand for various industry types which may establish in the estate.

The current licensed capacity of the Yule and De Grey aquifers is approximately 13.5 gigalitres per annum (GL/a). An estimated extra 15 GL/a is likely to be needed to meet growth for future use, including the BHP Direct Reduced Iron Pty Ltd (BHP DRI Pty Ltd) Hot Briquetted Iron plant and growth in Port Hedland. Requirements of the Boodarie Resource Processing Estate will be in addition to this, and further water supplies will require investigation.

The BHP DRI Pty Ltd Hot Briquetted Iron plant currently accounts for a major part of the excess capacity of the De Grey aquifer. Use of current developed sources by the Boodarie Resource Processing Estate is considered to be a short term solution. Supply of water from new supplies would form part of the off-site infrastructure development for the site, and would be facilitated by DRD.

A number of studies into other water supply options for the Boodarie Resource Processing Estate are underway or are being considered. These include:

- possibility of expansion of De Grey and Yule aquifers. A Water Corporation investigative drilling programme in the De Grey Aquifer report expected this year;
- possibility for exploitation of surface water sources including the Yule and Shaw Rivers in the longer term;
- potential to develop the West Canning Basin, 170 km east of Port Hedland, as a groundwater source for the Pilbara Region;
- assessment of desalination of seawater as a possible future water source is currently being undertaken with support from government, industry and water technology providers;
- first stage of the Pilbara Groundwater Resources Assessment which was released by the Water and Rivers Commission as Hydrogeological Report 61 (Wright, 1997); and
- development by the Pilbara Development Commission of a proposal for a regional ground water resource appraisal in consultation with Water and Rivers Commission.

LandCorp-DRD have indicated that water supply from groundwater sources may be sufficient for the medium term, but that new proposals would be expected to consider desalination of seawater as an option.

The EPA is in the process of preparing an Environmental Protection Policy which will apply to groundwater throughout the state. The use of groundwater to support native vegetation and wetlands would be likely to be considered a beneficial use under such a policy, and will thus be a factor in determining the groundwater resources available for abstraction.

Accordingly the EPA would be concerned if demand for water for the estate exceeded sustainable supplies and adversely affected surrounding users or the environment.

Submissions received from a number of State and Federal Government agencies stressed the need to identify sufficient water resources for use on the Boodarie Resource Processing Estate in the long term, particularly as domestic and industrial demand is expected to grow in the future.

Submissions also highlighted desalination of seawater and recycling of treated waste water as being of a high priority for the estate.

LandCorp notes that it understands that the sustainability of the water supply is a limiting factor on the eventual development of the estate.

Consideration

The area considered for evaluation of this issue is the Pilbara Region, taking into account the possible impacts of the Boodarie Resource Processing Estate, its service corridors and associated infrastructure, and associated aquifers and surface water supplies.

The EPA's objective in regard to this issue is to ensure that the planning and development of additional water resources for the Pilbara Region is carried out in a coordinated and sustainable manner with appropriate assessment of potential environmental impacts.

As the disposal of liquid waste is also considered an important environmental issue relating to the Boodarie Resource Processing Estate, recycled, treated waste water and stormwater could be used as a water supply for the Estate.

The EPA notes the:

1. probable use by BHP DRI Pty Ltd of a significant amount of the potentially available groundwater capacity of the De Grey aquifer;
2. requirement to develop one or more of the potential water sources to service the demands of the estate, depending on the size and nature of the industries which actually establish in the estate;
3. investigations by various government and industry bodies into various water supply options as outlined in "Aspects of water supply" above;
4. undertaking to develop suitable water supply options in the Pilbara by the Water Corporation, funded by industry; and
5. apparent environmental benefit in recycling industrial waste water and treated stormwater runoff as a method of liquid waste treatment.

The supply of sufficient water resources to the Boodarie Resource Processing Estate is critical to development in the area. The EPA would need to be assured that a viable water supply is available to serve the needs of the estate before approving development, and that the utilisation of groundwater resources did not cause significant "draw down" of the water table, and the subsequent impact this may have on native vegetation.

In considering aspects of water supply, any future proposal should undertake, but not be limited to, the following studies and further actions:

Studies and further actions to be undertaken by Water and Rivers Commission and Water Provider:

1. address the total water requirements for industries proposing to establish within the estate to ensure that environmental impacts from development of water resources are managed to acceptable levels;

Studies and further actions to be undertaken by Proponents:

1. consider using treated recycled water and stormwater for industrial water supply needs.

The EPA brings to the attention of Government the need to adequately determine and develop water supplies in the Port Hedland area. Water supply proposals should be referred to the EPA for consideration of potential environmental impacts of the proposal and resulting actions.

Should a sustainable water supply not be identified, the Government should note that this may place constraints on development of the site.

In order to develop a resource processing estate which is capable of being managed so as not to compromise the EPA's objective with regard to water supply, it will be necessary to take measures to ensure that suitable long term supplies are available. Water supply has the potential

to limit the growth of the estate, and industries proposing to establish on the estate should be strongly encouraged to investigate waste water recycling and seawater desalination as part of their proposals.

5. Other issues

5.1 Site selection

LandCorp-DRD identified eight sites in the Port Hedland area which were potentially suitable for such a development. A brief assessment process followed in which the features of each site were considered. Criteria included proximity to road, rail, power, water and port facilities as well as site drainage. Environmental acceptability was considered, mainly in terms of proximity to populated areas and direction of prevailing winds. The study concluded that all sites were potentially suitable in terms of the above criteria. Sites 5 to 8 (shown in Appendix 1, Figure 1) were considered most suitable, with a combination of sites 6 and 8 chosen due to their proximity to the port and adequacy of buffers (Woodward-Clyde, 1996).

There are a number of environmental matters associated with the selected site which will require special management consideration, but there are no overriding reasons why the site should not be developed as an industrial estate. Matters such as liquid and solid waste disposal, drainage and flood mitigation will need to be given special attention in the planning process so that the environmental impacts are managed to produce a satisfactory outcome. Including part of the land to the south west, ie. part of area 7 in the LandCorp-DRD's environmental document (Woodward-Clyde, 1996) may have some environmental benefits through providing greater flexibility in siting. If LandCorp-DRD consider extending into this area there may be some matters requiring further consideration, but the EPA is of the opinion the recommendations in this report would largely carry over.

5.2 Buffer distances

The Boodarie Resource Processing Estate Concept Plan includes the securing of a 3 km to 4.5 km buffer, surrounding the intended industrial core of the estate (Appendix 1, Figure 6). The intention of this buffer is to mitigate environmental impacts and provide an area within which land uses can be managed. It is intended that no housing will be permitted within the buffer area.

It is envisaged that stock grazing within the external buffer will continue to occur, and that building of some structures (with the exception of housing) within the buffer may be allowed (Woodward-Clyde, 1996).

The Boodarie Resource Processing Estate area is not currently covered under Town of Port Hedland Town Planning Scheme 4, but will require zoning under an amendment of this Town Planning Scheme or to be covered under a new Scheme.

LandCorp-DRD also intend to establish internal buffers between occupiers and service corridors within the estate, with the objective of providing a visual break and screening noise and light spill (Woodward-Clyde, 1996).

The results of air quality and risk modelling are presented in the Environmental Report (Woodward-Clyde, 1996). These investigations were used to verify the area set aside for the external buffer area. Noise modelling indicated that the nominated buffer should be extended towards South Creek, a recommendation which has been implemented. Risk modelling is also useful in determining appropriate separation distances between industries.

The EPA endorses the view of LandCorp-DRD that the buffer area needs to be formally recognised and designated in planning provisions for the estate. Establishing an appropriate buffer area prior to development is an important aspect of environmental protection. The use of the buffer must be carefully controlled by appropriate legislation so that sensitive premises are not impacted by the development and operation of the resource processing estate, and the estate must be managed such that the total cumulative impact of the estate does not exceed the capacity of the buffer.

EPA criteria for air quality, noise and risk must be met at sensitive premises outside the industrial core. Provision of a buffer area should ensure that this is the case. Details of the criteria at sensitive premises for these issues are given in Sections 4.6, 4.8, 4.9 and 4.10.

As the area being considered for the Boodarie Resource Processing Estate does not fall within the Town of Port Hedland Town Planning Scheme 4, a zoning application will be made to incorporate the area, including the external buffer area within this or a later Scheme. The area indicated in Appendix 1, Figure 6 of this advice as a buffer area which surrounds the Boodarie Resource Processing Estate is to be secured for buffer purposes prior to the construction phase of the estate (Woodward-Clyde, 1996).

The DEP has emphasised that no housing should be allowed on the Boodarie Pastoral Lease between the town planning boundary and South Creek (Appendix 1, Figure 3) to ensure that the eastern buffer is adequate to protect sensitive premises from air emissions. At present this area falls within the designated buffer for the Water Corporation's water treatment facility. LandCorp-DRD have indicated that they are not aware of any proposals to build houses in this area.

The DEP commented that a five km buffer around the industrial core would be more appropriate than the three km indicated in the concept plan, and that there should be a two km separation between the support industry area and residences. As noise modelling has indicated that the buffer should extend to South Creek, LandCorp-DRD have advised that the buffer is to extend to South West Creek (see Appendix 1, Figure 6) and it is anticipated that discussions with the Town of Port Hedland regarding Town Planning Scheme amendments will identify this area as falling within the estate buffer.

Industry submissions highlighted a concern that their interests be protected as outlined in various State Agreement Acts relating to overlapping buffer areas. The use of land adjacent to the BHP DRI plant for pastoral purposes will be allowed until industrial development begins.

LandCorp-DRD have committed to discuss this issue with the industries involved.

Consideration

In considering aspects of a buffer area around the Boodarie Resource Processing Estate, the EPA notes the:

1. restriction on residential use within the Support Industries Area and surrounding Water Corporation water treatment facility west of South Creek;
2. indication of noise modelling that buffer boundary should be extended to South Creek, and LandCorp-DRD's intention to accept this recommendation;
3. commitments made by LandCorp-DRD with regard to Town Planning Schemes and State Agreement Acts;
4. commitments made by LandCorp to establish an Estate Manager;
5. commitments made by LandCorp that the Estate Manager will undertake cumulative impact monitoring of buffer conditions; and
6. requirement for any industry wishing to establish on-site to refer the project to the EPA pursuant to Part IV of the Act.

Noise, air quality and risk are issues which have the potential for off-site impacts for individual industries making it necessary to establish adequate separation between industry and sensitive premises. Prior to establishment of industries on-site, the most accepted method of verification of an adequate buffer is by computer modelling of noise, air emission dispersion and risk. In the case of an industrial estate concept, where exact details of industries which may establish on the estate are not known, generic industry types can be used, with further details being input into future models as they become available. Modelling of risk and air emission dispersion was carried out for the Environmental Report. Noise modelling has been undertaken separately.

The results from all such models should be used to establish the appropriate buffer size for the estate, and this buffer must be protected from sensitive development under appropriate schemes.

5.3 Infrastructure requirements

The anticipated expansion in the resource sector and downstream processing that would stimulate the development of the Boodarie Resource Processing Estate Concept Plan would result in regional population growth. Cultural and social issues have been addressed in Section 4.12.

A brief review of the existing infrastructure relevant to the Boodarie Resource Processing Estate Concept Plan is presented in Chapter 3 of the Environmental Report (Woodward-Clyde, 1996).

Port facilities, in particular require further definition. Studies of future port expansion requirements include the heavy Industry Site Studies Port Development Port Hedland report (Rendel Scott Furphy, 1992) and the Port Hedland Port Authority *Port Strategy 1995* (Port Hedland Port Authority, 1995 in Woodward-Clyde, 1996).

The port currently consists of two Port Hedland Port Authority operated wharfs (No 1 Wharf and No 3 Wharf), and three BHP berths (two at Nelson Point on the eastern side of the harbour, and one at Finucane Island) (Woodward-Clyde, 1996). Current and possible future port facilities in Port Hedland Harbour are shown in Appendix 1, Figure 5.

Exports from existing users are expected to increase over the next decade, and No 1 Wharf will be required to handle much of this increase, either through expansion or through streamlining of ship loading operations. No 3 Wharf is expected to be capable of handling additional exports of salt and petroleum products (Woodward-Clyde, 1996).

In the longer term further port development of the port may be required due to expansion of BHP's operations, establishment of heavy industries within the Boodarie Resource Processing Estate, or possible use of the port by a second iron ore producer. In this case, the main area available for development of further berthing facilities is on the western side of the harbour. Areas considered by Rendel Scott Furphy include Stanley Point and Anderson Point (Rendel Scott Furphy, 1992). The Environmental Report also includes Lumsdan Point as a possible future possibility (Woodward-Clyde, 1996).

A further possibility is the establishment of a new port, possibly at Downes Island. As outlined in Section 4.10 above, risk levels associated with importation of crude oil may limit the use of the existing port. Implications of establishing a port at Downes Island, including the service corridors linking with the Boodarie Resource Processing Estate, were not addressed in the Environmental Report (Woodward-Clyde, 1996).

Any new wharf will also require an associated marshalling and storage area and infrastructure such as conveyors. As the Port Hedland port area is characterised by mangroves and mudflats, any plans for filling of land or impact on mangroves will require environmental assessment in accordance with EPA policy.

Other infrastructure related issues considered important in the establishment of a resource processing estate at Boodarie are:

- **water supply** in the Port Hedland area is from the Yule and De Grey aquifers. The Water and Rivers Commissions Hydrology Report No. HR 61 (Wright, 1997) is a desk top review of data on water resources in the Pilbara, and identifies that there is potential for adequate water resources in the medium term to supply additional industries which may establish on the Boodarie Resource Processing Estate. Long term water supplies will need to be investigated by individual proponents. This issue is covered more fully in Section 4.13.
- **gas supply** to Port Hedland from the Karratha - Port Hedland gas pipeline is currently fully utilised. Requirements for industry wishing to establish in the region need to be more fully addressed, including whether further pipelines will be needed, or existing facilities upgraded.

- **power generation and transmission** requirements to service the Port Hedland area are derived from Western Power's Interconnected North West Power System. Subject to commercial agreements and availability, power for the resource processing estate may be obtained from either the Pilbara Energy Pty Ltd Power Station or from the North West Interconnected System.
- the supply of **basic raw materials** for construction should be easily obtained from existing sources in the area including many quarries already in operation.

Consideration

The above issues are of a regional nature, and are likely to require consideration for any site chosen for resource processing within the Port Hedland area. Issues which will require further consideration in any proposal to establish heavy industries within the Boodarie Resource Processing Estate include:

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

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

Major infrastructure proposals which have the potential to impact on the environment will need to be referred to the EPA for consideration.

5.4 Planning and additional facilities in the Port Hedland Region

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

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

The *Pilbara 21 Report* (Pilbara 21 Steering Committee, 1992 in Woodward-Clyde, 1996) was a strategy document which developed a number of recommendations for the Pilbara Region and Port Hedland for the future. Submissions on the Environmental Report (Woodward-Clyde, 1996) highlighted the need for more detailed Regional Planning for the Port Hedland and South Hedland area. A further comment was that the locations of industrial estates in the Pilbara Region could allow synergies to arise from the collocation of industrial developments.

The Pilbara 21 study addressed the need to identify sites in the Pilbara Region at which resource processing could establish to undertake value-added processing of minerals, oil and gas (Woodward-Clyde, 1996). Recommendations of the report included the:

- establishment of suitable resource processing sites in the Port Hedland area;
- preparation of the Pilbara Land Use Planning Strategy based on multiple land use.

As outlined in Section 5.1 above, a desktop site selection study was undertaken by LandCorp-DRD and the Boodarie site chosen.

The *Pilbara Land Use Strategy* (Pilbara Development Commission, 1997) has recently been released. 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 strategy was developed by the Pilbara Land Use Planning Group with support from the Ministry for Planning, Pilbara Development Commission, Local Government Authorities, the Department of Conservation and Land Management, the Department of Agriculture, Aboriginal Affairs Department and industry representatives (Woodward-Clyde, 1996).

Planning for a resource processing estate necessarily involves planning for associated infrastructure such as water supply, power and gas, and port facilities. These issues were covered in Section 5.3 above.

Consideration

In relation to the Boodarie Resource Processing Estate Concept Plan, preliminary investigations for this site have been completed and this report forms the EPA's review and advice to the Minister for the Environment on the Concept Area, under Section 16(e) of the *Environmental Protection Act 1986*. This report concludes that issues such as water supply, liquid and solid waste management and drainage issues will require special management consideration at the design and planning stages to ensure that the environmental impacts are managed to produce a satisfactory outcome.

Implementation of the Boodarie Resource Processing Estate would have implications for areas and resources external to the estate itself. Demand for port facilities would likely increase as industries established on site, associated with this will be increased shipping and possible impacts on the marine environment. Off site service corridors and infrastructure, including sources of construction materials, solid waste disposal sites and particularly water supply will require investigation of potential environmental impacts. These issues have been briefly discussed in LandCorp-DRD's Environmental Report (Woodward-Clyde, 1996), and within this advice, with suggested further studies included in the relevant sections. Proposals for extensions of port facilities and other infrastructure related to the estate will need to be referred to the EPA for consideration under Part IV of the *Environmental Protection Act 1986*.

With respect to the importance of sound planning in the Port Hedland area, potential exists for conflict in the resolution of land and water uses which are being experienced, specifically with respect to regional water supply, and suitable regional waste disposal facilities, as well as in connection with industries already established adjacent to the planned resource processing estate, and with respect to existing port facilities.

5.5 Estate management

A two tiered system of estate management has been proposed by LandCorp-DRD in the Environmental Report (Woodward-Clyde, 1996). This system will involve individual occupiers to be responsible for the environmental impacts of their operations, while cumulative impacts and matters relating to the estate as a whole will be managed by the Boodarie Resource Processing Estate Management Body, as defined in Section 1.4 of this advice.

An emphasis on best industry practice environmental management should be adopted by individual proponents and for overall estate management, using EPA criteria and objectives as the performance requirements. Adoption of procedures such as that set out in the International Standards Organisation standard ISO 14000 series would be appropriate as a means of proponents putting in place the management systems to support the achievement of these performance requirements.

The Estate Management Body would be responsible for the coordination of infrastructure to the Estate, and for the location of proposed new industries within the Estate. Issues such as air quality modelling, noise modelling and risk modelling will need to be taken into account to ensure that criteria are not exceeded at the boundary of the buffer zone. In addition, the infrastructure requirements relating to waste water, water supply and drainage will need to be considered.

Placement of industries such that wastes produced by one industry are available and accessible for use by other industries as raw product should also be a priority in order to minimise waste from industrial processes. Suitable products for use by other industries may include gaseous emissions, heat and waste water.

Further functions of an Estate Manager will be to establish baseline monitoring and to perform cumulative monitoring of various environmental parameters, to manage a database of monitoring data, and to integrate this data with updated models of risk, noise and air quality.

More specific functions of the Estate Manager are outlined in Section 6 below.

6. Environmental management and related studies

LandCorp-DRD in their Environmental Report proposed a two tiered management structure to be put in place for the resource processing estate, if implemented. Under this structure individual operators would be responsible for their own operations, and the Boodarie Resource Processing Estate Management Body (Estate Manager), comprising representatives of all operators within the estate, would take responsibility for ongoing site-wide concerns.

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

It may be appropriate for LandCorp-DRD or similar representative to undertake certain functions within the operation of the Estate. In addition, an Advisory Body may be set up to provide technical advice to the Estate Manager on such issues as modelling, cumulative monitoring, environmental studies and criteria.

In their Environmental Report, LandCorp-DRD made a number of commitments with regard to the management of the resource processing estate if implemented (Woodward-Clyde, 1996). These commitments relate to a wider range of issues than those reflected in the relevant issues presented in this advice.

Management commitments which specifically relate to the relevant issues referred to in this advice are provided in Section 6.3 below. Additional studies are also included to:

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

6.1 Environmental management system

The Estate Manager and proponents of specific proposals within the estate should implement management systems which include the principles and relevant components from the Australian Standard on environmental management systems (AS/NZS ISO 14000 series). Compliance auditing of regulatory requirements should be included as part of the monitoring plan.

The EMS should include an environmental management programme as described below.

6.2 Environmental management programme

A programme designed to achieve the objectives and targets of the organisation; it includes environmental management plans to address specific issues, and procedures to implement the plans.

The EPA is of the opinion that initially LandCorp-DRD, and subsequently the Estate Manager, should prepare, review, implement and report on an overall Environmental Management Programme for the Concept Plan area. This programme should form part of a more extensive Environmental Management System which describes the procedures to implement the proposal. Environmental management plans for the estate as a whole will be required to address air quality, drainage, mangrove damage during construction of service corridors, marine spills, soil and water contamination during the construction phase, and dust.

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

6.3 Summary of suggested environmental management initiatives and related studies and actions

The responsibilities and structure for environmental management in the estate area will differ for the concept development, construction and operational phases of the estate. Consequently the roles of LandCorp-DRD, the Estate Manager and proponents will vary according to these phases and are reflected in the commitments made to the concept by LandCorp-DRD. The broad outline for an environmental system can be used for each issue. The suggested studies and further actions to be undertaken by the Estate Manager and proponents were outlined in Section 4 of this report, and are summarised below.

Estate Manager

Concept Development Phase

Studies, initiatives and design

- undertake a full survey of areas to be disturbed by construction activities for threatened or endangered species of flora and fauna, including specific targeting of the vulnerable fauna species *Dasycercus cristicauda* (Mulgara) in hummock grassland, and Priority One flora species *Ptilotus appendiculatus* var. *minor*;
- identify the area affected by service corridors accessing the port, and potential impacts on mangroves in the area;
- undertake, if appropriate, a regional survey of marine habitats;
- undertake studies prior to implementing the recommendations relating to drainage constructions outlined in the report by Jim Davies and Associates to ensure that the EPA's objective with regard to flood mitigation can be balanced with the objectives for maintaining natural drainage systems and indigenous vegetation for this site;
- determine probability of site inundation from the Turner River East Branch as recommended by Jim Davies and Associates;
- assess the effect of infrastructure elements such as roads, pipelines and conveyors as to their effect on local drainage, particularly in the south and east of the site;
- support Government investigations into Pilbara air quality;
- evaluate cumulative dust impacts using baseline data and results of meteorological studies;
- identify a process to address the issue of cumulative noise impacts, possibly by setting limits on individual operators such that noise levels from the entire estate do not exceed allowable levels;
- identify a liquid waste outfall site and associated service corridor location;
- identify a suitable location for evaporation ponds if intended;
- identify a strategy for liquid and solid waste disposal for industries proposing to establish in the estate, in parallel with Government initiatives in the region;
- undertake detailed ethnographic and archaeological study of the proposed development area for Aboriginal heritage sites;
- consult local Aboriginal communities and the Aboriginal Affairs Department on Aboriginal cultural matters;
- consult the WA Heritage Council on a heritage survey of relevant areas;

Baseline studies

- undertake a baseline study of surface water and groundwater quality;
- perform a baseline air quality study prior to establishment of industries on-site;
- undertake a baseline dust monitoring programme;

Modelling

- undertake further air quality modelling using more detailed information on regional meteorology, and modify buffer allocation as appropriate;

Management Plans

- develop an Air Quality Management Plan which will include continuous monitoring of cumulative impacts of the resource processing estate including impacts on vegetation to protect the environment and human health and modelling to establish the capacity of the local air shed to accommodate air emissions;
- develop a Heritage Management Plan for the Estate;

Construction Phase

Management Programmes and Installations

- develop and implement an environmental management programme to minimise damage to the nearshore marine environment during construction of service corridors;
- develop and implement procedures to prevent spills which may impact on water ways and the marine environment;
- adhere to the requirements of treaties and legislation dealing with threatened marine species;
- implement mechanisms to contain potential spills during the construction phase;
- implement a Dust Management Programme incorporating best available management practices;
- consult local Aboriginal communities and the Aboriginal Affairs Department on Aboriginal cultural matters;

Monitoring

- implement a monitoring programme to control introduced pests and weeds, and record the presence of significant vegetation and fauna species;
- undertake dust monitoring during construction;

Operation Phase

Industry Location

- use air quality modelling results to ensure that the configuration of industries within the resource processing estate reduces the likelihood of excursions of gaseous emissions above set standards and criteria;
- locate industries within the resource processing estate such that the likelihood that excursions of particulate emissions and dust above set standards and criteria will occur is minimised;
- utilise the results of additional noise emission modelling for placement and allocation of maximum noise levels for industries proposing to establish on the estate;
- take cumulative noise impacts into account when optimising location for new industries wishing to establish within the resource processing estate;
- use risk modelling to determine appropriate location of new industries establishing on-site, and adequacy of internal buffers;
- locate industries within the resource processing estate such that the use of waste products as primary feedstock by suitable industries is encouraged;

Monitoring

- implement a monitoring programme to control introduced pests and weeds, and record the presence of significant vegetation and fauna species;
- monitor the quality of water leaving the estate when it may have the potential to impact on the marine environment.
- monitor flood levels and flows in the South West Creek and Turner River East Branch by installing flood markers;
- establish a cumulative ground water and surface water quality monitoring programme;
- monitor the quality of water leaving the estate when it may have the potential to impact on the marine environment;

- develop and implement an Air Quality Management Plan which will include continuous monitoring of cumulative impacts of the resource processing estate including impacts on vegetation to protect the environmental and human health and modelling to establish the capacity of the local air shed to accommodate air emissions;
- undertake cumulative dust monitoring;
- develop and implement a programme of noise monitoring to assess cumulative impacts;
- implement an ongoing programme for the determination of cumulative risk, both individual and societal;

Management

- adhere to the requirements of treaties and legislation dealing with threatened marine species;
- develop and implement procedures to prevent spills which may impact on water ways and the marine environment;
- coordinate drainage systems from all industries establishing on-site to ensure that untreated waste water and runoff does not enter adjacent water systems;
- develop and implement procedures to prevent spills within the estate area;
- undertake remedial action in the event that contaminants are detected so that impact on mangrove communities is minimal.
- maintain a database of meteorological and air quality information of utilisation in appropriate placement of new proponents as necessary;
- identify a process to address the issue of cumulative noise impacts, possibly by setting limits on individual operators such that noise levels from the entire estate do not exceed allowable levels;

Proponents

Concept Development Phase

Studies, initiatives and design

- adopt industry best practice management environmental principles for air quality, noise and waste management;
- undertake further studies into the impacts port development may have on mangrove communities;
- undertake, if appropriate, a regional survey of marine habitats;
- design and implement appropriate drainage control measures;
- design and implement drainage systems and waste water treatment initiatives;
- design facilities to minimise gaseous emissions;
- determine the quantity of greenhouse gases produced and identify measures adopted to limit greenhouse gas emissions from the project;
- 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;
- assess cumulative impact of proposal on dust levels as part of the environmental impact assessment process;
- assess noise from industrial plant proposed for the resource processing estate;
- assess transport infrastructure including road, rail and bulk conveyors for each industry locating on the estate and using that mode of transport for potential noise impacts;

- resolve the issue of solid and liquid waste disposal prior to establishing on-site;
- undertake detailed ethnographic and archaeological study of the proposed development area for Aboriginal heritage sites;
- consult local Aboriginal communities and the Aboriginal Affairs Department on Aboriginal cultural matters;
- consult the WA Heritage Council on European Heritage on a heritage survey of relevant areas;
- investigate the feasibility of recycling waste water and treated stormwater for reuse by industries;
- consider using treated recycled water and stormwater for industrial water supply needs;

Baseline studies

- undertake full surveys of the proposal area for threatened or endangered species of flora and fauna, including specific targeting of the vulnerable Fauna Species *Dasycercus cristicauda* (Mulgara) in hummock grassland, and Priority One flora species *Ptilotus appendiculatus* var *minor*;

Modelling

- prepare a risk and hazard analysis for new, potentially hazardous facilities;
- assess societal risk following accepted guidelines;

Management Plans

- be aware of obligations under the Heritage Management Plan for the estate;

Construction Phase

Management Programmes and Installations

- minimise disturbance to fauna habitats and vegetation communities during construction;
- notify the Endangered Species Unit of the Biodiversity Group at Environment Australia in the event that any endangered species are located on a development site, and propose action towards their protection;
- develop and implement an environmental management programme to minimise damage to the nearshore marine environment during construction of service corridors as appropriate;
- adhere to requirements of treaties and legislation dealing with threatened marine species as appropriate;
- develop and implement procedures to prevent spills which may impact on water ways and the marine environment;
- design and implement appropriate drainage control measures;
- contain potential spills during construction to avoid contamination of soil, surface water and groundwater;

Monitoring

- undertake noise monitoring of noisy activities during construction;

Operation Phase

Environmental Management

- adopt environmental management measures with particular emphasis on industry best practice technologies and procedures to minimise environmental impacts;

- notify the Endangered Species Unit of the Biodiversity Group at Environment Australia in the event that any endangered species are located on a development site, and propose action towards their protection;
- adhere to requirements of treaties and legislation dealing with threatened marine species as appropriate;
- develop and implement procedures to prevent spills which may impact on water ways and the marine environment;
- manage operations to minimise the potential for ground or surface water contamination to occur;
- develop and implement procedures to prevent spills to avoid contamination of soil, surface water and groundwater;
- implement dust management measures with particular emphasis on best available containment;
- apply industry best practice waste management principles;

Monitoring

- monitor the quality of water leaving the estate when it may have the potential to impact on the marine environment.
- establish a groundwater and surface water quality monitoring programme.
- monitor and report on air emissions from individual plants;
- report greenhouse gas emissions associated with their proposal to the DEP during operation, using the generally accepted methods;

Water and Rivers Commission and water provider

Concept Development Phase

- address the total water requirements for industries proposing to establish within the estate to ensure that draw down of the water table will not occur;

6.4 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 that this buffer zone needs to be formally recognised and designated in planning provision for the estate.

Estate Management

Management of the resource processing estate will be on a two tiered basis. An estate management body will be responsible for overall environmental management of the estate, including cumulative impact monitoring, coordinating the optimal location of new industries, and management functions such as the provision of infrastructure. As outlined in Section 2, this function will initially be undertaken by LandCorp-DRD, and may later include representatives from owners and lessees within the estate.

Within this environmental management system, individual industries will be responsible for environmental management and control of environmental impacts from their operations.

Communication (with proponents and community on estate management)

The EPA considers that effective communication of environmental concerns between the Estate Manger, 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 to

establish mechanisms for providing information and liaison with potential proponents and the community on significant aspects associated with the estate.

Decommissioning

Proponents intending to cease operations of established industries within the 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

Liquid and solid waste disposal, issues related to the provision of gas and electricity supply, together with transport infrastructure requirements such as road, rail and conveyor transport have only been considered very briefly 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.

It is the EPA's view that the provision of infrastructure support for the resource processing estate concept plan 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.

7. Advice to the Minister for the Environment

The EPA offers the following advice:

Recommendations to the Minister for the Environment

Recommendation 1

That the Minister for the Environment notes that the EPA has provided environmental advice in this report on the Boodarie Estate concept to assist LandCorp and the Department of Resources Development in their further planning and development of the area, and to assist individual proponents who may desire to operate on the site.

Recommendation 2

That the Minister for the Environment notes that the EPA advice covers issues of terrestrial flora and fauna, marine environment, surface hydrology, drainage and flood mitigation, groundwater and surface water quality, air quality, greenhouse gases, dust and particulate emissions, noise and vibration, public health and safety, liquid and solid wastes, cultural, heritage and social surroundings, water supply, site selection, buffers, planning and additional facilities in the Port Hedland region and infrastructure requirements.

Recommendation 3

That the Minister for the Environment notes the EPA has included advice that a series of studies and further actions should be undertaken, as identified in Section 4 for each issue, and summarised in Section 6.3, so that relevant information is available when individual proposals are presented to the EPA for assessment and also to assist in continuous improvement in environmental management.

Recommendation 4

That the Minister for the Environment notes that the establishment of a Boodarie Estate Resource Processing Estate Management Body is proposed and that this will facilitate the investigation and management of cumulative site impacts and off-site servicing impacts.

Recommendation 5

That the Minister for the Environment notes that infrastructure requirements of the Boodarie Resource Processing Estate 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 6

That the Minister for the Environment notes that industries with the potential to significantly impact on the environment of the Boodarie Resource Processing Estate Concept Area would be subject to assessment under Part IV of the *Environmental Protection Act.*

Recommendation 7

That the Minister for the Environment endorses the EPA advice contained in this report, and in transmitting that advice to the Minister for Resources Development and the Minister for Lands advises them that there are some matters, such as liquid and solid waste disposal, drainage and flood mitigation, which may constrain full development of the site and which will need to be given special attention in the planning process so that the environmental impacts are managed to produce a satisfactory outcome.

Table 5: Important factors, 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
Terrestrial flora and fauna	Concept area including service corridors and Port Hedland Port Authority area within the broader Pilbara Biogeographical Region.	• To protect rare and priority flora and fauna in accordance with the provisions of the *Wildlife Conservation Act 1950.* • To maintain the abundance, diversity, geographic distribution and productivity of vegetation communities and terrestrial fauna. • To maintain the ecological function, abundance, species diversity and geographic distribution of mangroves. • To meet Australia's international agreements on migratory birds.	Six major plant communities occur within the area from Finucane Island to the southern boundary of the resource processing estate. A number of vulnerable or priority species are expected to occur in the area, or have been recorded in the past.	Monitoring and control of pests and weeds during clearing and construction. Minimise potential impacts by staged clearing of vegetation, and landform modifications. Protection of declared rare and priority flora species.	It is likely that implementation of the resource processing estate concept plan is capable of being managed so as not to compromise the EPA's objective with regard to terrestrial flora and fauna if the following studies are undertaken: ***Estate Manager*** • undertake a full survey of areas to be disturbed by construction activities for threatened or endangered species of flora and fauna, including specific targeting of the vulnerable fauna species *Dasycercus cristicauda* (Mulgara) in hummock grassland, and Priority One flora species *Ptilotus appendiculatus* var. *minor*; • implement a management plan, including a monitoring programme and control strategy, to control introduced pests and weeds; and • identify the area affected by service corridors accessing the port, and potential impacts on mangroves in the area. ***Proponents*** • undertake full surveys of the proposal area for threatened or endangered species of flora and fauna, including specific targeting of the vulnerable fauna species *Dasycercus cristicauda* (Mulgara) in hummock grassland, and Priority One flora species *Ptilotus appendiculatus* var. *minor;* • undertake further studies into the impacts port development may have on mangrove communities; • minimise disturbance to fauna habitats and vegetation communities during construction; and • notify the Endangered Species Unit of the Biodiversity Group at Environment Australia in the event that any endangered species are located on a development site, and propose action towards their protection.

RELEVANT FACTOR	RELEVANT AREA	EPA OBJECTIVES	CONCEPT PLAN CHARACTERISTICS	MANAGEMENT COMMITMENTS	ADVICE TO MINISTER ON EPA OBJECTIVES AND ENVIRONMENTAL MANAGEMENT
Marine water quality and fauna	Nearshore marine environment and Port Hedland Port Authority area.	• To meet the requirements of the Australian Water Quality Guidelines for Fresh and Marine Waters (ANZECC, 1992) • To consider, in the longer term, to maintain or improve water and sediment quality based on the environmental quality objectives (EQO's) and Environmental Quality Criteria (EQC's) from the Southern Metropolitan Coastal Waters Study (DEP, 1996). • to protect Specially Protected (Threatened) Fauna, consistent with the provisions of the *Wildlife Conservation Act 1950.*	The concept area itself is situated inland. Potential marine impacts will be due to drainage to the nearshore marine environment, and increased shipping traffic related to industries which establish on the estate. Future impacts from port expansion or establishment of a new port will be subject to separate assessment by the EPA.	Monitor surface runoff and groundwater quality leaving the estate	It is likely that implementation of the resource processing estate concept plan is capable of being managed so as not to compromise the EPA's objective with regard to impacts on the marine environment providing any significant impact on the habitats of protected species can be avoided and if the following studies are undertaken: ***Estate Manager/Proponent*** • undertake, if appropriate, a regional survey of marine habitats; • undertake a baseline survey of water quality; • develop and implement an environmental management programme to minimise damage to the nearshore marine environmental during construction of service corridors; • monitor the quality of water leaving the estate when it may have the potential to impact on the marine environment; • develop and implement procedures to prevent spills; • adhere to requirements of treaties and legislation dealing with threatened marine species.

RELEVANT FACTOR	RELEVANT AREA	EPA OBJECTIVES	CONCEPT PLAN CHARACTERISTICS	MANAGEMENT COMMITMENTS	ADVICE TO MINISTER ON EPA OBJECTIVES AND ENVIRONMENTAL MANAGEMENT
Surface Hydrology, drainage and flood mitigation	Concept area and associated natural drainage systems and catchments	• To maintain the integrity functions and environmental values of the natural drainage systems where possible. • To reduce the impact of flooding and storm surge on surrounding areas as far as possible. • To ensure that alterations to surface water drainage do not adversely impact on indigenous vegetation.	Drainage is in the form of broadsheet flow across the concept area in a north flowing direction. A number of recommendations have been made which, if implemented, should reduce the risk of inundation of the site from the Turner River East Branch and South West Creek.	Minimise topsoil disturbance and impacts on surface hydrology, and to ensure that contractors undertake drainage control through contour banking during construction or service corridors and roadworks.	The EPA has concerns with issues arising from the location of the estate. A balance between the EPA's objective with respect to drainage and flood mitigation will be difficult to achieve for the proposed site. The EPA believes that special attention will need to be given to the design of drainage systems to achieve this balance. The EPA further believes that the following should be undertaken: ***Estate Manager*** • undertake studies prior to implementing the recommendations relating to drainage constructions outlined in the report by Jim Davies and Associates to ensure that the EPA's objective with regard to flood mitigation can be balanced with the objectives for maintaining natural drainage systems and indigenous vegetation for this site (Jim Davies & Associates, 1995); • determine the probability of site inundation from the Turner River East Branch as recommended by Jim Davies and Associates; • assess the effect of infrastructure elements such as roads, pipelines and conveyors on local drainage, particularly in the south and east of the site; and • monitor flood levels and flows by installing flood markers in South West Creek and Turner River East Branch as recommended by Jim Davies and Associates. ***Proponents*** • design and implement appropriate drainage control measures.

RELEVANT FACTOR	RELEVANT AREA	EPA OBJECTIVES	CONCEPT PLAN CHARACTERISTICS	MANAGEMENT COMMITMENTS	ADVICE TO MINISTER ON EPA OBJECTIVES AND ENVIRONMENTAL MANAGEMENT
Groundwater and surface water quality	Concept area and adjacent groundwater and surface water systems	To maintain or improve the quality of groundwater to ensure that existing and potential uses, including ecosystem maintenance are protected, consistent with the draft WA Guidelines for Fresh and Marine Waters (EPA, 1993).	A number of drainage reserves will be developed such that treated storm water is directed to South West Creek, then drain to mangrove communities on the coast.	Baseline study of surface and groundwater quality. Cumulative impact monitoring of surface and groundwater quality. Protection of water quality during construction through procedures.	It is likely that implementation of the resource processing estate concept plan is capable of being managed so as not to compromise the EPA's objective with regard to protection of groundwater and surface water quality if the following studies and actions are undertaken: ***Estate Manager*** • undertake a baseline study of water quality; • implement mechanisms to contain potential spills during the construction phase; • coordinate drainage systems from all industries establishing on site to ensure that untreated waste water and runoff does not enter adjacent water systems; • establish a cumulative groundwater and surface water quality monitoring programme; • undertake remedial action in the event that contaminants are detected so that impact on mangrove communities is minimal; ***Proponents*** • design and implement drainage systems and waste water treatment initiatives; • contain potential spills during construction; • manage operations to minimise the potential for ground or surface water contamination to occur; • establish a groundwater and surface water quality monitoring programme.

RELEVANT FACTOR	RELEVANT AREA	EPA OBJECTIVES	CONCEPT PLAN CHARACTERISTICS	MANAGEMENT COMMITMENTS	ADVICE TO MINISTER ON EPA OBJECTIVES AND ENVIRONMENTAL MANAGEMENT
Air Quality	Concept area including buffer, and surrounding areas.	To ensure that emissions of gases, particulates and odours conform with agreed standards and criteria and do not cause health, amenity or environmental problems.	Potentially substantial emissions of fine particulates, NOx, SO_2 and other gases from industrial sites. Buffer is included in concept plan, separating industry from populated areas.	Monitor and manage cumulative impacts. Air monitoring programme. Maintain public comments register. Require contractors to use emission control equipment as required by EPA guidelines for vehicular emissions. Provide funding for the Pilbara Air Quality Studies to be undertaken by the DEP.	It is likely that implementation of the resource processing 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 studies are undertaken: ***Estate Manager*** • support investigations into Pilbara air quality and perform a baseline air quality study prior to establishment of industries on site; • undertake further modelling using more detailed information on regional meteorology, and modify buffer allocation as appropriate • develop an Air Quality Management Plan; • use air quality modelling results to ensure that the configuration of industries within the resource processing estate reduces the likelihood of excursions of gaseous and particulate emissions above set standards and criteria; • locate industries within the resource processing estate such that the use of waste products as primary feedstock by suitable industries is encouraged; • maintain a database of meteorological and air quality information for use in the appropriate placement of new proposals in the estate. ***Proponents*** • design facilities to minimise gaseous emissions; • adopt best practice management environmental principals; • monitor and report on air emissions.

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 meet acceptable standards and requirements of Section 51 of the *Environmental Protection Act 1986*	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; • report on the comparative greenhouse 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. • report greenhouse gas emissions associated with the proposal to the DEP during operation, using the generally accepted methods;
Dust and particulate emissions	Concept area	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 DEP guidelines for land development sites and impacts on air quality and EPA Kwinana EPP.	Site development, ship loading and conveyors are potentially significant dust sources. Industrial processes can produce fine particulates which can be harmful to health. Buffer surrounding industrial core is included in the concept area to provide separation from populated areas.	Dust management plan to be prepared. Dust contingency measures to be applied by contractors. Topsoil loss to be minimised by not clearing during the cyclone season.	The EPA has concerns with issues arising from the location of the estate. Dust levels in the Port Hedland area are already high, and have the potential to increase with further materials handling in the area. The EPA believes that these concerns may be mitigated if the estate is established to the south west of the proposed site. ***Estate Manager*** • undertake baseline dust monitoring programme; • evaluate cumulative dust impacts using baseline data and results of meteorological studies; • implement a Dust Management Programme; • locate industries within the estate such that the likelihood of excursions of particulate emissions and dust above set standards and criteria is minimised; • undertake cumulative dust monitoring. ***Proponents*** • assess cumulative impact of proposal on dust levels as part of environmental impact assessment process; • implement dust management measures with particular emphasis on best practice containment.

RELEVANT FACTOR	RELEVANT AREA	EPA OBJECTIVES	CONCEPT PLAN CHARACTERISTICS	MANAGEMENT COMMITMENTS	ADVICE TO MINISTER ON EPA OBJECTIVES AND ENVIRONMENTAL MANAGEMENT
Noise and vibration	Concept area and surrounding areas including residences and outdoor recreation areas.	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.	Noise emissions from industry are likely to be substantial. Noise modelling has led to the extension of the buffer area to include South Creek.	Buffer will extend east to include South Creek. Discussions will be held with Town of Port Hedland to ensure that the area is secured for buffer purposes. Monitor and manage cumulative impacts.	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 if the proponent undertakes the following: ***Estate Manager*** • utilise the results of additional noise emission modelling for placement and allocation of maximum noise levels for industries proposing to establish on the estate; • take cumulative impacts, including infrastructure, into account when locating new industries; • identify a process to address the issue of cumulative impacts such that noise levels from the entire estate do not exceed allowable levels; • develop and implement cumulative modelling programme. ***Proponents*** • assess noise from proposed industrial plant; • assess transport infrastructure for possible noise impacts. • undertake noise monitoring of noisy activities during construction; • adopt best practice noise management approaches.
Public Health and Safety	Concept area and surroundings, existing and potential infrastructure corridors, and existing and potential port facilities.	To ensure that public risk associated with implementation of the concept are as low as reasonably achievable and in compliance with the criteria detailed in EPA Bulletins 611 and 627.	Industry types likely to establish on the estate may have the potential for risk. Risk and hazard modelling of generic industries, and of associated port operations showed that EPA criteria could be met for the estate area, but that import of both ammonia and crude oil resulted in unacceptable risk in the Port Hedland area. When ammonia only is imported, risk levels fall within EPA criteria.	500 m separation distance between the heavy industrial core and the support industries area to facilitate emergency response. Cumulative risk analysis to be undertaken as new industries propose to establish on site.	It is likely that implementation of the resource processing 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 studies are undertaken: ***Estate Manager*** • use risk modelling to determine appropriate location of new industries establishing on site, and adequacy of internal buffers; • implement an ongoing programme for the determination of cumulative risk, both individual and societal; ***Proponents*** • prepare a risk and hazard analysis for new, potentially hazardous facilities; • assess societal risk following accepted guidelines.

RELEVANT FACTOR	RELEVANT AREA	EPA OBJECTIVES	CONCEPT PLAN CHARACTERISTICS	MANAGEMENT COMMITMENTS	ADVICE TO MINISTER ON EPA OBJECTIVES AND ENVIRONMENTAL MANAGEMENT
Liquid and Solid Wastes	Concept area including service corridors.	To ensure that wastes are managed in accordance with the waste management hierarchy (avoid, minimise, 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 the Draft *Western Australian Guidelines for Fresh and Marine Waters* (EPA, 1993)	As the needs of the industries which may establish on site cannot be anticipated at this stage, specific plans have not been made to establish either solid or liquid waste disposal or treatment facilities on site.	Waste management plan to be implemented during the construction phase. Cooperation in Government initiatives to identify and develop appropriate landfill sites in the region.	Liquid waste and evaporation ponds pose potential problems for the proposed site due to its potential for flooding. The EPA believes that suitable studies and appropriate design of evaporation ponds and drainage systems will be required. Studies should include the following: ***Estate Manager*** • identify suitable outfall site and associated service corridor location; • identify suitable location for evaporation ponds if intended; • identify a strategy for liquid and solid waste disposal for industries proposing to establish in the estate, in parallel with Government initiatives; • locate industries within the resource processing estate such that the use of waste products as primary feedstock by suitable industries is encouraged. ***Proponents*** • apply best practice waste management principals; • resolve the issue of solid and liquid waste disposal prior to establishing on site.
Cultural, Heritage and Social Surroundings	Concept Area and surrounding areas.	• To ensure that development complies with statutory requirements in relation to places and sites of heritage significance. • To ensure that changes to the physical and biological environment resulting from the development do not adversely affect cultural associations with the area.	Some archaeological sites exist near South West Creek within a service corridor, and at Boodarie Landing. It is possible that further archaeological or ethnographic material exists within the estate area.	Detailed surveys to locate further aboriginal archaeological or ethnographic sites within the concept area. Compliance with the *Aboriginal Heritage Act 1972-1980.* Compliance with the *WA Heritage Act.*	It is likely that implementation of the resource processing estate concept plan is capable of being managed so as not to compromise the EPA's objective with regard to cultural, heritage and social surroundings if the following studies are undertaken: ***Estate Manager/Proponents*** • undertake detailed ethnographic and archaeological studies of the proposed development area for Aboriginal heritage sites; • consult local Aboriginal communities and the AAD on Aboriginal cultural matters; • develop a Heritage Management Plan for the Estate; • consult the WA Heritage Council on a heritage survey of relevant areas.

RELEVANT FACTOR	RELEVANT AREA	EPA OBJECTIVES	CONCEPT PLAN CHARACTERISTICS	MANAGEMENT COMMITMENTS	ADVICE TO MINISTER ON EPA OBJECTIVES AND ENVIRONMENTAL MANAGEMENT
Water Supply	Concept area and surrounding region.	To ensure that the planning and development of additional water resources for the Pilbara Region is carried out in a coordinated and sustainable manner with appropriate assessment of potential environmental impacts.	Current water supply is from the Yule and De Grey aquifers, but current capacity will be utilised by other industry users. A report detailing the results of recent investigations by the Water Corporation into expanding the De Grey aquifer is in preparation. Other studies are underway to identify alternative supplies.		Water supply issues have the potential to limit the development of the estate and requires resolution prior to development of the estate. ***Estate Manager*** • address the total water requirements for industries proposing to establish within the estate to ensure that draw down of the water table will not occur; • investigate the feasibility of recycling waste water and treated stormwater for reuse by industries. ***Proponents*** • consider using treated recycled water and stormwater for industrial water supply needs.

Appendix 1

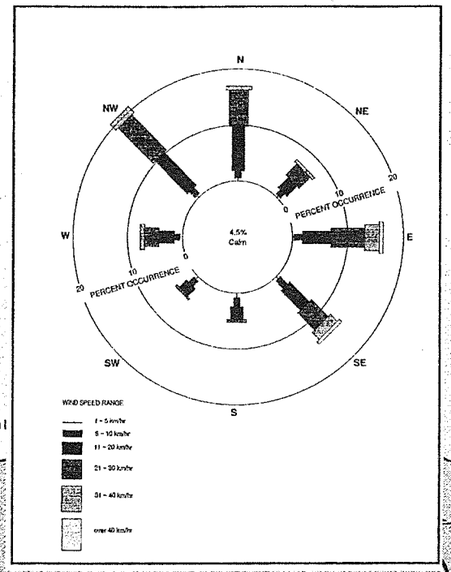
Figures

650 000m E 660 000m E 670 000m E 680 000m E

7 750 000m N

7 740 000m N

7 730 000m N



Indian Ocean

North Point
Finucane Island
Cooke Point
Hospital
Spinifex Hill
Downes Island
Town Centre
PORT HEDLAND
Boodarie Landing
Stanley Point
Cargill Salt Salt Evaporators
Wedgefield
Proposed Buffer Area
8
BHP DRI PLANT AND SUPPORT AREA
Support Industries Area
South Hedland
Boodarie Hill
6 Mile Well
Sand Hill Well
Boodarie
Proposed Access Road
South Hedland
Proposed Boodarie Resource Processing Estate (Industrial core)
6
PERL POWER STATION
Proposed Buffer Area
Pipping Well
5
Boodarie Pastoral Lease
7
Proposed Buffer Zone boundary
Great Northern Highway
1
Port Hedland - Goldsworthy Railway
De Grey - Mullewa Stock Route
Great Northern Highway
De Grey Aquifer approx 50Km
2
Pippingarra Pastoral Lease
4
3
Pippingarra Hstd
Boodarie Hstd
De Grey - Mullewa Stock Route
Turner River
Turner River
West Branch
East Branch
Yule Aquifer approx 25km
Port Hedland - Newman Railway
Beebingarra Creek
Peterminer Creek
Creek

REFERENCE
- Port Hedland Townsite boundary
- Pastoral Lease boundary
- 4 — Sites evaluated by LandCorp - DRD, 1993
- BHP High Volume Dust Monitors

NORTH
0 1 2 3 4 5
KILOMETRES

DESIGNED RAK	Woodward-Clyde Engineering & sciences applied to the earth & its environment	REVISION C	LANDCORP / DRD Boodarie Resource Processing Estate
DRAWN PGC	AGC Woodward-Clyde Pty Ltd 5th Floor, 233 Adelaide Terrace Perth, WA, Australia 6000 Tel (09) 325 9077 Fax (09) 325 9091	SCALE As Shown	TITLE: SITE SELECTION EVALUATION
CHECKED CR		DRAWING 2690G.002	
APPROVED		FIGURE 2	
DATE MAY '96			

Figure 1. Location — Boodarie Resource Processing Estate, and Annual Wind Rose for Port Hedland.

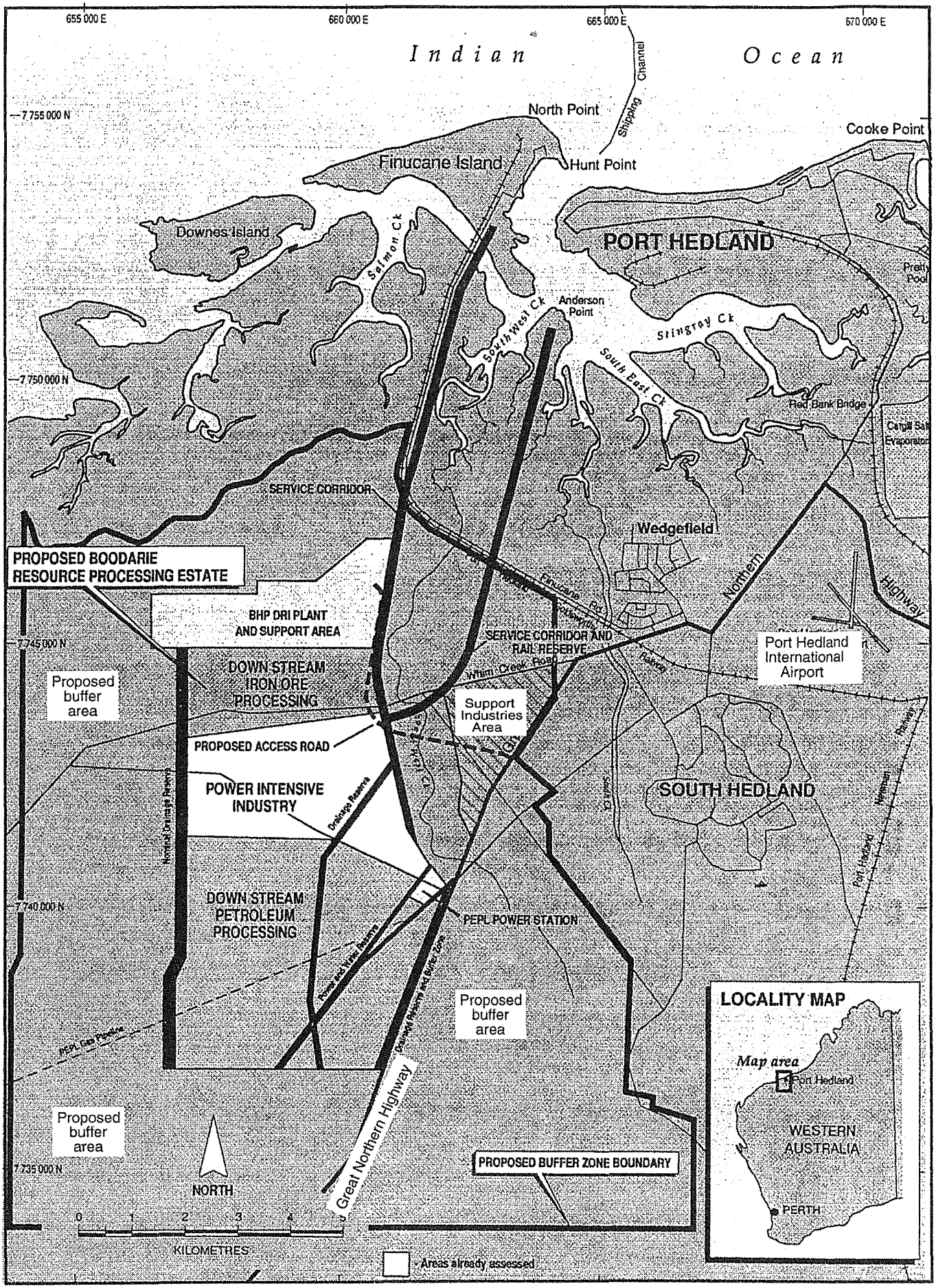


Figure 2. Components of the Boodarie Resource Processing Estate.

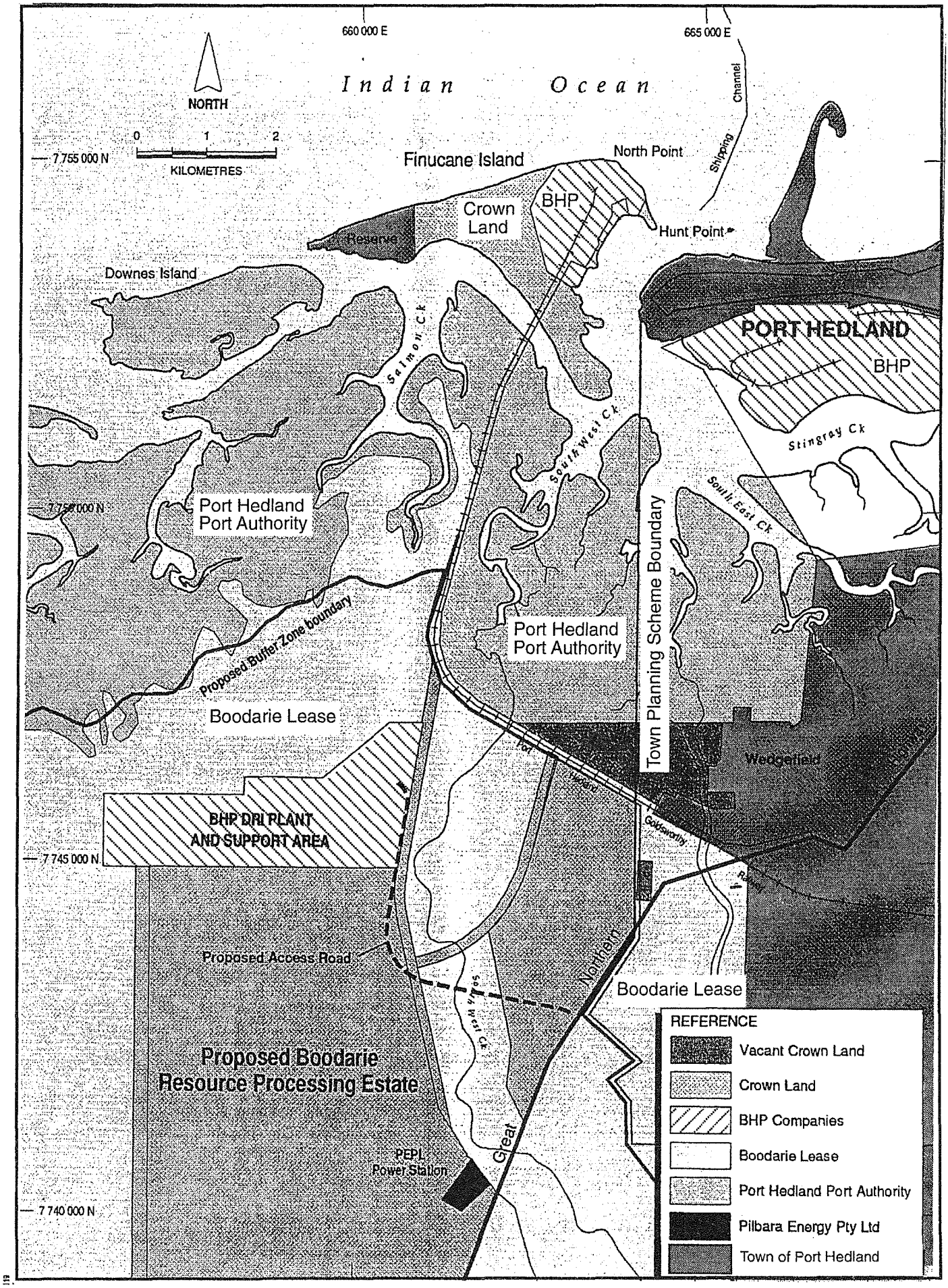


Figure 3. Land tenure in the Port Hedland area.

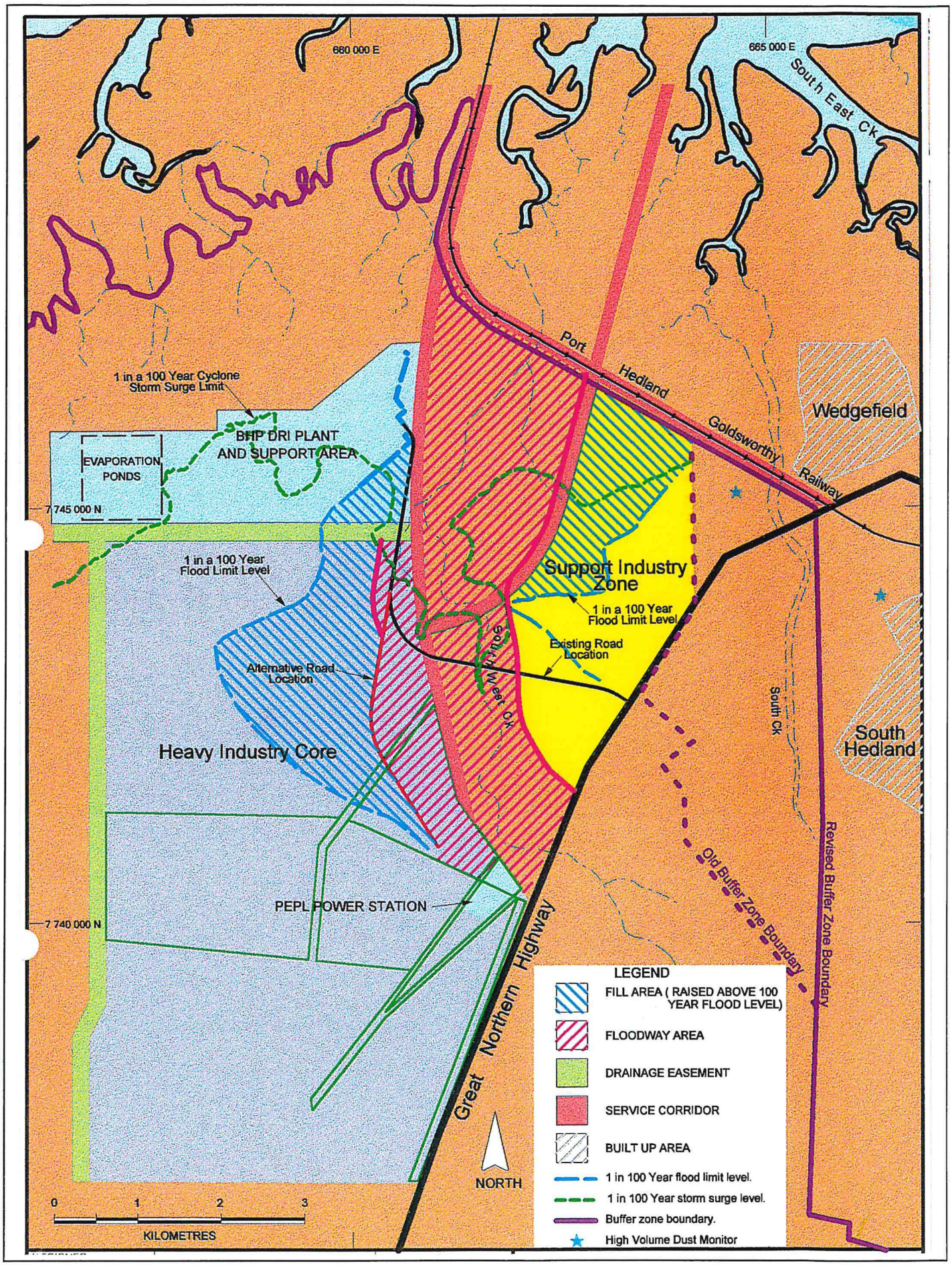


Figure 4. Storm surge and flood level contours.

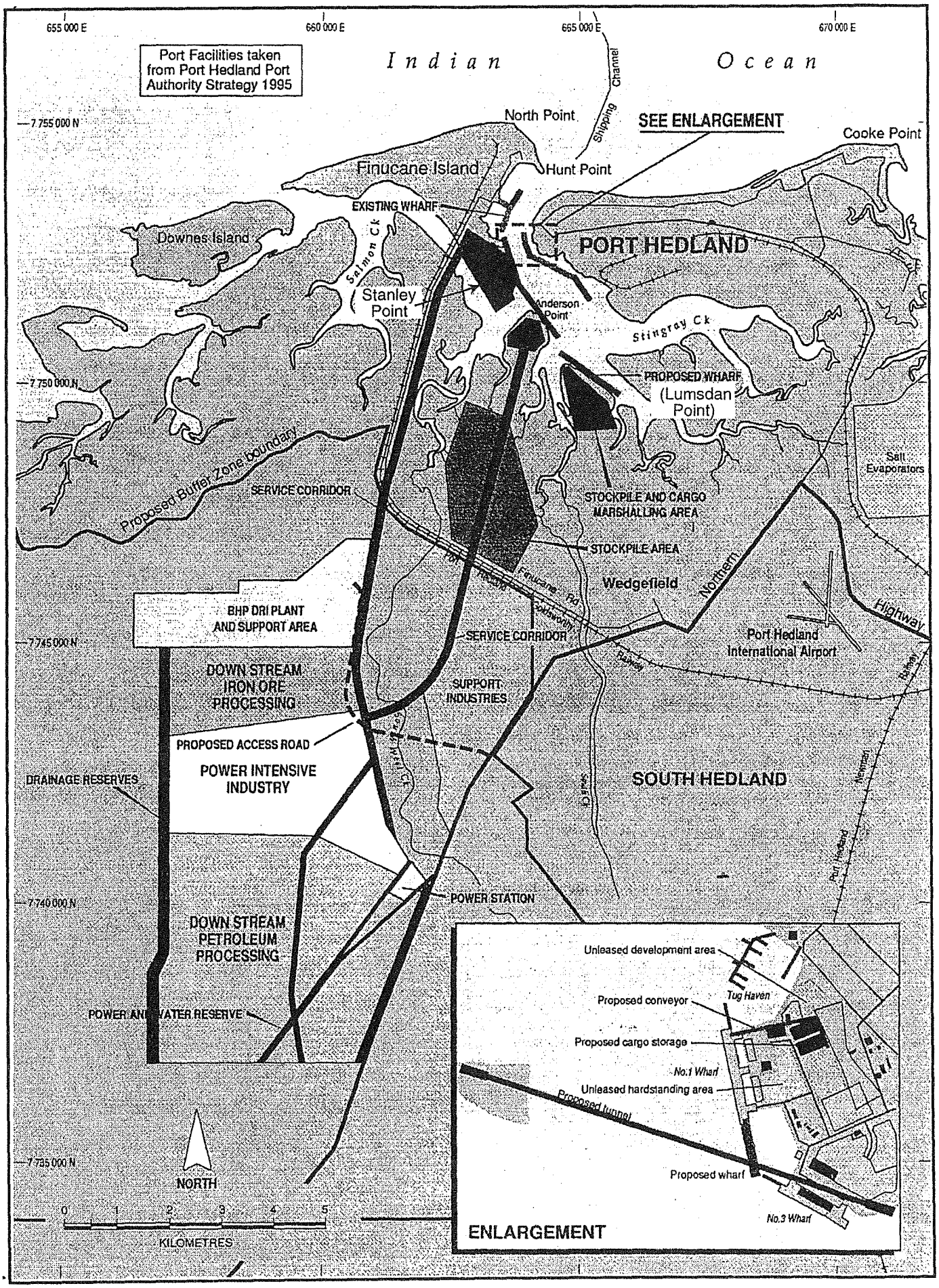


Figure 5. Possible development of Port Hedland Harbour.

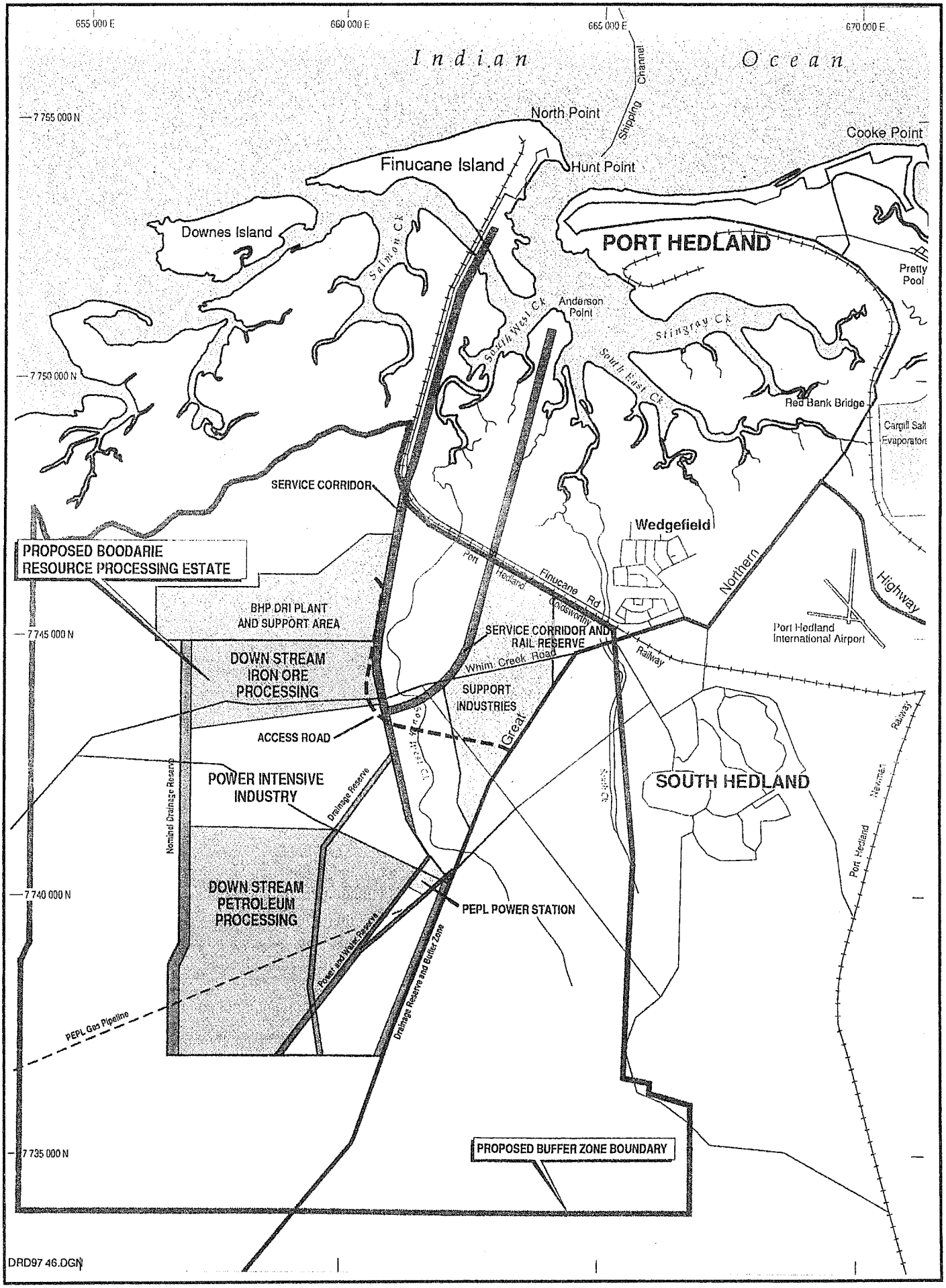


Figure 6. Proposed extended buffer zone boundary.

Appendix 2

List of people and organisations that made submissions

Federal Government

Australian Nature and Conservation Agency

State Government

Water Corporation

Water and Rivers Commission

Department of Conservation and Land Management

Aboriginal Affairs Department

Department of Transport (Made no comment)

Industry Bodies

BHP Direct Reduced Iron Pty Ltd

Others

Pilbara Development Commission

Appendix 3

Commitments made by LandCorp-DRD

Note that the commitments made by LandCorp-DRD in the Environmental Report (Woodward-Clyde, 1996) are not binding, as the Concept Plan is not being formally assessed by the EPA under Part IV of the *Environmental Protection Act 1986*. The purpose of this advice is to provide advice to the Minister for the Environment on environmental matters relating to the Concept Plan.

However, the commitments are included here as an indication of work to be undertaken at a later stage of assessment.

7.0 MANAGEMENT COMMITMENTS

7.1 INTRODUCTION

The categories of management commitments made in this review are:

- environmental management commitments made by LandCorp as a proponent relating to the planning of the Boodarie Resource Processing Estate and development of the industrial sites;
- environmental management commitments made by DRD as a proponent relating to the planning of the Boodarie Resource Processing Estate and development of the service corridors;
- environmental management commitments made by the Boodarie Resource Processing Estate Management Body relating to ongoing estate management; and
- other general (non-environmental) estate management commitments made by LandCorp and DRD.

7.2 ENVIRONMENTAL MANAGEMENT COMMITMENTS MADE BY LANDCORP AND/OR DRD

(i) LandCorp will prepare and finalise development guidelines to be applied within the industrial estate, prior to sale of the first allotment. In doing so, LandCorp will liaise with the relevant regulatory authorities (DEP and the Town of Port Hedland) to ensure the guidelines are consistent with their requirements and can be implemented, as appropriate, through their statutory processes.

(ii) LandCorp will finalise the legal and administrative arrangements for establishing the Boodarie Resource Processing Estate Management Body (comprising representatives of all landowners within the industrial estate) which will be established as a corporate entity specifically to assume certain ongoing operational responsibilities within the proposed industrial estate. The Management Body will be established before, or at the time of, issue of the first title for a new allotment. By way of covenants attached to the titles of all allotments within the industrial

estate, all landowners within the estate will become members of the Management Body upon purchase of their property and will be compelled to adhere to its rules and regulations. LandCorp will prepare articles of association for the Management Body to satisfy the requirements of all relevant regulatory authorities. Industry members of the Management Body will also be required, via covenants to their property titles, to make appropriate financial contributions to the cumulative impact monitoring programme for the estate.

(iii) LandCorp will finalise the ultimate design of the industrial estate in consultation with, and to the satisfaction of, the relevant regulatory authorities (DEP, Department of Planning and Urban Development and the Town of Port Hedland) before the commencement of any site development works. On-site buffers between industries will be established along all boundaries and over surface features within the industrial site. These buffers will be integrated into an overall landscape plan for the estate and their establishment will be part of the agreement for sale of the land.

(iv) LandCorp, as the proponent for development of the industrial estate infrastructure will, in consultation with DRD and the relevant servicing authorities, co-ordinate the infrastructure development (power, gas, telecommunications and water) for the site. LandCorp will, when commissioning contractors for on-site development work, emphasise the need for all facets of the physical construction and installation processes to be undertaken in an environmentally sensitive manner. Particular issues that will be stressed in this context include:

- minimising the direct and indirect disturbance of vegetation;
- limiting the extent of direct and indirect disturbance from earthworks;
- reshaping and otherwise treating areas affected by earthworks to interface with the surrounding landscape;
- re-establishing appropriate native vegetation on disturbed areas, where feasible;
- maintaining surface drainage features, where practicable; and
- restricting construction/installation activities to times when intrusion upon the human and natural environment is limited.

(v) During contract negotiations, LandCorp will also emphasise the need for direct liaison with the DEP, the Town of Port Hedland and other relevant State Government agencies to secure all requisite approvals and establish any particular requirements in advance of work being initiated. This will be achieved, where possible, by formally incorporating these objectives into contractual documentation for the required work.

(vi) LandCorp and DRD will require contractors to reuse materials excavated during site development works, where feasible.

(vii) LandCorp and DRD will be responsible for minimising impacts on fauna, vegetation and habitats during the construction stages of the respective sites and corridors. This is to be achieved by the staging of vegetation clearing operations and landform modifications (where possible), restricting vegetation clearance to development sites only, restricting access to known areas of fauna sensitivity and requiring construction-related traffic to be cleaned and inspected before coming onto the estate. The management plan to address these aspects will be prepared by LandCorp and DRD in consultation with, and to the satisfaction of, the DEP and Department of Conservation and Land Management.

(viii) LandCorp and DRD will require contractors to use air emission control equipment which is in compliance with the EPA guidelines for vehicle exhaust emissions.

(ix) LandCorp and DRD will require that dust contingency arrangements during the site development works conform with the guidelines set by the EPA. LandCorp and DRD will seek containment of dust generation during on-site development work by directing contractors to:

- minimise land clearing;
- promptly and progressively rehabilitate or stabilise disturbed surfaces;
- avoid unnecessary machinery movements; and
- damp down with water trucks or sprays as necessary.

Dust control plans will be developed by LandCorp and DRD in consultation with the DEP.

(x) Through contract documentation, LandCorp and DRD will require that:

- waste materials generated during construction activities will be contained and removed for off-site disposal or recycling at approved locations;
- any on-site servicing and refuelling of machinery and vehicles will be confined to designated areas, wherein drainage would be contained;
- any hydrocarbon contaminated soil will be removed from the servicing and refuelling area by contractors upon completion of the construction programme; and
- on-site disposal of solid (except clean material suitable for fill) and liquid wastes will not be undertaken during construction works.

(xi) LandCorp and DRD will, in consultation with the DEP and other relevant government agencies, design and implement an appropriate programme to monitor and manage cumulative environmental impacts of the estate development and operation. The programme will be designed and implemented to the satisfaction of DEP. Programme design and approval will be completed prior to the commencement of estate development works.

(xii) DRD will co-ordinate off-site development works for service corridors to minimise site disturbance.

7.3 ENVIRONMENTAL MANAGEMENT COMMITMENTS MADE BY THE MANAGEMENT BODY

(i) The Management Body will be responsible for the overall co-ordination of environmental management associated with the industrial estate for the life of the estate to the satisfaction of the DEP.

(ii) The Management Body will require compliance of industry/operators with all estate environmental management requirements through conditions stated in its articles of association.

(iii) Specific environmental monitoring activities to address cumulative impacts, that may arise as a consequence of developing the industrial estate, will be the responsibility of the Management Body. In all instances, the specific programmes will be designed, initiated and implemented in consultation with the relevant regulatory authorities.

(iv) LandCorp and, subsequently, the Management Body, will arrange for the control or removal of weeds, pests and diseases within the industrial estate, where possible, to the satisfaction of the Town of Port Hedland.

(v) LandCorp and, subsequently, the Management Body, will be responsible, if appropriate, for providing public warnings for:

- potential pedestrian hazards;
- occupational health and safety requirements;
- exposure to potentially hazardous materials/substances; and
- potential accidental hazards.

(vi) The Management Body will advise the regulatory authorities of any unforeseen event and of remedial action implemented in response to the event. The Management Body will respond to any unforeseen events in accordance with the environmental management plan for the estate and in consultation with and to the satisfaction of, the DEP and other relevant regulatory authorities. (Where environmental pollution problems result from individual industries, these industries will be required by DEP to take remedial action under the provision of the *Environmental Protection Act 1986).*

(vii) The Management Body will audit compliance (by individual operators) with development guidelines for the industrial estate and other requirements specified in its articles and report the audit findings to the EPA and other relevant regulatory authorities.

7.4 OTHER COMMITMENTS

(i) In consultation with the relevant authorities, LandCorp will prepare a zoning application for the Town of Port Hedland's District Town Planning Scheme, to zone the sites for the Boodarie Resource Processing Estate, including the associated off-site buffer zone.

(ii) Other development approvals required for the establishment of the estate will be sought by LandCorp, as appropriate, including seeking a development approval from the Town of Port Hedland for the industrial estate.

(iii) In the event that material of Aboriginal origin is exposed during on-site construction works, LandCorp and DRD will comply with requirements under the *Aboriginal Heritage Act 1972-1980.*

(iv) If additional archaeological evidence is revealed at any stage throughout the construction period, LandCorp and DRD will report these finds to the Department of Aboriginal Sites and proceed with works only if approval is granted under the *Aboriginal Heritage Act 1972-1980.*

Appendix 4

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