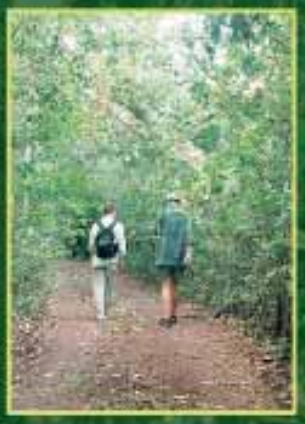
Rainforest to Reef just 40 km from Darwin



An assessment of the conservation values of the Gunn Peninsula/Vernon Islands area and the impacts of the proposed Glyde Point heavy industry and residential estate

April 2006

Australian Marine Conservation Society

The Environment Centre NT

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Rainforest to Reef
just 40 km from Darwin



An assessment of the conservation values of the Gunn Peninsula/Vernon Islands area and the impacts of the proposed Glyde Point heavy industry and residential estate

April 2006

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Preface

This report has been prepared for the Environment Centre of the Northern Territory (ECNT) and the Australian Marine Conservation Society (AMCS) as a guide to the published and known conservation values of the Gunn Peninsula/Vernon Island area north of Darwin, the impacts on those values from proposed heavy industry, and a brief analysis of future options for the area. Information has been compiled primarily through desktop analysis of published and unpublished literature. Expert advice has been sought where possible. Due to time and resource constraints this report must be considered as an important but not final statement of the conservation values of the area. This report aims to publicise the natural and cultural values at risk in current development plans, and to guide and focus efforts to consider more sustainable options conducive to the long term appreciation and protection of the values of the Vernon Islands and the Gunn Peninsula.

"The whole of the coast within the plan area is included in a broad land use unit designated in this plan as the Coastal Park…the inclusion of this new park in the Gunn Point Peninsula Land Use Structure Plan 1990 will provide a continuous link between these coastlands and other coastal resources relating to the Vernon Islands and Cape Hotham… the park includes elements which contribute significantly to the conservation, recreation, scientific and fisheries resources of the Darwin region."

(The Gunn Point Peninsula Coastal Park proposal, NT Department of Lands and Housing (DLH 1990b))

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The Poola Foundation (Tom Kantor Fund), Australian Conservation Foundation and The Wilderness Society for their financial support through the Northern Australian Small Grants Program. The Mullum Trust has also contributed substantially to ongoing efforts to highlight concerns regarding the future of the Gunn Peninsula/Vernon Islands region.

Thank you as well to the many people who provided generous input and valuable knowledge of the area for the purposes of this report.

The Environment Centre NT and the Australian Marine Conservation Society would especially like to thank Taegan Calnan for researching and compiling this important report.

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Executive Summary

Summary of Values and Threats

In 1990 the NT Department of Lands and Housing (DLH) proposed that the entire coastal region of Gunn Peninsula, from Adelaide River mouth around to Howard River mouth – and including Glyde Point, become a "Coastal Park" in recognition of its outstanding conservation values (DLH 1990b).

A little more than a decade later the same department, renamed as the Department of Infrastructure, Planning and Environment (DIPE), identified the Glyde Point coastal area as the preferred site for a major new fossil fuel-based heavy industry development including smelters, chemical factories, a new port and a residential subdivision at Murrumujuk Beach on Shoal Bay. This proposal is now undergoing a formal EIS process.

As a consequence of this development proposal ECNT and AMCS commissioned (via a Northern Australia Small Grants Program grant) a report to bring together existing knowledge of the area from a wide variety of sources.

This report serves three purposes. Firstly, it identifies and describes the natural and cultural values of the Gunn Peninsula/Vernon Island (GPVI) area – showing that it is of very high conservation value. Secondly, it identifies the potential impacts and key threats to these natural and cultural values that would result from the proposed large scale industrial development; and finally it commences a discussion as to how the natural and cultural values of the area can be protected and managed for the long term benefit of the NT community.

This preliminary assessment of the conservation values and status of the GPVI area has found the area to be of national and probably international conservation significance, containing species, ecological communities, landscapes, recreational destinations and cultural values worthy of secure protection and careful management.

The area is largely ecologically intact, with woodlands, sandy beaches, productive mangrove systems, rare rainforest communities, islands and coral reefs.

It contains:

- Over 40 sites of cultural and archaeological importance including the visually striking shell mounds of Hope Inlet;
- Over 50 species of flora and fauna that have been recognised in international agreements as warranting active protection;
- NT and nationally listed threatened species and migratory species;
- Important populations of dugong and turtles;
- Remnant threatened rainforest patches and *Callitris intratropica* communities;
- Mangrove communities, seagrass patches and reef systems providing habitat for a rich and diverse marine fauna;
- Significant coral structures and communities known as the 'blue holes'; and
- Natural features and landscapes, including the Vernon Islands, of outstanding scientific, recreational and conservation value.

The GPVI area has long been recognised as an area of great interest for its diverse natural, cultural and recreational values and due to its proximity to the NT population centre of Darwin.

The values of the GPVI area and the broader region – including the semi-enclosed Van Diemen Gulf region – are now under threat as a result of the NT government's proposed large scale heavy industry development at Glyde Point and associated residential and infrastructure corridors. This proposal would seriously impact many of the identified natural and cultural values of the area.

The project would destroy up to 4,000 ha (40km^2) of relatively pristine woodland, rainforest, and marine and mangrove habitat. In addition it would entail large scale dredging and ocean-infilling to create a new port and a 4.9 km long shipping access channel; two major infrastructure corridors over 100km in total length; a residential development for 16,000 people, including sewage outfall into Shoal Bay; substantial groundwater and surface water extraction; and marine and air pollution risks.

The industrial development would also risk air and sea pollution of the Van Diemen Gulf region, a marine and coastal environment which includes such nationally and internationally significant areas as Kakadu National Park, Garig Gunak Barlu (Cobourg) National Park and Marine Park, and the Tiwi Islands.

Key Findings of this Report

1. The GPVI area is of Territory and National conservation significance in its own right.
2. The GPVI area is likely to be of international conservation significance as an integral part of the larger Van Diemen Gulf and Darwin Coastal Bioregion environments including the Tiwi Islands, Garig Gunak Barlu (Cobourg) National Park and Marine Park; Adelaide River floodplain/Djukbinj National Park; and Kakadu National Park.
3. The NT Government (NTG) Draft Parks and Conservation Masterplan (NRETA 2005) identified the coastal environments immediately adjacent to Gunn Peninsula to be of international conservation significance, and the coastal environment from the Adelaide River mouth to Shoal Bay, including Glyde Point, to be of national conservation significance.
4. The GPVI area provides an outstanding opportunity for a major new conservation and sustainable tourism initiative for the Darwin region in partnership with the area's Traditional Owners.
5. Much of the area and its values remain little known or not studied.
6. Significant degradation of some features and values of the area is occurring due to a lack of management of fire, weeds, feral animals and recreational usage.
7. The NTG's proposed Glyde Point heavy industry and residential development on the Gunn Peninsula would have major and irreversible impacts on the ecosystems, environment and social and cultural values and uses of the region, including the marine and coastal environments of the semi-enclosed Van Diemen Gulf.
8. The rationale behind the proposed siting of polluting and hazardous heavy industry in a remote and relatively pristine coastal/marine environment prone to cyclones and other climatic extremes should be reconsidered. The area offshore from Glyde Point experiences very large tidal ranges and very strong currents.
9. There appear to be no satisfactory or transparent criteria for the selection of this location for heavy industry.
10. Native Title claims have been lodged over the area. The ongoing use of the area by the Larrakia, Tiwi and Wulna people for hunting, teaching and ceremonial purposes would be compromised by the placement of fossil fuel and chemical-based industries that involve large scale clearing, highly toxic materials and processes, and emissions over surrounding areas.
11. In addition to the impacts of large scale vegetation clearing, dredging and ocean infilling, the project would potentially expose underlying acid sulphate soils and change the hydrology of the surrounding area. The tidal flows and natural hydrology of Leaders Creek is likely to be altered substantially.
12. A number of important remnant rainforests on Gunn Peninsula, including Ginger Palmer's Jungle, are at risk of destruction or permanent degradation.
13. Heavy industry such as the proposed smelters and chemical plants at Glyde Point would use large quantities of fresh water and energy and use or emit hazardous chemicals and pollutants including ammonium, fluorine, chromium, lead, arsenic, dioxins, sulphur dioxide and nitrous oxide. These industrial processes and pollutants would entail significant impacts on, and risks to, the marine and terrestrial environments and surrounding communities.
14. A dredged channel of nearly 5 km in length is planned to access the low lying coastal site at Glyde Point. This would destroy the benthic habitat of the proposed channel and disposal sites, and create a shipping channel in an area of large tidal ranges, strong currents and coral reefs.

    A new port with potentially high levels of shipping usage poses significant risks to the marine environment from shipping accidents, oil spills and ballast water discharge (containing toxic materials or pests and diseases).
15. The proposed Murrumujuk Residential Development, catering for 16 000 people, is planned for a wide sandy beach facing Shoal Bay. The dunes behind the beach are of regional conservation significance, and the cultural sites that are scattered through the dunes are significant and registered with the Aboriginal Areas Protection Authority.

16. There is insufficient groundwater in the area for a permanent population of the size proposed, and no alternative water source has yet been identified.
17. The proposed release of sewage from the residential estate into the Shoal Bay marine environment would affect the health of the marine life and amenity in the area.
18. The two major infrastructure corridors associated with the proposed Glyde Point industrial estate would result in extensive clearing of native vegetation, including within gazetted conservation reserves, and would traverse seasonally inundated floodplains.

Recommendations

1. That the Northern Territory government (NTG) halt the current incomplete Glyde Point Environmental Impact Assessment process and withdraw plans for the Glyde Point industrial estate and residential development.
2. That the NTG establish an independent inquiry to:
   - further investigate and report on the natural and cultural values of the Gunn Peninsula/ Vernon Islands area, including its significance as part of the Van Diemen Gulf marine and coastal environment and Darwin Coastal Bioregion;
   - assess the benefits to the community of protecting (and where necessary restoring) the ecosystems and landscapes of the area, including sustainable tourism opportunities and 'ecosystem services' benefits such as fish habitat;
   - further examine the relative merits and benefits of a range of possible reservation, management, and sustainable economic activity options for the area (e.g. Indigenous Protected Area/Marine Park status combined with eco- and cultural tourism);
   - examine alternative sites for appropriate industrial (and residential) development away from sensitive and pristine coastal environments and based on appropriate, best practice, and transparent site selection criteria.
3. That the NTG address as a matter of urgency the conservation and Indigenous concerns in the area, including protection of threatened areas of high conservation value such as Callitris and rainforest communities; resolution of land claims; and support for the traditional custodians to protect and manage sites of cultural significance.
4. That in order to facilitate much needed and appropriate conservation management of the Gunn Peninsula area, and pending any final decision on the future ownership and management of the area (which must be negotiated with the Indigenous Traditional Owners), tenure/vesting of the area should be transferred from the NT Land Corporation to a body dedicated to and capable of conservation management.

Acronyms

AAPA – *Aboriginal Areas Protection Authority*
DLPE – *Department of Lands Planning and Environment*
NRETA – *Department of Natural Resources, Environment and the Arts*
CCNT – *Conservation Commission of the Northern Territory*
PWCNT – *Parks and Wildlife Commission of the Northern Territory*
OEH – *Office of Environment and Heritage (now–"Environment Protection Agency")*
NTG – *Northern Territory government*
CAMBA – *Chinese and Australian Migratory Bird Agreement*
IUCN – *International Union for the Conservation of Nature*
BONN – *Convention of the Conservation of Migratory Species of Wild Animals*
CITES – *Convention on International Trade in Endangered Species*
JAMBA – *Japanese and Australian Migratory Bird Agreement*
DIPE – *Department of Infrastructure Planning and Environment (now "Department of Planning and Infrastructure")*

1.0 Aims of report

The aims of this report are to:

- Document the natural and cultural conservation values of the Gunn Peninsula/Vernon Island area based on available knowledge and literature;
- Highlight the potential impacts of an industrial estate on the values of the area; and
- Explore alternative options for the future of the Gunn Peninsula/Vernon Islands area.

2.0 Geographic Scope

For the purposes of this report the study area refers to the Gunn Peninsula/Vernon Islands (GPVI) area and the adjacent marine environment and includes the entire western side of the peninsula, from Gunn Point to Hope Inlet.

The Vernon Islands are immediately north of the peninsula, bridging the waters between the mainland and the Tiwi Islands. The northern coast of the peninsula has a series of Points, including Gunn, Fright and Glyde Point. Leaders Creek drains to the eastern side of the Peninsula, between Glyde Point and Point Stephens. To the south of Point Stephens lies Saltwater Arm, which is part of the mouth of the Adelaide River. The Tree Point and Shoal Bay Conservation Reserves are at the base of Shoal Bay.

Within the study area locations of particular focus are Glyde Point, Vernon Islands, Murrumujuk Beach, Hope Inlet, the blue holes and Leaders Creek (See Figure 1).

The tip of Gunn Peninsula lies forty kilometres north-east of Darwin. It is Larrakia land, with acknowledged Wulna and Tiwi interest in the area. The Vernon Islands lie to the north with an extensive reef complex surrounding them. The Larrakia and Tiwi people use this area for hunting purposes (D. Jackson, pers.comm. 2005; J. Hicks, pers.comm. 2005). The Wulna people speak for the country south of the peninsula along the Adelaide River floodplains (G. Kenyon, pers.comm. 2005).

On a larger scale but within a 50km radius, the study site sits within an ecologically diverse region. This region includes Cape Hotham to the east, Adelaide River Delta on the south-east, the Tiwi Islands (Melville Is) to the north, and Shoal Bay within Beagle Gulf to the west. All areas are rich in natural and cultural values and all are connected to the study site through natural corridors and marine and landscape processes.

The NTG, through the NT Land Corporation,

Figure 1: Significant Sites and Proposed Development on Gunn Peninsula

3.0 Tenure and Land Use

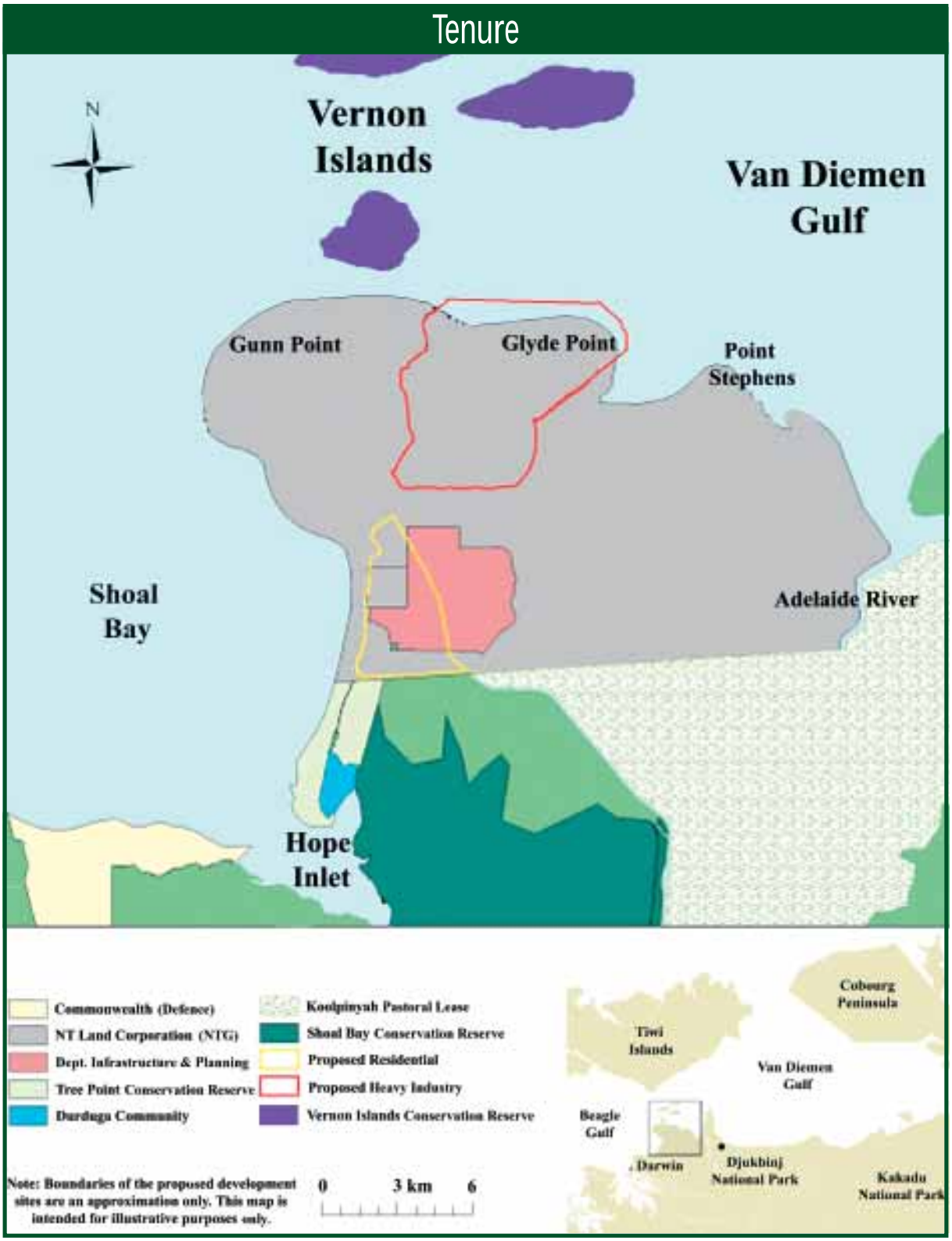


Figure 2: Tenure map of Gunn Peninsula and surrounding area

currently owns the Gunn Peninsula land that is the subject of this report (NT Portion 2626).

The Northern Territory Land Corporation was issued Crown Lease Perpetual No. 311 over NT Portion 2626 in 1984 (KBR 2003a) (See Figure 2 – Tenure). The Department of Planning and Infrastructure manages the vacant crown land of Portion 2727, the former Gunn Point Prison Farm. The Northern Territory Land Corporation currently subleases an area of approximately 2 ha, located to the south of Leaders Creek adjacent to the boat ramp, which is known as the Leaders Creek Fishing Base.

Several mostly small conservation reserves exist in close proximity to the study area:

- The Vernon Islands are a conservation reserve to the low water mark;
- On the Adelaide River to the east is Djukbinj National Park;
- To the south at the mouth of the Howard River are the Shoal Bay and the Tree Point Conservation Reserves, protecting the habitat of many migratory birds;
- Mallacca Swamp is a nature reserve established to protect the estuarine crocodile population (*Crocodylus porosus*). Extensive studies have been undertaken on the crocodile population in this reserve located along the Adelaide River (Webb et al. 1994; Webb et al. 1991; Webb et al. 1989; Webb et al. 1983);
- To the south of the peninsula are the Lambell's Lagoon, Black Jungle, and Howard River Nature Reserves.

Conservation reserves in the southern part of the GPVI area represent a series of rich monsoon rainforest communities and permanent wetlands that support many species of plants and animals. Extensive scientific studies in the rainforest and savanna communities on the Gunn Peninsula have been undertaken in the past decade (Price et al. 1998).

The Gunn Peninsula has been used by Larrakia people for hunting, teaching and ceremonial purposes both pre- and post-European contact. There are numerous registered sacred sites and three native title claims are currently active over the Peninsula, as well as a fourth native title claim that is active over the Vernon Islands. The Larrakia acknowledge that the neighbouring Tiwi and Wulna people also have customary use of the area. The Tiwi have both sacred sites and an ongoing presence at the Tree Point (Durduga) Community on the Peninsula. Wulna people continue to use the areas around the Adelaide River floodplains for hunting, teaching and ceremonial purposes (G. Kenyon, pers.comm. 2005; D. Jackson, pers.comm. 2005).

Plants, animals and the physical features within the landscape are all part of Aboriginal cultural heritage. Some sites that are significant to Aboriginal people may not contain physical evidence of past use or occupation. Therefore, although several surveys for cultural heritage have been conducted, and the Aboriginal Areas Protection Authority has numerous sites listed, these should not be presumed to be comprehensive. A systematic survey together with an oral history would enable fuller appreciation of the history of Aboriginal use on Gunn Peninsula and its significance to contemporary Aboriginal people (D. Jackson, pers.comm. 2005).

A relatively large number of Aboriginal midden sites along with surface scatters of stone artefacts have been recorded. Some exposed midden sites are currently subject to erosion due to uncontrolled pedestrian access and natural shoreline erosion (Sinclair Knight and Mertz 2004).

It is believed that the once extensive *Callitris* pine forests that covered the Peninsula were used in the building of the settlement of Palmerston (now Darwin) (CCNT 1982). A number of miscellaneous and agricultural leases were taken out over the Peninsula during the1800's and early 1900's, all of which failed.

Grazing was the primary non-indigenous land use across the Peninsula from around 1907 until 1969 when the northern section of the Koolpinyah pastoral lease was reclaimed by government (KBR 2003a).

A prison farm was based here from 1972 until 1995. Forestry and horticulture were failed ventures in the region.

Currently, Darwin region residents use the Gunn Peninsula for recreational fishing and informal camping, as well as traditional hunting and teaching. Figures are not available on the numbers of people that access the area on an annual basis, however in 2004 from Leaders Creek Fishing Base alone over 2,500 boats, with an average of three people on each, went fishing in the area (D. Edwards, pers.comm. 2005). It is likely this figure is only a fraction of the number of people accessing the Gunn Peninsula and Vernon Islands for recreational fishing, camping and traditional uses.

4.0 Physical characteristics

4.1 Climate

The Gunn Peninsula experiences the same monsoonal climate as the Darwin Region. The wet season commences approximately in October and continues usually until April. Some 85% of annual rainfall occurs between December and March. The mean annual rainfall is 1614mm. Temperatures are highest in November and December when the mean maximum is 34°C and the mean minimum is 27°C. The coolest month is July when the mean maximum is 30°C and mean minimum is 19°C (KBR 2003a).

4.2 Hydrology

On the Gunn Peninsula the ground water is naturally saline therefore there is limited fresh water for extraction. The major watercourses of the study area are Leaders Creek and the Howard River. Leaders Creek is a permanent, tidally influenced creek that drains extensive mangrove and salt flats to the southeast of Glyde Point. Surface water from Glyde Point generally drains to the southeast towards Leaders Creek (KBR 2003b).

Very large tidal ranges and very strong currents are characteristics of the channel between the Tiwi Islands and the Gunn Peninsula. Astronomical tidal range at Glyde Point is 5.64 m. Mean neap range is 1.53 m and mean spring range is 3.90m. The tides at Glyde Point are somewhat unusual compared to Darwin Harbour in that slack water generally occurs well after the high and low water. Tidal currents are high, exceeding 4 knots during spring tides (KBR 2003b).

4.3 Geomorphology

The entire peninsula is low lying, not rising beyond 45 metres above sea level. Significant geomorphologic features of the study area include the Vernon Islands and the coastal chenier dune systems that occur along the coastline at Gunn, Fright and Glyde Points and Point Stephens, which are of regional significance and educational and scientific value (CCNT nd.). These rare dunes are formed parallel to the shore and are made of deposited materials overlying estuarine mud (NSWNPWS 2004). The intertidal flats and saltmarshes, such as those found at the base of Shoal Bay and the rocky reefs that are a topographic feature of the ocean floor off the Peninsula, have also been recognized for their significance in a regional context (CCNT nd.).

5.0 Key natural and cultural values

Diverse habitats and communities exist throughout the study area. Rainforest patches harbour rare orchids, woodlands support at least one breeding pair of a nationally listed endangered raptor (Red goshawk) and the coral reefs offshore are home to a wide variety of marine life – the diversity of which has never been comprehensively documented.

This section examines the key conservation values of the GPVI area as we move from the rainforest to the reefs. Firstly, the biodiversity values of major ecological communities will be identified, including remnant rainforest patches, savanna woodland and wetlands, mangroves, tidal and coastal habitat (eg seagrass) and coral reefs. Secondly, species of conservation significance are identified, with particular reference to IUCN-listed Dugong, the recently discovered Howard River Toadlet, the threatened Red Goshawk and "near threatened" bladderworts. Thirdly, particular locations of significance will be highlighted such as the Vernon Islands and Ginger Palmer's Jungle. This will also include archaeological sites of significance such as the Hope Inlet shell mounds.

5.1 Biodiversity

"A number of areas on Gunn Point Peninsula are considered to be of Territory wide conservation significance. The Peninsula is botanically rich. There is considerable diversity of plant life not found elsewhere close to Darwin…The Peninsula is also relatively abundant in habitats of rare or endangered species of plants and animals. These habitats are of intrinsic value for conservation and for scientific and educational purposes. Disturbance to these areas should be avoided."

(NT Department of Lands and Housing; DLH 1990b)

Australia has been divided up into bioregions for the purposes of ensuring a nation-wide 'comprehensive, adequate and representative' (CAR) protected area system (NRETA 2005b). The Northern Territory has been divided into 20 bioregions and Gunn Peninsula lies in the Darwin Coastal bioregion which extends roughly 100 km inland near the mouth of the Victoria River to just west of the Cobourg Peninsula (NRETA 2005b). This bioregion, much of which has been recognised as being of international conservation significance (NRETA 2005b), harbours rich wetlands, extensive mangrove forests and estuaries and a large proportion of the Northern Territory's rainforest patches.

5.1.1 Major Communities

The major communities present on the peninsula are briefly described below. The tables within the report list species found in the proposed development area that have a restricted range or are particularly vulnerable to the changes that would occur should the industrialisation and subsequent urbanisation of the Peninsula proceed (See Tables 1 & 2).

"Reduction in the available area of habitats that are of naturally small size…(e.g. rainforests, riparian vegetation, billabongs) is likely to result in disproportionate declines in the abundance of species at the regional level, including species that may predominantly use other habitats."

(GHD 2005)

Rainforests

Four significant unprotected monsoon forests have been identified on the Gunn Peninsula: at Point Stephens; 'Ginger Palmers Jungle' near Glyde Pt; Leaders Creek; and along the north west escarpment of Gunn Point (CCNT nd.). Research indicates these patches have high rates of endemism and may represent Gondwanan relicts (Bach and Price 2000; Shapcott 1999).

Rainforests in the Northern Territory support a diverse range of species, both plant and animal. They are highly valued ecologically because the proportion of species that depend on the rainforests is much greater than the proportion of the landscape the rainforests occupy (Price et al.1998). Rainforests support fruit eaters such as birds and bats that in turn disperse seeds and maintain viable rainforest plant populations over large areas, frequently with long distances between rainforest patches (Palmer 1999).

Guidelines for maintaining rainforests in the Top End

1. **Maintain all existing rainforest patches**
2. **Maintain the vegetation within 500 m of each patch.**
3. **Maintain considerable areas of all habitats that provide significant flower resources.**
4. **Protect all known Black Flying-fox roost sites.**
5. **Never destroy a *Ficus virens* tree.**
6. **Manage feral animals, fire and weeds.**

Management conclusions from the Environment Australia/PWCNT study of the rainforest patches on the Gunn Peninsula (Bach and Price, 2000).

The Darwin Coastal bioregion has 205 rainforest patches, of varying sizes and composition (NRETA 2005b). Research shows that the ecological integrity of each rainforest patch is dependent on the other rainforest patches in the regional network as well as other adjacent vegetation communities (Price et al. 1998). As well as clearing for development, major threats to rainforests are fire and invasive species (PWCNT 2005).

There is great diversity in the rainforest patches along the northwest escarpment of Gunn Point – 178 species of plant have been recorded in the rainforest patches along the coastal fringe. A high proportion of all species identified in the western escarpment of Gunn Point are endemic to Australia (Price et al. 1998), and 29 species have fewer than 50 records for the NT (See Table 2). Many of the patches on Gunn Point are floristically diverse, with one small patch along the north western coastline having 98 plant species recorded, being in the top 2 % of NT rainforest for species richness (Price et al. 1998).

The Point Stephens rainforest patch is considered to be regionally significant, with 46 plant species identified. It is 348 ha in size, and is the second largest patch in Litchfield Shire (Price et al. 1998).

The orchid *Malaxis marsupichila* has been found only once (in 1984) in the Northern Territory (PWCNT 2002) in one of the rainforest patches on Gunn Point. The new plant species *Terminalia D20544*, which is poorly known throughout Australia, was located in the Point Stephens rainforest.

Savanna woodland and wetlands

The eucalypt woodland that dominates the inland of Gunn Peninsula is part of the northern Australian tropical savannas, the most extensive area of largely intact eucalypt habitat in the world (Woinarski et al. 2000b). The woollybutt (*Eucalyptus miniata*) and ironbark (*E. tetradonta*) woodland provides an essential supplementary food source for rainforest fruit eating birds and bats during the dry season (Price et al. 2005), as well as a range of finches, parrots and pigeons that forage on the abundant seeding grasses in the savanna (Franklin 1999).

A number of temporary wetlands occur on the Gunn Peninsula. These support *Melaleuca* stands/thickets, which in turn support rainforest bats and birds and a variety of other wildlife when in flower (Bach and Price 2000). The wetlands are also stopover points for many migratory birds.

The forests support some of the largest eucalyptus trees on the mainland of the Northern Territory, comparable only to the Tiwi Islands and North East Arnhem Land. These forests are the closest in the Northern Territory to the South Eastern Australian eucalypt forests that are particularly valuable for forest dependant species such as hollow nesting mammals and birds.

There are significant stands on the Gunn Peninsula of the native cypress pine – *Callitris intratropica* – that is declining across the NT due to its fire sensitivity.

The Gunn Peninsula has suffered declines in mammal numbers similar to those observed across the Top End coastal region, which is yet to be conclusively explained (Armstrong et al. 2002; Woinarski 2000; Price et al. 2005). Of the 25 mammal species identified in the area during surveys, there are six species that are classified as 'threatened' or 'near threatened' status (See Table 1).

Mangroves

Mangrove forests are one of the world's most threatened tropical ecosystems with global loss exceeding 35% (Mumby et al. 2004). Mangrove forests on the northern coast of Australia are extensive and vital to the health of the ocean and fisheries. The benefits of mangroves extend beyond the boundaries of the ecosystem itself – fuelling the food chain into neighbouring ecosystems as well (DEH 2001).

Mangrove communities represent a unique and significant ecosystem and are critical to many fish and crustacean species during some stage of their life cycle. Mangroves play a crucial role in maintaining biodiversity as many marine and terrestrial fauna are dependent on them. They are one of the most productive natural systems in the world. The destruction of mangroves consequently leads to a lower productivity of marine life, including fish, and deterioration of water quality (DEH 2001). Mangroves also protect the coastal zone through acting as a buffer against cyclones, storm surges, flooding and coastal erosion (DEH 2001).

Mangroves fringe the coastline from Gunn Point to Point Stephens and also encircle South West Vernon Island. Twenty nine mangrove species are found in the study area (Brocklehurst 1996). Leaders Creek has the most substantial mangrove forests between the Adelaide and Howard River deltas. The fieldwork necessary to identify the communities and their relative abundance in the region was recommended 10 years ago (Brocklehurst 1996) but has not yet been done.

The close proximity of coral reefs and mangroves found at the north west tip of Gunn Peninsula is likely to enhance the biodiversity of the marine life in the area. Studies elsewhere have shown that the connectivity between coral reefs and mangroves greatly enhance the presence of reef fishes. The most likely explanation for mangroves enhancing the fish biomass on nearby reefs is through provision of a refuge from predators and plentiful food that increases the survival of juveniles (Mumby et al. 2004).

As well as fish nurseries, mangrove forests harbour a variety of traditional food species, including rays, crustaceans and mollusks, which continue to be harvested by the Larrakia people (D.Jackson, pers.comm. 2005). These forests provide roosting sites for flying foxes and rich foraging for many bird species in the area. Mangroves also improve water quality through filtering and provide coastal stabilization (NOO 2002).

Reefs

Coral reefs are exceptionally diverse marine ecosystems. Globally, reefs are continuing to decline – approximately 25% of the world's reefs have been lost (DEH 2001). The reefs of the Northern Territory are little known, although surveys conducted along the Arnhem Land coast found extensive coral communities linking the eastern and western Australian coastal coral communities (Veron 2004). There is only one marine park in the Northern Territory where these reefs are protected and managed - Garig Gunak Barlu National Park. (Miller and Sweatman 2004).

There is very little data on what flora, fauna or reef communities live in the waters surrounding the Vernon Islands, however it is generally accepted that the area is a highly significant marine community, with special habitats and higher species diversity than surrounding areas (R. Willan, pers.comm, 2005; N. Smit, pers.comm. 2005).

The anemone fish (*Amphiprion spp.*) is found on the Vernon Island's coral reefs and is endemic to the Northern Territory (CCNT nd.). Hawksbill turtles, Green turtles, dugongs and a number of cetaceans are seen regularly in the area (Whiting 2004; C. Makepeace, pers.comm. 2005), and the draft Parks Masterplan identifies the coastline of the Gunn Peninsula as an important turtle nesting area (NRETA 2005b).

The number of corals and molluscs have been noted to be higher in the Vernon Islands area than Darwin Harbour, and more similar to the reefs found in the Garig Gunak Barlu National Park (R. Willan, pers.comm. 2005). The South West Vernon Island reef slopes support up to 75% cover of hard corals, which is rare in near shore northern coastal waters (CCNT nd.).

Surveys conducted by CCNT indicate that the coral reef communities that lie off Gunn Point are the southern ends of a coral reef complex extending north through the Vernon Islands to the southern shores of Melville Island (CCNT nd.). Given the recreational fishing enthusiasm for the area (D. Edwards, pers.comm. 2005), the lack of scientific knowledge of local marine ecosystems, and the proposal for heavy industry in the area, research on the Vernon islands marine environment should be a high priority.

Littoral (coastal/tidal) environment

The GPVI area littoral marine environment includes a rich reef system surrounding the Vernon Islands, rocky shelves and stacks, seagrass and algal beds and the mangal forests fringing the coastline, and the estuary of Leaders Creek. This productive area is a popular fishing and hunting destination for Larrakia, Tiwi, other Indigenous people and fishers from Darwin and beyond. Turtles and dugongs are frequently sited in the area.

Rock shelf habitat adjoins the mangrove islet at Glyde Point and the rock stacks off Point Stephens. These rock habitats typically support clusters of rock oyster (*Saccostrea cucullata*) and barnacles (*Chthalamus cf. malayensis*). Small colonies of hard corals are present in rock pools on top of the rock shelf. The intertidal pavement extends seaward from the mangrove fringe from Gunn Point through to Glyde Point (URS 2003). The pavement areas that form Points along the coastline also exhibit hard coral patches (KBR 2003b).

The embayments between the Gunn and Glyde Points consist of mudflat. Intertidal mudflats are ecologically important in areas where tidal range is high (KBR 2003b). Little research has been conducted in Australia, however the limited work done suggests that mudflats are a valuable feeding and breeding site for migratory birds, and are a diverse habitat in their own right (DEH, 2001; Noske 1996).

Extending northwards from Glyde Point beyond the tidal zone, the sea floor consists of rock pavement where turbidity levels are high due to strong currents. The epibenthic communities are dominated by filter-feeders (sponges, gorgonians, ascidians, etc) with some soft corals, bryozoans and echinoderms (pencil urchins, sea stars, feather stars) (URS 2003).

Seagrasses are also found in the intertidal zone. They are important for stabilizing coastal sediments, providing food and shelter for a range of organisms, acting as a nursery ground for shrimp and fish and for nutrient trapping and recycling (Coles et al. 2004). Seagrass play an important role as habitats for endangered species and commercial fisheries. Once removed, seagrass recovery is not assured (DEH 2001), making the prevention of damage to seagrass critical.

Australian seagrass species are generally well documented elsewhere in Australia, but are poorly known in the northern tropical region (Coles et al. 2004). Seagrass patches have been observed along the mainland in the Vernon Islands area (N.Smit, pers.comm. 2005), however they are small isolated patches consisting of species of *Halophilus ovalis*, *Halodule uninervis.*and *Enhalus acoroides* (N. Smit pers. comm. 2005). This data is comparable to a recent seagrass survey conducted for the coastal intertidal waters of Kakadu National Park (Roelofs, Coles and Smit 2005).

The dependence of dugongs on seagrass has been recognised for some time. However in a radio tracking study of dugongs around the Vernon Islands and Darwin Harbour it was found that dugongs spent a considerable amount of time on intertidal rocky reefs. The study concludes that algal growth on reefs around Darwin may be an essential food source for dugongs, as well as seagrass beds (Whiting 2004). The importance of protecting and attempting to understand the intertidal zone should be of high priority, given the destruction that occurs in these areas when land is reclaimed or dredging is undertaken. The fragile networks of dependence may extend to fauna that would in turn disappear with the intertidal zone.

5.1.2 Fauna species of conservation significance

Fauna species of conservation significance in the Glyde Point area (listed under NT or Commonwealth legislation and believed to be in this location (see Table 1):

- Over 60 fauna species of conservation concern, including threatened species, migratory species and marine turtles and mammals.
- 5 Endangered species.
- 10 Vulnerable species.
- 2 Near Threatened species.
- 15 Migratory species.

The IUCN listed critically endangered Hawksbill turtle is found in the waters adjacent to Glyde Point (KBR, 2003a).

"The peninsula contains one of a very few relatively undisturbed roosting sites for wading birds. It is a resource of national significance." (DLH 1990b)

There are forty species of migratory bird that use the habitat along the proposed service corridor, and thirty migratory bird species that intermittently use the Glyde Point site (KBR 2003a). Those species that have a conservation status (Territory, national or international) such as "data deficient" or "not evaluated" are not sufficiently known to assume the well being of the population in the face of dramatic changes to habitat.

Animals that are denoted as "near threatened" or "vulnerable" have had available data assessed, and active management or protection of that species and its habitat is required in order to ensure an ongoing healthy population. From the many fauna species listed in Table 1, three examples of vulnerable species in the area are expanded upon below. For a full species list see the Glyde Point Development Project Notice of Intent (KBR 2003a).

Dugong

The dugong (*Dugong dugong*), or sea cow, is a large herbivorous marine mammal that has a range extending from east Africa to Vanuatu (Whiting 2004). It is the only living member of the family Dugongidae. A significant proportion of the world's remaining dugong population is found in northern Australian waters (NRETA 2005f). Internationally, its status is vulnerable to extinction while in the NT it is listed as near threatened.

Threats to dugongs in this region include habitat destruction from the unknown impacts on seagrass beds from trawling and the clearing of fringing mangroves, boat strike and human activity (Whiting 2004). The dugong is fully protected from commercial use under state, Territory and national legislation (NRETA 2005f).

Howard River Toadlet

A new species of frog has been identified in the Howard River region in 2005 (Howard River Toadlet, *Uperoleia* Grey, Young, 2005) less than fifty kilometres from Darwin. The proposed access corridor from Glyde Point to Middle Arm dissects the Howard River floodplain where this toad was located (Price et al. 2005).

"the proximity…(of the toadlet)…to Darwin highlights the current inadequate state of knowledge of the northern Australian frog fauna"

(Young 2005; author of new species found 30 km from Darwin).

Red Goshawk

This secretive raptor is a powerful bird of prey that feeds on birds and reptiles. A red goshawk nest is located on the Gunn Peninsula (GHD 2005) with the territory size of each breeding pair being about 150 km^2 (Garnett and Crowley 2000). There are only 350 pairs of this bird thought to be remaining in Australia – population contractions in eastern Australia are linked to land clearing and perhaps fire (Garnett and Crowley 2000). They are vulnerable to bird poachers however their inaccessibility and difficult to reach nests are factors in their protection (Goodfellow 2005).

Table 1: Significant* fauna species in the Gunn Peninsula region		
Taxonomic Group	Species	Status
Mammals	Northern Quoll (*Dasyurus hallucatus*)	Vulnerable (NT); Near Threatened (IUCN)
	Black footed tree rat (*Membriomys gouldii*)	Near Threatened (IUCN)
	Pale Field Rat (*Rattyus tunneyi*)	Near Threatened (IUCN)
	Delicate Mouse (*Pseudomys deliculatus*)	Near Threatened (IUCN)
	Common Planigale (*Planigale maculata*)	Data Deficient (IUCN)
	Common Bent wing Bat (*Miniopterus schreibersii*)	Near Threatened (IUCN)
	Yellowbellied Sheathtailed Bat (*Saccolaimus flaviventris*)	Near Threatened (IUCN)
	Irrawaddy Dolphin (*Orcaella brevirostris*)	Data Deficient (IUCN)
	Dugong (*Dugong dugong*)	CITES and CMS
	Indo-Pacific Hump-backed Dolphin (*Sousa sinensis*)	Data Deficient (IUCN)
Birds	Eastern Curlew (*Numenius minutus*)	Near Threatened (IUCN); CAMBA; JAMBA; BONN
	Black necked Stork (*Ephippiorhynchus asiaticus*)	Near Threatened (IUCN)
	Australian Bustard (*Ardeotis australis*)	Vulnerable (NT)
	Red Goshawk (*Erythriotiochis radiatus*)	Vulnerable (NT & National & IUCN)
	Bush Stone Curlew (*Burhinus grallarius*)	Near Threatened (IUCN)
	Asian Dowithcher (*Limnodromus semipalmatus*)	Near Threatened (IUCN)
	Australian Spotted Crake (*Pozanus fluminea*)	Data deficient (NT)
	Wood Sandpiper (*Tringa glareola*)	Data deficient (NT); CAMBA; JAMBA; BONN
	White Bellied Sea Eagle (*Haliaeetus leucogaster*)	CAMBA
	Fork-tailed Swift (*Apus pacificus*)	CAMBA; JAMBA
	Great Egret (*Ardea alba*)	CAMBA; JAMBA
	Cattle Egret (*Ardea ibis*)	CAMBA; JAMBA
	Eastern Reef Egret (*Egretta sacra*)	CAMBA
	Black Bittern (*Ixobrychus flavicolis*)	Data Deficient (NT)
	Beach Stone Curlew (*Esacus neglectus*)	Near Threatened (IUCN)
	Greater Sand Plover (*Charadrius leschenaultii*)	CAMBA; JAMBA; BONN
	Lesser Sand Plover (*Charadrius mongolis*)	CAMBA; JAMBA; BONN
	Grey Plover (*Pluvialis squatarola*)	CAMBA; JAMBA; BONN
	Pacific Golden Plover (*Pluvialis fulva*)	CAMBA; JAMBA
	Oriental Plover (*Charadrius veredus*)	JAMBA
	Restless Flycatcher (*Miagra inquieta*)	BONN
	Leaden Flycatcher (*Miagra rubecula*)	BONN
	Oriental Cuckoo (*Cuculus saturatus*)	CAMBA; JAMBA
	Oriental Pratincole (*Glareola maldivarum*)	CAMBA; JAMBA
	White winged Black Tern (*Chlidonias leucopterus*)	CAMBA; JAMBA
	Little Tern (*Sterna albifrons*)	CAMBA; JAMBA
	Lesser Crested Tern (*Sterna bengalensis*)	CAMBA
	Caspian Tern (*Sterna caspia*)	CAMBA; JAMBA
	Rainbow Bee Eater (*Merops ornatus*)	JAMBA
	Common Sandpiper (*Actitis hypoleucas*)	CAMBA; JAMBA; BONN
	Ruddy Turnstone (*Arenaria interpres*)	CAMBA; JAMBA; BONN
	Sharp Tailed Sandpiper (*Calidris acuminata*)	CAMBA; JAMBA; BONN
	Red Knot (*Calidris canutus*)	CAMBA; JAMBA; BONN
	Curlew Sandpiper (*Calidris ferruginea*)	CAMBA; JAMBA; BONN
	Red Necked Stint (*Calidris ruficolis*)	CAMBA; JAMBA; BONN
	Great Knot (*Calidris tenuirostris*)	CAMBA; JAMBA; BONN

Table 1: Significant* fauna species in the Gunn Peninsula region *continued…*

Taxonomic Group	Species	Status
Birds	Grey Tailed Tattler (*Heteroscelus brevipes*)	CAMBA; JAMBA; BONN
	Bar Tailed Godwit (*Limosa lapponica*)	CAMBA; JAMBA; BONN
	Black Tailed Godwit (*Limosa limosa*)	CAMBA; JAMBA; BONN
	Little Curlew (*Numenius madagascariensis*)	CAMBA; JAMBA; BONN
	Whimbrel (*Numenius minutus*)	CAMBA; JAMBA; BONN
	Common Greenshank (*Tringa nebularia*)	CAMBA; JAMBA; BONN
	March Sandpiper (*Tringa stagnatalis*)	CAMBA; JAMBA; BONN
	Terek Sandpiper (*Xenus cinereus*)	CAMBA; JAMBA; BONN
	Brown Booby (*Sula leucogaster*)	CAMBA; JAMBA
	Sanderling (*Calidris alba*)	CAMBA; JAMBA
	Lathams Snipe (*Gallinago hardwickii*)	Data Deficient (NT) CAMBA; JAMBA
	Swinhoes Snipe (*Gallinago megala*)	Data Deficient (NT) CAMBA; JAMBA
	Glossy Ibis (*Plegadis falcinellus*)	CAMBA
Frogs	Giant Frog (*Cyclorana australis*)	Data Deficient (NT)
	Ornate Burrowing Frog (*Limnodynastes ornatus*)	Data Deficient (NT)
Reptiles	Green Turtle (*Chelonia mydas*)	Vulnerable (National/EPBC)
	Hawksbill Turtle (*Eretmochelys imbricata*)	Critically Endangered (IUCN); Vulnerable (National/EPBC); Data Deficient (NT)
	Sea Snakes (*Hydrophiidae and Laticaudidae*)	Protected (National/EPBC)
	Estuarine crocodile (*Crocodylus porosus*)	Protected (National/EPBC); BONN
	Howard River Toadlet (*Uperoleia Grey*)	Data Deficient
	Mangrove Monitor (*Varanus indicus*)	Data Deficient (NT) CITES
	Macleays Water Snake (*Enhydris polylepis*)	Data Deficient (NT)
	Black Whip Snake (*Demansia atra*)	Data Deficient (NT)
	Olive Whip Snake (*Demansia olivacea*)	Data Deficient (NT)
	Papuan Whip Snake (*Demansia papuensis*)	Data Deficient (NT)
	Collared Whip Snake (*Demansia torquata*)	Data Deficient (NT)
	Taipan (*Oxyuranus scutellatus*)	Data Deficient (NT)
	King Brown (*Pseudechis australis*)	Data Deficient (NT)
	Western Brown Snake (*Pseudonaja nuchalis*)	Data Deficient (NT)
	Northern Small Eyed Snake (*Rhinoplocephalus pallidiceps*)	Data Deficient (NT)
	Northern Bandy Bandy (*Vernicella multifasciata*)	Data Deficient (NT)
	Common Blue Tongue Lizard (*Tiliqua scincoides*)	Data Deficient (NT)
	Mertens Water Monitor (*Varanus mertensi*)	Data Deficient (NT) CITES
	Spotted Tree Monitor (*Varanus scalaris*)	Data Deficient (NT) CITES
	Varanus primordius	Data Deficient (NT) CITES

(Species lists are collated from the database of NTPWS November 2005; KBR 2003a and marine animals – URS 2003).

* 'Significant' – is defined as those species in need of active management or protection as recognized in one or more of the following agreements and treaties.

CAMBA = China-Australia Migratory Bird Agreement (CAMBA 1986)
JAMBA = Japan-Australia Migratory Bird Agreement (JAMBA 1974)
BONN = Convention of the Conservation of Migratory Species of Wild Animals (Bonn Convention 1979)
CITES = Convention on International Trade in Endangered Species
EPBC = Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
IUCN = World Conservation Union Red List

5.1.3 Flora of conservation significance

- 833 flora species found in the development areas (Glyde Pt, Murrumujuk and access corridors).
- 32 listed as being of conservation concern.
- 16 listed under NT legislation as endangered (1), vulnerable (3) or near threatened (12).
- Further 16 listed as 'data deficient'.
- 7 spp restricted to Glyde Point area.
- 22 spp of conservation significance found in or near corridors.
- Most of the 32 species of concern are found within sandplain (14), rainforest (9) or riparian communities (6).
- Only 6 of the 32 are found outside these habitats.
- Of the nine species of concern found in the rainforests at Glyde Point, two are listed species found only in rainforests in this area (GHD 2005).

Of the more than 800 flora species recorded in the study area, there are 30 species of plant that are endemic to the Northern Territory. In the proposed service corridors between Gunn Peninsula and Middle Arm, 23 flora species have an IUCN listing that requires protection and management, 8 have not been evaluated – and there are 65 species of plant that are endemic to the Northern Territory (KBR 2003a).

"Of the Glyde Point plant species, only *Cycas armstrongii* and *Malaxis marsupichila* (orchid) are listed as Vulnerable (IUCN 2002). All Northern Territory cycads and orchids are protected under the Territory Parks and Wildlife Act (2000). In the corridor area, *Ptychosperma macarthurii* is listed as Endangered. This species typically occurs in coastal monsoon vine forests such as Black Jungle. Near threatened species in the corridor area include *Utricularia hamiltonii*, *U. holtzei* and *U. triflora*, *Nymphoides subacuta* and *Citrus gracilis*. The latter plant is the only endemic native citrus tree."

(GHD 2005)

The rainforests on Gunn Peninsula and the heath of the Howard River floodplains are both highly diverse vegetation communities. Rates of endemism are high, and many of the plants known to occur in the area are data deficient, indicating an insufficient knowledge of the ecological requirements of the species to make an assessment of conservation status. For a full species list see the Glyde Point Development Project Notice of Intent (KBR 2003a).

Bladderworts (Utricularia spp.)

The four 'near threatened' species of *Utricularia* – *Utricularia hamiltonii*, *U. holtzei*, *U. quinquedentata*, *U. triflora* – are found in the area proposed for the access corridor. These small bladderworts occur as scattered individuals, and are restricted in their range across the Northern Territory. Most of these *Utricularia* populations have been found in the Howard River floodplains, and three species are endemic to the Northern Territory (Holmes et al. 2005).

Table 2: Significant* Flora Species in the Gunn Peninsula Region		
Family	Species	IUCN Status
Apiaceae	*Trachymene rotundifolia*	Not Evaluated and Endemic to NT
Araceae	Typhonium praetermissum	Data Deficient and Endemic to NT
Aracaceae	*Ptychosperma macarthurii*	Endangered
Asclepiadaceae	*Cynanchum leibianum*	Data Deficient and Endemic to NT
Combretaceae	*Terminalia* D20544 Black Pt	Near Threatened
Convolvulaceae	*Jacquemontia browniana var. grandiflora* *Operculina turpethum*	Not Evaluated and Endemic to NT Near Threatened
Cycadaceae	*Cycas armstrongii*	Vulnerable and Endemic to NT
Cyperaceae	*Fimbristylis* A64431 Howard River *Fimbristylis dunlopii*	Data Deficient and Endemic to NT Data Deficient and Endemic to NT
Droseraceae	*Drosera brevicornis* *Drosera darwinensis*	Not Evaluated Not Evaluated and Endemic to NT
Eriocaulaceae	*Eriocaulon nematophyllum* *Eriocaulon tricornum*	Data Deficient Data Deficient and Endemic to NT
Euphorbiaceae	*Margaritaria indica*	Not Evaluated
Goodeniaceae	*Goodenia* D73968 *elaiosoma*	Data Deficient and Endemic to NT
Lentibulariaceae	*Utricularia hamiltonii* *Utricularia holtzei* *Utricularia quinquedentata* *Utricularia triflora*	Near Threatened and Endemic to NT Near Threatened and Endemic to NT Near Threatened Near Threatened and Endemic to NT
Lindsaeacae	*Lindsaea ensifolia subsp. ensifolia*	Not Evaluated
Loganiacae	*Mitrasacme secedens*	Data Deficient and Endemic to NT
Loranthaceae	*Decaisnina signata subsp. signata*	Not Evaluated
Menyanthaceae	*Nymphoides subacuta*	Near Threatened
Orchidaceae	*Chiloischista phyllorhiza* *Habenaria hymenophylla* *Habenaria triplonema* *Malaxis marsupichila*	Near Threatened Data Deficient Data Deficient Vulnerable
Pittosporaceae	*Pittosporum moluccanum*	Near Threatened
Poaceae	*Elionurus citreus* *Schizachrium perplexum*	Data Deficient Not Evaluated
Polygalaceae	*Polygala pycnophylla*	Not Evaluated
Rubiaceae	*Pavetta conferta*	Not Evaluated and Endemic to NT
Rutaceae	*Citrus gracilis*	Near Threatened and Endemic to NT
Stylidiaceae	*Stylidium capillare* *Stylidium cordifolium* *Stylidium fissilobum* *Stylidium tenerrimum*	Data Deficient Data Deficient Data Deficient Data Deficient and Endemic to NT
Tiliaceae	*Corchurus capsularis*	Data Deficient
Verbenaceae	*Avicennia integra*	Near Threatened and Endemic to NT

(Species lists collated from NT Herbarium Database November 2005 and KBR 2003a)

*'Significant' – is defined as those species in need of active management or protection as recognised by the Northern Territory Parks and Wildlife Commission of the Northern Territory.

5.2 Key locations of significance

5.2.1 Vernon Islands

The Vernon Islands have been established as a IUCN Class 1A Conservation Reserve (See Appendix B for IUCN Reserve Classes). The reserve status extends to the low water mark, thus incorporating at least some of the marine reef environments. IUCN Class 1A classification allows for educational and scientific use of the reserve, however it excludes uses not compatible with conservation (NRETA 2005b).

The recently released NTG draft Parks and Conservation Masterplan (September 2005) recognizes two of the three Vernon Islands as places of national significance. However, most of the surrounding marine environment, which supports significant dugong and turtle populations as well as reefs and corals, is very little known by the scientific community, and not protected. Fishers and divers use these areas frequently. The main access to the Vernon Islands is from Darwin Harbour or Leaders Creek fishing base.

No numbers are readily available for the number of boats travelling from Darwin to the islands, however Leaders Creek fishing base recorded 2614 boats using the public ramp in 2004. Each boat had an average of three people on board. Although fishers go in and around Leaders Creek and the Adelaide River delta from the fishing ramp, a significant proportion of fishers are using the Vernon Islands as the main attraction to the area (D. Edwards, pers. comm. 2005). Tiwi people also use the islands as hunting grounds (J.Hicks pers.comm. 2005).

The links between connected corridors of mangroves, seagrass beds and coral reefs should be protected in order to sustain ecosystem function, fisheries productivity and resilience of reefs (Mumby et al. 2004). Research done on the Vernon Islands is sparse and incomplete but based on what is known about this area, e.g. the habitats that support the fisheries so important to the Darwin region, it should be protected.

5.2.2 Blue holes

These are a small number of naturally occurring deep holes in the reefs surrounding the Vernon Islands. They support coral communities that have greater species diversity than surrounding reefs in the Vernon Island chain (URS 2003). At the Gunn Point blue hole, coral reefs and mangroves grow within metres of each other, and a site sacred to the Traditional Owners coincides with a favoured fishing spot. This area is used and appreciated by many people and stakeholder groups.

There are two blue holes in the reef surrounding South West Vernon Island. The blue hole closest to Gunn Point is a sacred site registered with the AAPA. Fishers and divers also visit the blue holes (D. Edwards, pers.comm. 2005).

The holes are up to 20 metres in depth, with walls of coral that become increasingly healthy below the low tide mark (N. Smit, pers.comm. 2005). The surveys conducted by the CCNT indicate that these coral communities are restricted to sites at Gunn Point, northwest Vernon Island and one site in the Grose Island chain. The report by the CCNT indicates these communities are of regional conservation significance (CCNT nd.).

5.2.3 Murrumujuk

Murrumujuk, on the western side of the Gunn Peninsula, derives its name from the registered sacred site located at the beach. Murrumujuk is a long coastal strip stretching between Gunn Point and Tree Point and characterised by sandy beaches, dunes and beach ridges with slopes between 2-8% and grassland with pockets of low closed forest. Unstable cliffs lie behind the main beach, where fossils have been collected for a number of years (CCNT 1982).

The adjacent cliffs were used for university field trips over a number of years (CCNT 1982) and are of regional significance and of educational and scientific value (CCNT nd.). Seven sacred sites are also listed in and around this site (AAPA 2004).

Recreational visitors including fishers, trail bike riders and campers have used the Murrumujuk beach and dune area for a number of years. There was concern raised in 1982 that the informal camping and collection of fossils from the Murrumujuk area was damaging a recreationally and scientifically valuable site (CCNT 1982). The fossil ammonites that occur

along this stretch of beach are particularly attractive and sought after, and Murrumujuk was the first collection site for ammonites recorded in northern Australia (Dames and Moore 1994).

5.2.4 Hope Inlet

Hope Inlet lies at the southern point of Shoal Bay. The adjacent Shoal Bay Conservation Reserve is a significant wetland, used for hunting overflow from the Howard Springs Hunting Reserve during peak shooting season (NRETA 2005e). The Tiwi community of Tree Point (Durduga) have a freehold tenure on the tip of Hope Inlet, where there is also a reserve for migratory birds that use the wetlands in the area – Tree Point Conservation Reserve.

The Hope Inlet shell mounds rise 7 metres above the coastal plains just 25km from Darwin and are thousands of years old. Archaeological surveys conducted in the Hope Inlet area in the 1990's found a high density of archaeological places, the high significance of which prompted the application for a NT Heritage listing for the site (Bourke 2004).

Representing a period of cultural shell mound building between 2500 and 500 years old, this unique group of sites has remained intact only due to their relative inaccessibility. The lack of a management strategy to protect this site from illegal removal of artefacts is of particular concern (Bourke 2004), and the proposed development of rural residential blocks in the Hope Inlet Archaeological area is inconsistent with the *Northern Territory of Australia Heritage Conservation Act 2000*, the principal intention of which is to "provide a system for the…conservation and protection of places and objects of prehistoric…social, aesthetic or scientific value, including…archaeological sites…of the Territory".

5.2.5 Leaders Creek

Leaders Creek is the main drainage system between the Howard River and the Adelaide River. It supports a large mangrove forest community and there is a rainforest patch amongst the mangrove forest of Leaders Creek, which is recognized as one of the four significant rainforest patches found on the peninsula (CCNT nd.).

Leaders Creek is already the major focus of recreational activity on the Gunn Peninsula. The freshwater creek provides the only reliable wet season swimming hole on the peninsula, and the freshwater creek crossing is used for overnight camping and as a day use picnic area (CCNT nd.). Boat owners use the ramp on Leaders Creek to access the major recreational fishing locations of the Vernon Islands and the Adelaide River delta (D. Edwards, pers.comm. 2005).

5.2.6 Ginger Palmer's Jungle

This highly significant rainforest is within the proposed Glyde Point industrial estate development area and would be either destroyed or irreversibly fragmented and degraded by the proposed development.

STATEMENT OF HERITAGE VALUE – submitted for nomination April 2002

"This site – as a whole – illustrates Northern Australia's links with the past – both natural and human. Ginger Palmer lived on the fringes of modern, mainstream, society and the pioneer / hunter-gatherer Aboriginal society of an earlier time. He might have said that he had the best of both worlds.

Ginger Palmer's Jungle has an unusually high biodiversity – containing elements of dry rainforest, wet rainforest and coastal monsoon vine forest. Ginger and Maude's existence there is linked to the biodiversity of this jungle and the mangroves. The rich and relatively pristine environment in which this camp was located allowed him and his wife to exploit the rich food of the Gunn / Glyde Point area – the mangroves, monsoon forests and the open Eucalypt woodland. For instance, the area is said to support unusually large numbers of native bees. One piece of roughly hewn timber on the forest floor appears to have been shaped to form a ladder for gathering honey.

His simple camp on the fringe of the forest and the mangroves is a reminder of the tough way of life of bushmen and their Aboriginal partners, living between two worlds."

Excerpt from NT Heritage nomination for Ginger Palmers Camp (Stobo 2002)

Ginger Palmers Jungle was nominated for NT Heritage Listing in April 2002. It has been accepted as having heritage value but the site is yet to be assessed or granted Heritage status. (See previous text box for heritage values statement).It is a relatively large rainforest patch on the coastline nestled between mangroves and melaleuca swamps, roughly half way between Gunn Point and Glyde Point. It has been recognised as having significant Aboriginal and European cultural heritage values, as well as significant biological diversity. Ginger Palmers Jungle is registered with the Aboriginal Areas Protection Authority (AAPA) under an Aboriginal name, indicating contemporary significance for the Indigenous community in the area.

The site was used during the evacuations of the 1940's during World War II, when Aboriginal people hid from authorities in order to avoid being evacuated (D. Jackson, pers. comm. 2005).

The name stems from its use as a camp for Ginger Palmer – described as an "outback rogue" bushman, tracker, crocodile hunter, buffalo shooter and poddy dodger – in the 1950s with his Aboriginal wife Maude (Stobo 2002). He cleared some of the jungle and planted mango trees and a row of coconut palms. It has been suggested that he chose to hide in this remote and inaccessible spot, whilst on the run from the law (Stobo 2002).

Ginger Palmer's Jungle was a study site for research into the ecology, genetics and conservation of the Top End's rainforest patches and their dependence on fruit-eating birds and bats, in the late 1990s (Price et al. 1998). It is believed to be a stop-off point for migrating birds, such as the Torres Strait Imperial Pigeon, and was found to be a centre of genetic diversity for one of the two plant species studied (*Carpentaria acuminata* palms). This rainforest patch is also a possible source of genetic relicts from previous moister climates (Shapcott 1999).

The Gunn Peninsula coastal area including this Jungle area has been a rich and important seasonal hunting ground for people for thousands of years. Occasional storms reveal buried middens and stone artefacts (Sinclair Knight and Mertz 2004).

5.2.7 Van Diemen Gulf

Van Diemen Gulf is a marine and coastal environment of national and international conservation significance (NRETA 2005b), bounded by Gunn Peninsula and the Vernon Islands; Kakadu National Park; Garig Gunak Barlu (Cobourg) National Park and Marine Park; the Tiwi Islands; and the Mary River and Djukbinj National Parks.

A major fossil fuel industrial development involving toxic materials and serious pollution risks at one of the two entrances to the Van Diemen Gulf marine environment is a matter of great concern. Because of the international significance of this regional environment, Australia's obligations under various international agreements, treaties and conventions – including the World Heritage Convention – will be called into question by this proposal.

REGIONAL VALUES
Darwin Coastal Bioregion (DAC)

"This bioregion [which includes the GPVI area] contains some of the most extensive and rich floodplain systems in northern Australia, extensive and diverse mangrove forests, and significant rainforest and riparian vegetation. The bioregion is the most important in the Northern Territory for colonially breeding waterfowl. It contains parts of two Ramsar wetlands and several other wetlands of national significance. It also includes a relatively high diversity of threatened species (33 listed at Territory or national level)."

Draft NT Parks and Conservation Masterplan NRETA 2005

5.2.8 Archaeological sites

In the greater Gunn Peninsula region, there are over 200 archaeological sites in an area less than 100km^2 (Sinclair Knight and Mertz 2004). These sites are significant in the Territory's cultural evolution, representing a period of Aboriginal coastal occupation when traditional practices of mound building were carried out. They have a special association with the Larrakia community for spiritual reasons. These sites have the potential to reveal information leading to a better understanding of Territory heritage – more about people living in the Late Holocene and also about environmental change that has occurred in that time span (Bourke 2004).

Nearly half of the archaeological sites found in the development area lie within the Glyde Point industrial development zone (12 of 25)(Sinclair, Knight and Mertz 2004). Four of these have been recognised as of high significance, and risk destruction or burial should the project go ahead. The recommendation of the heritage survey report was that further studies of these sites were needed prior to any activity in the area (Sinclair, Knight and Mertz 2004).

Archaeological sites have been found mostly on the boundaries between vegetation types – where the rich harvests from this coastal zone have been consumed for thousands of years. From shell middens seven metres tall to the background smatterings detectable only to the expert gaze, the Peninsula is saturated with a long history of human use.

5.3 Previous recognition of the importance of Gunn Peninsula/Vernon Islands area

The value of Gunn Peninsula and the Vernon Islands to various sections of the community has been expressed on numerous occasions over the past twenty five years, with a number of management plans and proposals written and conservation areas identified that attempt to protect sites and values of significance. These have included:

- Conservation Commission Management Plan1982.
- Gunn Point Area Draft Plan of Management 1982.
- Evaluation of Options for the Development of Weekender and Urban Residential Development at Gunn Point1987.
- 1990 Gunn Peninsula Land Use Structure Plan (DLH 1990b): acknowledges the high conservation values of the Peninsula and proposes most of the Peninsula become a "**Coastal Park**", with "weekend cottages at Point Stephens and Glyde Point" developed to "ensure that features of rare distinction are protected and enjoyment of the coast is enhanced".
- Gazettal of conservation reserves: The Black Jungle Conservation Reserve; Shoal Bay Conservation Reserve; Vernon Islands Conservation Reserve.
- Beagle Gulf Marine Park Concept Plan (nd).
- Gunn Peninsula Concept Plan (nd).
- NT Water Act declaration: Community consultation resulted in the declaration of the Shoal Bay/Vernon Islands waters as an "aquatic ecosystem protection, recreational water quality and aesthetics" area under the beneficial uses provisions of the NT Water Act (DIPE 1998).
- NT Parks and Conservation Masterplan: The NT government's draft Parks and Conservation Masterplan (NRETA 2005) identified the coastal environments immediately adjacent to Gunn Peninsula to be of international conservation significance and the coastal environment from the Adelaide River mouth around to Shoal Bay and including Glyde Point to be of national conservation significance.

In 1982 the Conservation Commission of the Northern Territory recognised that there were a number of features on the Gunn Peninsula of outstanding interest and value, and that the casual use of the Gunn Peninsula for recreation was damaging these features. A plan of management was drawn up that recognized monsoonal vine thickets, mangrove communities, foreshore areas and the forested areas of the Peninsula as sensitive environments worthy of conservation through regulation and protection (CCNT nd).

When the Beagle Gulf Marine Park was initially planned it was to extend from Cape Ford to Cape Hotham, including the Vernon Islands (Coulter 1994). The Gunn Peninsula was included in plans for protection and conservation of the coastal area in the Darwin region (Collins 1994).

The rainforests, mangroves, cypress remnants, savannah woodlands, tamarind trees, coral reef communities and the geomorphology of the peninsula are all cited in these reports as warranting protection (CCNT 1982; CCNT nd.)

The reports also recognised the recreational potential of places such as Leaders Creek, Point Stephens and the beaches on the western side of the peninsula for fishing, swimming, boating and camping (CCNT 1982) and the potential for a trail network for extended bushwalking, an interpretive centre and construction of day use facilities were also mooted (CCNT nd.).

As of March 2006, the Beagle Gulf Marine Park is yet to be declared.

THE GUNN PENINSULA COASTAL PARK PLAN 1990

In 1990 the NT Department of Lands and Housing (predecessor of today's Glyde Point industrial estate proponent, the Department of Planning and Infrastructure) proposed that most of the coastal region of Gunn Peninsula become a 'Coastal Park'. Below are some of the statements made by the Department in its Gunn Point Peninsula Land Use Structure Plan 1990 (DLH 1990b):

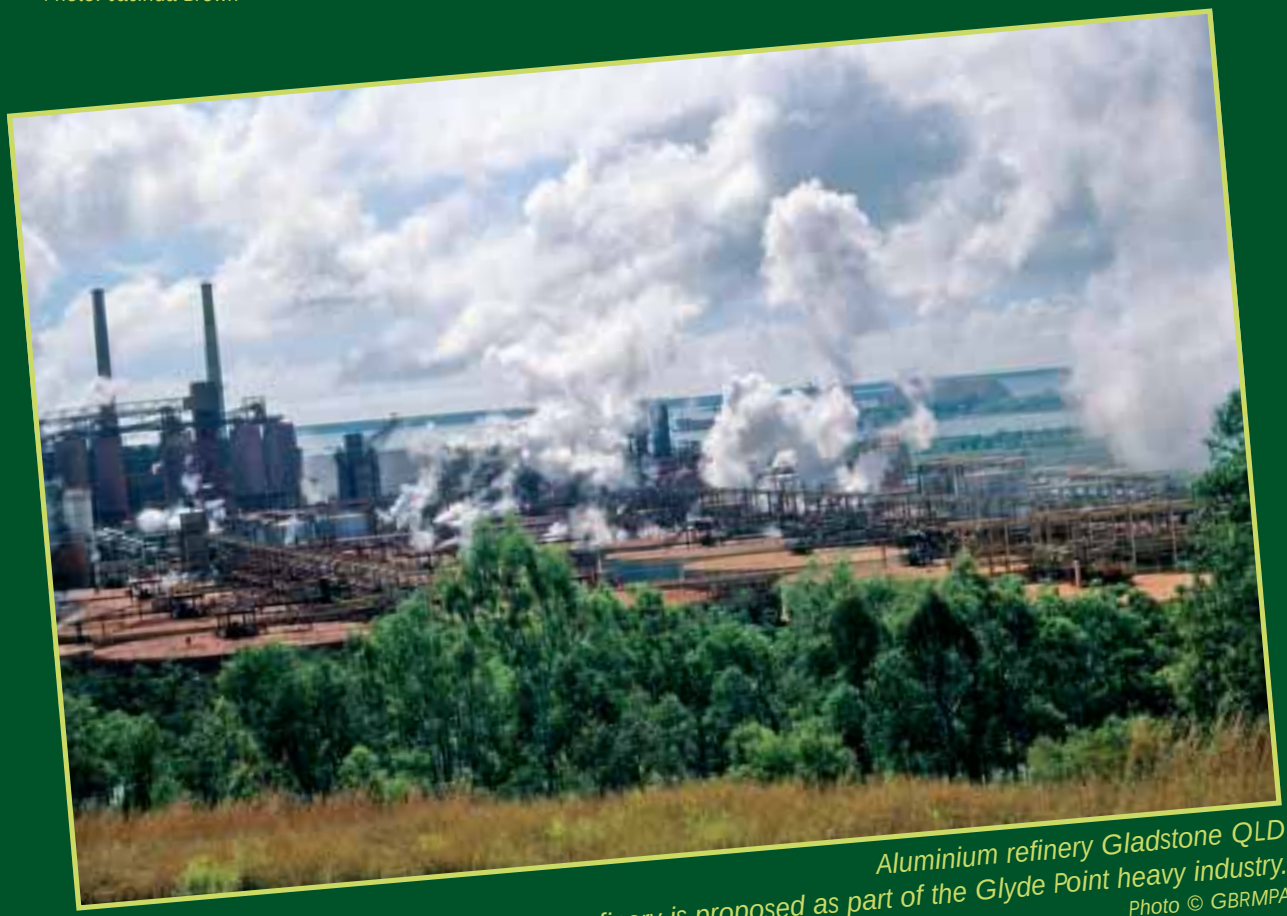
"A number of areas on Gunn Point Peninsula (GPP) are considered to be of Territory wide conservation significance. GPP is botanically rich. There is considerable diversity of plant life not found elsewhere close to Darwin…The GPP is also relatively abundant in habitats of rare or endangered species of plants and animals. These habitats are of intrinsic value for conservation and for scientific and educational purposes. Disturbance to these areas should be avoided."

"Part of Tree Point is also a conservation reserve administered by the Conservation Commission. The peninsula contains one of a very few relatively undisturbed roosting sites for wading birds. It is a resource of national significance."

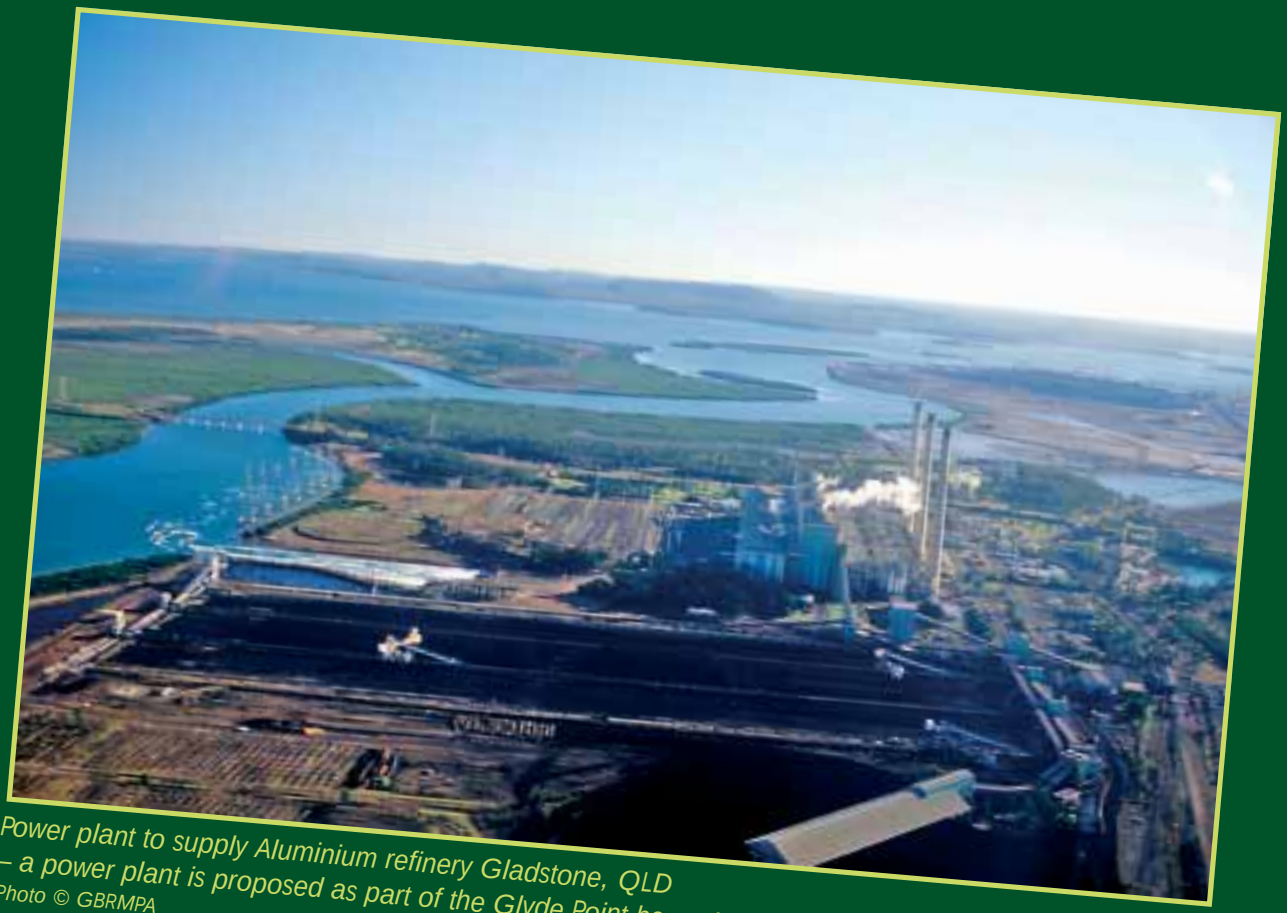
"The whole of Point Stephens Peninsula contains virtually intact monsoon forest of very high regional significance. The forest is dense, with a substantial vine thicket and is important bird habitat. The area is highly susceptible to damage from human activity. The Ginger Palmers site on the north of the GPP contains smaller patches of monsoon forest of regional significance which is under threat from cyclone and fire damage. The dry monsoon forest contains the orchid Malaxis and is the only known site of this plant and thus is considered to have Territory wide significance."

Glyde Point rainforest tree. INSERT: Boobook Owl at Glyde Point.
Photos: Jacinda Brown.

View towards Glyde Point from Fright Point, Gunn Peninsula.
Photo: Jacinda Brown



Aluminium refinery Gladstone QLD
– an Aluminium refinery is proposed as part of the Glyde Point heavy industry.
Photo © GBRMPA



Power plant to supply Aluminium refinery Gladstone, QLD – a power plant is proposed as part of the Glyde Point heavy industry.
Photo © GBRMPA

Murrumujuk Beach – ECNT and AMCS field trip 2004.
Photo: Jacinda Brown

ABOVE: Seven metre high shell mound at Hope Inlet Gunn Peninsula.
Photo: Lorraine Williams.

RIGHT: Bladderwort (Utricularia hamiltonii) in wetland in flood, Howard River floodplain (the area proposed for the access corridor to the industrial estate).

"The whole of the coast within the plan area (the whole of Gunn Point Peninsula from Adelaide River all the way round to Howard River) is included in a broad land use unit designated in this plan as the Coastal Park…the inclusion of this new park in the GPP Land Use Structure Plan 1990 will provide a continuous link between these coastlands and other coastal resources relating to the Vernon Islands [also entirely designated as "park" in this document] and Cape Hotham… the park includes elements which contribute significantly to the conservation, recreation, scientific and fisheries resources of the Darwin region…"

(DLH 1990b)

6.0 Threats to the values of the study area arising from the proposed Glyde Point Industrial Estate

6.1 History of the Glyde Point industrial estate development proposal

Glyde Point was formally gazetted as an industrial development zone under the Planning Act in September 2003 at precisely the same time as the NT government was gazetting most of the mangroves of Darwin Harbour as a 'conservation zone'.

In December 2003, with a view to bringing Timor Sea gas onshore for processing and downstream industrial development, the Department of Infrastructure, Planning and Environment (DIPE, now DPI) presented a 'notice of intent' (NOI) for the Glyde Point Development Project to the NT Office of Environment and Heritage (now the EPA) (DIPE 2003).

Thirteen years earlier in 1990 the NT Department of Lands and Housing (DIPE's predecessor) released its Litchfield Shire Land Use Structure Plan which included the Gunn Point Peninsula Land Use Structure Plan and Murrumujuk Land Use Concept Plan.

These plans included zoning for the Murrumujuk residential area, and the designation of most of the Gunn Peninsula as "Coastal Park", including Glyde Point. No mention was made of industrial development at Glyde Point.

Under the 2003 revised zoning, the proposal is for a 4 212 hectare industrial estate developed in five stages; 1 572 ha of reclaimed land (from ocean infilling); a 4.9km long dredged access channel (17 m deep); a residential development for 16,000 people; and approximately 130 kilometres of infrastructure corridor linking Glyde Point to Darwin Harbour.

The presentation of the NOI triggered formal assessment under the *NT Environment Assessment Act, 1982*.

Due to the occurrence of Commonwealth-listed migratory birds and threatened species in the area the development proposal has triggered the *Commonwealth Environmental Protection and Biodiversity Conservation (EPBC) Act*. The Glyde Point EIS assessment is therefore a joint NTG/ Commonwealth process under their respective environment protection legislation and under the intergovernmental agreement covering such assessments.

To facilitate the proposed industrial development, various natural and cultural heritage surveys have been conducted on the site in recent years (Heritage Surveys 2000; EcOz 2001; URS 2003; KBR 2003; Sinclair Knight and Mertz 2004; GHD 2005). These studies have been conducted by or on behalf of the NT government Department of Infrastructure, Planning and Environment (DIPE).

"The prerequisite for the development occurring is that gas comes onshore in Darwin, which has not been secured to date."

(KBR 2003a)

In March 2004 the Northern Territory Government put out a tender for the preparation of the Glyde Point Industrial Estate Development Environment Impact Statement (EIS) (DIPE 2004). The scope of the EIS is narrow, excluding any impacts of the various industries envisaged for the site and ignoring downstream and cumulative impacts. Table 3 illustrates some of the potential impacts that would result from the heavy industries proposed for the Glyde Point site.

Appendix A demonstrates the current commitment of the Northern Territory Government to proceeding with the Glyde Point Proposal despite the apparent lack of industry interest.

Table 3: Some potential impacts of the proposed industrial development	
Activity	Impact
Dredging	Substrate removal and thus habitat and species removal; Alteration of bottom topography and hydrography, and thus destruction of local habitats and the risk of direct physical/mechanical stress to the species present. Dredging also releases bound heavy metals.
	Alteration of sediment composition leading to change of the nature and diversity of benthic communities - decline of individual density, species abundances or biomass; local resuspension of sediments. In muddy environments, substantial short-term turbidity can result. Smothering of adjacent environments.
Vegetation Clearance	Destruction of communities; habitat loss; changes in hydrology – drainage and groundwater levels; erosion; loss of ecological connectivity.
	The destruction of vegetated habitats such as seagrasses, saltmarshes, mangroves and algal communities presents problems analogous to that of vegetation clearance on land.
	Clearing of mangroves leads to increased erosion resulting in increased sedimentation and smothering of benthic organisms, and turbidity; also loss of coastal buffer stability.
	Clearing coastal wetlands results in the loss of beneficial filtering of water and potential acid-sulphate soil release.
Coastal Development	Destabilisation of coastal zones through clearing; reclamation and port structures; reduced habitat and increased pollution for marine and littoral environments.
Land Reclamation	Destruction of mangrove and littoral communities; required fill for reclamation sourced from benthic floor transported from site of extractive industry; potential acid-sulphate soil release.
Port and Groyne Structures	These not only directly impact on littoral and supra littoral habitats but can result in the loss of beach, seagrass and mangrove habitats when current and wave patterns are altered. Altering hydrology changes sediment transport and deposition patterns.
Shipping	Rubbish, galley wastes and wastewaters impact water quality, particularly in coastal and semi-protected waters. Introduction of exotic pests in bilge water. Shipping accidents can cause oil spills and other toxic contamination of the marine and coastal environment.
Spoil from Construction	Habitat loss due to burial and increased turbidity.
Toxic Substance Spills	Organochlorine, PCBs, heavy metals, acids and radioactive wastes – can cause direct poisoning and an array of secondary or cumulative effects (for more information see Table 2 - Industry Specific Impacts).
Release of Excessive Nutrients	Increased nutrient run-off and sewage disposal can result in eutrophication, leading to changes in communities, algal blooms, increased Biological Oxygen demand (BOD);
Sediments	Siltation and sedimentation can result in smothering, substrate change, clogging of gills in aquatic species, reduction in light and subsequent loss of vegetation;
Oil and Petroleum Spills	Spills can result in smothering of benthic organisms, and toxic effects from both the dissolved fraction of the oil and the chemicals used to clean it up.
Sewage	There are also complex mixtures, such as in sewage, which can contain many or all of the above components and have a range of effects.
Water Use	Water use exceeding the groundwater supplies; disrupts groundwater flows thus affecting vegetation communities; increases salinity of the groundwater supply.
Urban discharge	Runoff is characterised by high sediment and nutrient levels, leading to eutrophication, bacterial contamination, oxygen depletion, elevated turbidity and siltation.

Information compiled from [1]NOO (2002) and [2]EA (2003)

6.2 Potential flow-on impacts

In December 2003 the Federal Court of Australia in *Queensland Conservation Council Inc. v Minister for the Environment and Heritage [2003] FCA 1463* (the "*Nathan Dam Case*") interpreted the EPBC Act to require that the Commonwealth Minister must consider the 'whole, cumulated and continuing' effect of actions including indirect consequences in his or her deliberations over proposed development that may impact on a site triggering the EPBC Act. This case has set an important precedent in determining that the assessment process must address downstream and long term impacts, not just the immediate effects of a proposal.

The government of the Northern Territory has stated that various petrochemical and smelting projects are to be located at the site along with a gas power plant, new shipping channel and port, and urbanisation of the Murrumujuk coastal area (KBR 2003a; DIPE 2005). The draft Guidelines for an EIS on the Glyde Point Proposal were released in April 2004 and the scope addresses only the impacts of the site construction, excluding all potential industry impacts that would follow (DIPE 2004). This has resulted in a very narrow scope for assessing the impact of the proposed development. All flow-on or downstream impacts of the proposal should be included in the scope of the EIS, as required from the Nathan Dam Case. This must include associated infrastructure developments such as roads, pipelines, dams and industries.

6.2.1 Groundwater threats: industrial and residential use

It is stated in the KBR feasibility study of the Glyde Point project proposal that groundwater is likely to be a limiting resource both for industry and residential purposes on the Gunn Peninsula (KBR 2003b). In the Murrumujuk Residential Development Preliminary Report it was acknowledged that insufficient water was available for even domestic purposes, and would have to be sourced elsewhere (Dames and Moore 1994).

The groundwater survey of the Gunn Peninsula (Jolly 1984) found that the northern part of the groundwater on the Peninsula is subject to saline intrusion from the Adelaide River system. It was recommended that less than 4 200 m^3 of water should be drawn per day from the Peninsula groundwater supplies yet the industrial project requires 27 000 m^3 a day (Jolly 1984; KBR 2003b). The proponent has presented no other option for how the stated water shortage in the area would be addressed.

6.2.2 Industry water requirements

Most of the proposed heavy industry at Glyde Point would require large volumes of fresh water in order to operate. In the year 2004-2005 Darwin water use from the Darwin River Dam was 4 245 ML/a (N. De Castro, pers. comm. 2005). Water requirements for Stage 1 of the proposed development would be more than double (KBR 2003b) that which is currently being used by the whole of Darwin. Currently only 15% of full pumping capacity is available from Darwin River Dam. Current available water falls far short of industry requirements and raises the question of where the proposed development would access requisite water supplies.

Considering the seriousness of this component of the proposed development the wider community should be aware of any such commitments during the planning stages of the proposal. New sources of water and the impacts of extraction must be included in the environmental impact assessment process.

The Feasibility Study did not include any industry water requirements, and nor will the EIS given the narrow scope of the research required (DIPE 2004). The need for large quantities of freshwater has not been addressed

6.2.3 Industrialisation and pollution

In 2003 the NTG formally gazetted an industrial estate and new port at Glyde Point covering 40 km^2 (4,000 ha), 15 km^2 (1,500 ha) of which would be reclaimed mangrove forests and marine environments. An aluminium smelter and refinery, methanol plant, ammonia and urea plant, cryogenics industry, phosphate fertilizer factory, polyethylene plant, manganese smelter and power station based on offshore gas supplies are the industries suggested for the site (KBR 2003a).

To service the heavy industry site from sea and land would require extensive new infrastructure, and a number of reserves and valuable ecosystems would be threatened in the process. Murrumujuk has been earmarked for an urban centre, with the potential to house 16 000 people (KBR 2003a). Hope Inlet, to the south of Murrumujuk, has been identified as a potential rural living zone. The extensive industrial, residential and related corridor development of the Gunn Peninsula has serious implications for the natural and cultural values of the area.

Heavy industry would introduce a myriad of pollutants and hazardous materials as well as the associated threats and impacts of shipping, port operations and a large residential estate to the Peninsula.

"Future development proposals may include manufacturing of methanol, fertiliser, caustic soda and other gas-based products. Such manufacturing developments within the estate will be the subject of separate referrals and assessments."

Excerpt of letter to Federal Environment Minister from DIPE, 2001

Pollution may impact directly upon individual organisms, causing mortality, physiological stress or reproductive impairment, either immediately (for example through acute toxicity or smothering) or through cumulative effects such as bioaccumulation of heavy metals or organochlorines (NOO 2002).

Indirect or secondary effects can include changes in community composition and function when pollution-tolerant species or certain trophic groups such as filter feeders are able to dominate a community they previously occupied only marginally (NOO 2002).

The vulnerability of seagrasses to certain types of pollution such as siltation, turbidity, or chemical pollutants, may result in significant habitat changes or losses.

6.2.4 Coastal development

Environmental impacts of constructing coastal industry and port facilities include the destruction of aquatic habitats, loss of seagrass beds, disturbance of acid sulphate soils, altered bathymetry and water circulation causing sedimentation or erosion (NOO 2002), and increased risk of marine pollution.

A 1997 community survey conducted by the Marine and Coastal Community Network (MCCN) indicated that most Darwin residents believed new developments should be located away from the coastal zone and sited in already developed areas. This was a comprehensive community survey conducted in Darwin, involving 682 people, 112 of them random (Brown and Reynolds 1997).

6.2.5 Heavy industry and climate change

New and better information is coming to light every year on climate change and its potential impacts on the NT.

The CSIRO Division of Atmospheric Research published "Climate Change in the Northern Territory" in 2004 (Hennessy et al. 2004), which states that risks associated with extreme climate events are one of the potential impacts of climate change in the Northern Territory. Coastal areas are particularly vulnerable to these types of change including rising sea levels, increased intensity and frequency of extreme events and the fragility of coastal zones.

"The intensity of tropical cyclones is likely to continue to increase...the combination of sea level rise, stronger wind speeds and more intense rainfall may lead to more significant coastal impacts due to tropical cyclones."

Climate Change in the Northern Territory, CSIRO (Hennessy et al. 2004)

The Northern Territory government has released a policy framework for climate change, and committed to the principle of early action. This involves anticipation of climate change as a means to reduce or avoid adverse consequences (NRETA 2005a).

Placing heavy industry with toxic runoffs (KBR 2003b) in close proximity to fragile coastal ecosystems, which are susceptible to sea level changes, storm surges and cyclonic conditions (Hennessy et al. 2004) contradicts commitments to climate change policies.

Mangrove forests help to stabilize the coastline and offer a natural buffer that can soften the blow of storm surges, cyclonic conditions and tsunamis (Steinberg, 2005). In 1923 Groote Eylandt had a storm surge 6.6 metres above the normal tide level. The storm surge caused by cyclone Tracy was only 1.6m, although it did not occur in conjunction with a high tide (Hennessy et al. 2004).

Planning for all coastal development should be taking these historic events and climate projections into account.

6.2.6 Shipping and dredging threats

The Glyde Point Industrial Estate proposal involves a 4.9 km channel to be dredged so that ships can berth at a port that extends from reclaimed land along the northern edge of Glyde Point. The proponents identified solution to the difficult access issues in the area is a proposed limited access port, where the port can only be reached twice daily during neap tide due to the exceptionally high currents and large tides in the area (KBR 2003b).

Dredging of a 4.9km channel and a turning circle to accommodate these ships in strong currents would cause massive benthic disturbance to the area. Biota is destroyed with dredging, and permanent modification of the sedimentary environment has long term influences on the benthic fauna and such changes have been documented in temperate waters (Edgar 2001).

Impacts of shipping include noise pollution, disposal of rubbish, wastewater and galley waste. There are risks of introducing invasive species through ballast water (NOO 2002). Further, antifouling agents such as TBT, oil and noxious hazardous spills, groundings and sinkings as well as sewage waste are also recognised as impacts of shipping in an area (NOO 2002). In protected or coastal waters this can cause changes in water chemistry including a decrease in dissolved oxygen, changes to salinity and higher levels of nutrients. These all contribute to a loss of biodiversity in the area (NOO 2002). The very strong currents in the Vernon Islands region would result in a fast spread over a wide area should any shipping spillage or toxic flow occur.

Narrow entrances and the strong currents around reefs will ensure that tug boats would need to guide any ships that do present to the proposed port (KBR 2003b). Given the proposal involves petrochemicals, cryogenic materials and other toxic products to be transported under such risky circumstances and in sensitive ecological environments, shipping activities and a port are inappropriate for this area.

The impacts of shipping are felt on pelagic as well as benthic species, and the transport of possible adsorbed contaminants from the dredged area to potentially more sensitive areas is another risk associated with dredging (OSPAR Commission 2004). The turbidity of the water would also be affected by the dredging activities (NOO 2002), potentially spreading long distances given the shipping channels unsheltered orientation. Dredging activities may impact areas of conservation value such as the Vernon Islands through processes such as degradation of water quality and sedimentation, changes to the hydrodynamic regime, burial of benthic flora and fauna, translocation of species and removal of habitat (GBRMPA 2004).

Table 4: Industry Specific Emissions and Case Studies		
Proposed Industry	**Industry Products**	**Risks associated**
Phosphate Fertiliser	Ammonium, Nitrogen compounds, Sulphur compounds and Fluorides (NH3; NOx and N2O, SiF4 and HF; SOx)	Atmospheric pollutants emitted by the fertilizer industry can include gaseous Ammonia; Ammonium salt aerosols; fluorine; oxides of sulphur; fertiliser dust, acid mists and radiation from phospho gypsum. All are toxic to human and ecosystem health when released to the surrounding environment. As well as global problems such as GHG emissions acid rain, water acidification, eutrophication and chemical mist can directly affect people, animals, vegetation and property in the vicinity of the plant.[1]
	High CO2 emissions	Carbon dioxide, though not a pollutant as such, contributes to global warming and is emitted in large quantities by the fertilizer industry.[1]
Polyethylene Plant	Nitrogen compounds, Potassium Silica and Fluorine (NOx, K, NOx, S, Si, F)	Waste waters can include compounds of nitrogen, phosphate, potassium, sodium, silica, sulphur, fluorine as well as sludges and polluted wash water.[3]
Cryogenic Plant	28 gases (9 toxic, 2 radioactive)	There are four principal areas of hazard related to the use of cryogenic fluids or in cryogenic systems. These are: flammability, high pressure gas, materials, and personnel.[3]
Methanol Plant	Greenhouse Gas Emissions	Large quantities of greenhouse gases are associated with methanol plants. Greenhouse emissions of 3.32 MT p.a. during operation were calculated for the Methanol Plant of the Tassie Shoal project in the Timor Sea.[4]
Gas Power Plant	Dioxins	Dioxins are highly toxic persistent organic pollutants (POPs) linked to cancer, immune system problems and reproductive problems.[2]
Aluminium Smelter	Sulphur dioxide (SO_2)	These are emitted mostly from stacks, with maximum ground level concentrations are reached at a distance of 2 to 3 km downwind of the smelter site.[3]
	Particulate Matter (PM10)	Can affect respiratory health.[3]
	Fluoride Compounds	Fugitive emissions of fluoride mean maximum ground level concentrations of this pollutant are found close to the plant.[3]
	Nitrogen oxides (NOx)	Significant contributor to global warming.[2]
	Polycyclic Aromatic Hydrocarbons (PAHs)	Major diffuse sources include bushfires and motor vehicle emissions. Point-source emissions occur from petroleum refineries, fossil fuel power plants, coke ovens, and from anode production in aluminium smelters.[3]
	Chromium	Alcoa Aluminium Smelter in Western Australia has experienced problems with contaminating groundwater due to water leaking from its stockpiles of millions of tonnes of mining waste.[3]

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Table 4: Industry Specific Emissions and Case Studies

Proposed Industry	Industry Products	Risks associated
Aluminium Refinery	Cadmium	A heavy metal that has cumulative toxic effects on living organisms.[3]
	Lead	Lead can cause brain damage and growth deformities in children. At Lake Macquarie Aluminium refinery the effects of lead dust were found in children, with over 37% of children over the recommended exposure levels in 2003. Fish were also affected, with restrictions on fishing in Lake Macquarie implemented.[3]
	Arsenic	A cumulatively toxic chemical released from refineries, and found in higher concentrations in groundwater due to seepage from the site. [3]
	Nitrogen	Among toxins from the Wagerup Aluminium refinery smoke stacks operating 24 hours per day are arsenic, mercury, lead, hydrocarbons, sulphur dioxide, fluoride and nitrogen.[2]
	Sulphur dioxide	Sulphur dioxide emissions in 2002-2003 were 29,000 tonnes from the Wagerup Aluminium Refinery.[5]
	Fluoride	Fugitive emissions from the industry centre mean maximum ground level concentrations are found closer to the plant. Vegetation and forage animals such as cattle and horses are susceptible at concentrations up to 1000 time lower than humans. Fluoride emissions can cause severe burns and is toxic by inhalation.[3]
	Radioactive Thorium	Able to cause mutations in sensitive cells, potentially affecting reproductive ability of populations - plants, animals and people.[3]
	Uranium	Very long half life; Able to cause mutations in sensitive cells, potentially affecting reproductive ability of organisms; known carcinogen.[3]
Manganese Smelter	Dioxins	Dioxins are highly toxic persistent organic pollutants (POPs) linked to cancer, immune system problems and reproductive problems.[1]

[1] IFA 2003; [2] Greenpeace 2001; [3] NSW Department of Health 2003; [4] ECNT 2002; [5] ECNT 2004.

6.2.7 Habitat destruction

The proposed heavy industry estate at Glyde Point would result in clearing, dredging and infilling of up to 40 km^2 (4,000 hectares) of natural ecosystems including 15 km^2 (1,500 ha) of reclaimed land that would destroy intertidal zones and mangrove forests.

Leaders Creek mangroves and rainforest, Ginger Palmers (rainforest) Jungle and the woodland and paperbark swamps in the area would be destroyed or heavily impacted. Rural and urban living on the peninsula would potentially result in the loss of a further 28 km^2 (2,800 ha) of vegetation and the cultural sites contained within that area (KBR 2003a).

In total, up to 75 km^2 (7,500 ha) of varied ecosystems and habitats would be cleared and destroyed should the proposal go ahead.

6.2.8 Infrastructure corridors

Infrastructure requirements to service the Glyde Point industrial site include two major corridors from the Glyde Point development site to Darwin – totalling over 100 km in length. The first runs along the current Gunn Point Road, crossing the Shoal Bay Conservation Reserve, the Howard River floodplain and then proceeding to Middle Arm. The second proposed access corridor runs south of the Peninsula, parallel to the Adelaide River, meeting the Arnhem Highway east of Humpty Doo. Both of these access corridors run through low lying floodplain areas. Given a fifty metre width, the corridors would result in the clearing of a further 6.5 km^2 (650 ha) of vegetation and habitat (KBR 2003a).

In the proposed corridors, 19 fauna and 23 flora species have IUCN conservation status, indicating populations requiring active conservation management. Eight species of flora known to occur in the area are yet to be evaluated for their conservation status (See Table 1). Forty two species of bird that are listed in the JAMBA and CAMBA agreements use habitat along the proposed service corridor routes (NTPWS 2005).

Components of protected reserves, swamps, woodland and mangroves would all be destroyed in order to allow a heavy industry standard road and a gas pipeline to move through from Darwin to Gunn Peninsula. The corridors pass through three wetland areas, all of them rich in waterbird species (GHD 2005).

6.2.9 Invasive plants and animals

The Gunn Peninsula is one of the few areas in the Litchfield Shire that is not beset with serious weed issues, and the increased access and urbanisation of the region would facilitate more invasive species into the area. The Northern Territory has a suite of invasive species that are recognised as posing a threat to the wildlife and the economy of northern Australia (NRETA 2005c). These range from ***Mimosa pigra*** that has been steadily advancing its grip of the Adelaide River floodplains for the past thirty years – to the Cane Toad (***Bufo marinus***) that is expected to arrive in Darwin early 2006. The Northern Territory is now host to almost 400 exotic species.

Invasive species frequently gain access to areas through human facilitation. The most aggressive weeds, such as Gamba grass (***Andropogan gayanus***), can invade entire communities, and drastically change their structure and function. This can change the food availability for native animals, impede access to areas and change the fire regime of an area (Smith 2002). In the marine environment shipping can transport pest species in the ballast water and on the hull. Transfer between harbours could be amplified given the proximity of northern Australia to multiple tropical shipping ports with similar environments (NOO 2004).

6.3 Significant areas impacted

6.3.1 Glyde Point

The total area of natural habitat that the industrial site is proposed to occupy at Glyde Point is 40 km^2 (4,000ha). This includes 15 km^2 (1 500 ha) of mangrove and marine environments that would be destroyed in the process of reclamation. Rainforests, wetland/paperbark communities and savanna woodlands would be cleared in order to accommodate the heavy industry site (KBR 2003a).

The relatively large and intact rainforest communities in the immediate vicinity of Glyde Point, which would be destroyed or degraded by the industrial estate, are likely to form a crucial ecological link between the rainforests of the western Gunn Point escarpment and Point Stephens. Destruction or degradation of the Glyde Point rainforests is therefore likely to impact other high conservation value rainforests on the Gunn Peninsula.

Within the proposed Glyde Point heavy industry site there are 30 fauna and 8 flora species that have been accorded conservation significance by the International Union for the Conservation of Nature (IUCN)(GHD 2005 – See Table 1 & 2 for species list). IUCN recognises populations that may be vulnerable to change. This indicates populations that require active management, and in the case of the critically endangered species, active protection. There are a further 3 species of flora whose conservation status has not been evaluated (See Table 2). Thirty four species of birds that the Glyde Point site provides habitat for are listed under JAMBA and CAMBA agreements, as migratory birds whose habitats need to be protected (For complete species list see the Glyde Point Development Project Notice of Intent (KBR 2003a)).

There are 12 archaeological heritage sites located within the proposal area (See Figure 1). Four of these are of high significance (Sinclair, Knight and Mertz 2004).

6.3.2 Ginger Palmers Jungle

Ginger Palmers Jungle, a rainforest area close to Glyde Point, would be largely or entirely cleared for the industrial development. Even if the forest were retained, surrounding clearing and water extraction would severely impact on the forest. Ginger Palmer's Jungle is a registered sacred site with the Aboriginal Areas Protection Authority. Remains of Ginger and Maude Palmers house are still in the area, however the lack of active land management in this rainforest patch is leaving it vulnerable to vandals and souvenir seekers (Stobo 2002), as well as fire.

Drainage to the site is likely to be severely affected by the proposed Glyde Point Industrial Estate (See Figure 3). The effect that this would have on the rainforest productivity and growth is difficult to quantify, however a reduction in available moisture is unlikely to sustain rainforest health.

Of the nine species of conservation concern found in the rainforests at Glyde Point, three are threatened species found only in rainforests in the area (GHD 2005).

As discussed above, loss or degradation of the Glyde Point rainforests is likely to have a detrimental impact on rainforest communities over a much larger area.

6.3.3 Vernon Islands

As scientific knowledge on the islands is very limited the impact of a major industrial estate, port and shipping channel being developed in such close proximity to the Vernon Islands and reef complex is currently difficult to determine (N. Smit, pers.comm. 2005). The effects of a 4 000 hectare industrial estate, an urban centre of 16 000 people and a shipping lane in close proximity is likely to have a variety of impacts. These include the cumulative impacts of noise, increased turbidity, and decreased water quality. Hazards associated with shipping such as grounding or grinding on reefs and potentially toxic runoffs and spills also pose a threat to the Vernon Islands.

Until more is known of the area, which in addition to its natural values, supports a valued recreational fishing zone and has coral reefs and blue holes in its reef complex that lie unknown to science but sacred to the traditional owners, the area should not be placed at risk.

6.3.4 Marine environment

The proposed Glyde Point development would impact on turtles, dugongs and benthic and pelagic communities in the area. The decrease in growth of marine plants due to increased turbidity from dredging and land erosion and the increased activity and noise during construction and operation may cause dugong to avoid the area's foraging habitat. The modification of the coastline and reclamation would also irrevocably change habitat and possible pollution incidents may contaminate the area (Whiting 2004).

6.3.5 Murrumujuk Beach

There are 7 sacred sites within the proposed urban zone at Murrumujuk (AAPA 2004) and three archaeological sites of 'low to moderate' significance (Sinclair, Knight and Mertz 2004).

6.3.6 Dune systems and cliffs

The dune systems that run along the eastern edge of Shoal Bay are regionally significant for the occurrence of ammonite fossils, and as an example of a natural erosive process unrelated to coastal erosion or human impact. The cliffs are also of regional significance and of educational and scientific value (CCNT nd.).

6.3.7 Woodlands and Cypress (*Callitris*) stands

"The local extinction of *Callitris* is currently occurring in vast areas throughout the Top End. The decline of the cypress pines is occurring on all land tenures: Aboriginal land, pastoral land and national parks."

(Bowman & Panton 1993).

The introduction of urban living and rural lots would result in increased fire frequency and potentially the subsequent loss of many of the fire sensitive communities found on the north west tip of Gunn Peninsula. Woodland in the area that supports the endangered Red Goshawk would also be threatened by development in the area.

6.3.8 Shoal Bay

The proposal to release sewage from the Murrumujuk residential estate into Shoal Bay fails to take into account the Beneficial Uses Declaration made in 1998 (NRETA 2005d) which recognised the values of the Shoal Bay-Vernon Islands area as an aquatic ecosystem, a recreational water body and aesthetically valuable to the community. In 2001 the attempted development of a prawn farm at the base of Shoal Bay was halted due to the ensuing outrage at the large area of mangrove forest that would be destroyed and the proposed effluent levels impacting on the barramundi breeding environment of Shoal Bay (C. Makepeace, pers.comm. 2005). A direct ocean outfall into Shoal Bay for the sewage of a population of 16 000 people is inappropriate for this area.

6.3.9 Hope Inlet

The proposal for rural residential blocks in the Hope Inlet area has two major impeding factors- archaeological sites and potable water supplies. The archaeological surveys conducted in the area in 2004 reported a number of sites of high significance. There has been a heritage nomination filed with the NT government Environment and Heritage Division (DIPE 2004), and an express recommendation given in the report that this area not be developed due to the significance of the sites found there (Sinclair, Knight and Mertz 2004). These are shell mounds seven metres high and the widest in northern Australia.

As well as the archaeological sites the Hope Inlet area is adjacent to the Shoal Bay Conservation Reserve at the base of Shoal Bay, and Tree Point Conservation Reserve, both listed due to the number of birds that use the wetlands in the area (NRETA 2005e). It is an area valued by amateur fishermen for its barramundi breeding grounds in the extensive mangrove forests (C. Makepeace, pers. comm. 2005).

"The Hope Inlet sites have to date been protected by virtue of the inaccessibility of the area. The proposed development of rural residential blocks in close proximity and improved access routes and associated increased levels of casual visitation would pose a serious threat to these sites."

Sinclair, Knight and Mertz 2004

6.3.10 Conservation areas affected by infrastructure corridors

Black Jungle/Lambell's Lagoon Conservation Reserves

The Black Jungle Conservation Reserve is currently classified as an IUCN 1A reserve under the *NT Parks and Wildlife Conservation Act*: this means a protected area that is strictly a nature reserve, managed for scientific reasons. With sacred sites and rare plants within its boundaries an access corridor that disturbs and compromises the values of the area is not consistent with the intentions of a nature reserve (See Appendix B).

Shoal Bay Conservation Reserve/Howard Springs Hunting Reserves

Recognized for their importance to migratory birds (NRETA 2005e). Weeds, feral animals and fire are major problems for this conservation reserve (PWCNT 2004). These threats would be exacerbated through increased access points and greater levels of unregulated and unmanaged vehicles in the area. The Howard River floodplains are rich in a flora that is restricted to the sandy and well drained soils of the region. Given the rare flora and the likely continued competing interests of resource extraction and rural residential expansion, management strategies that conserve the vegetation communities of the area need to be developed rapidly in this area (Holmes et al. 2005). The discovery of the Howard River Toadlet in 2005 is a timely warning of how much may yet be unknown in this area.

7.0 Protecting the Future of the Gunn Peninsula/Vernon Islands area

As discussed previously, the natural, cultural and amenity values of the GPVI area are widely acknowledged. The predecessor of the Department currently proposing the industrial development at Glyde Point recognised the outstanding conservation values of the area and recommended protection (DLH 1990b).

7.1 Siting criteria for industrial development

This report does not attempt to identify other possible or preferred sites for heavy industry in the greater Darwin region. However, based on local concerns and national and international experience and standards, this report recommends the NT Government develop a transparent policy on siting criteria for industrial development, and consider the following as appropriate criteria for that policy and for future incorporation into relevant legislation.

Precautionary criteria for the selection of industrial development sites in the Darwin Coastal Region

1. **Must avoid areas of high recreational or cultural significance.**
2. **Must avoid known populations of endangered species, and take due consideration of vulnerable species.**
3. **Must avoid concentrations of restricted or high value vegetation types or species (eg rainforests, seagrasses).**
4. **Must avoid areas with high risk of flow-on impacts (such as hillslopes, on rivers and coasts).**
5. **Must take account of predicted impacts of climate change (increased storm frequency and intensity; rising sea levels).**
6. **Must not sever landscape connectivity.**
7. **Must avoid duplicating infrastructure (e.g. ports; pipelines; roads) where such duplication spreads impacts across large areas of high value marine or terrestrial environments.**

7.2 NT Parks and Conservation Masterplan

The current NT government has acknowledged that there are inadequacies in the representativeness of the parks and reserves system in the Northern Territory and has committed to substantially upgrading the formal land and sea conservation reserve system and improving environmental protection and management generally. The identification of areas of national and international significance, protection of biodiversity and comprehensiveness of the reserve system are all areas recognised within the draft NT Parks and Conservation Masterplan as in need of increased attention (NRETA 2005b).

The NT government has recognised the need to maintain the NT's relatively intact natural landscapes and avoid environmental mistakes made elsewhere in Australia (NRETA 2005b). Further, the government's election policy for the environment includes commitments to improved protection of the NT marine and coastal environment through increased protection of mangrove communities and a comprehensive marine planning process (ALP NT Election Policy 2005).

The draft NT Parks and Conservation Masterplan has committed to a number of key management elements for the future of the NT parks and conservation agenda that are directly applicable to Gunn Peninsula/Vernon Islands area, including the provision of full engagement of Indigenous people in all aspects of parks and conservation management; resolving of land claim and native title issues; advancing cooperative park planning and management and presenting the public with a broader range of nature-based tourism and recreational opportunities within parks and reserves and beyond (NRETA 2005b).

There is considerable emphasis within the draft Masterplan on the need to protect the Territory's coastal and marine biodiversity. The lack of knowledge regarding the biodiversity of marine environments in northern Australia is a serious impediment to implementing effective reserve and conservation strategies but should not be used as an excuse for inaction.

For protection of marine and coastal environments, the IUCN World Parks Congress has called on the international community to establish strictly protected areas that amount to at least 20-30% of each habitat by 2012. The NT is far short of these levels. Of all jurisdictions in Australia, the NT has the lowest proportion of its land and sea environments in conservation reserves with only 3.7% of terrestrial environments in reserves and 3.1% of marine environments in reserves (NRETA 2005b). Garig Gunak Barlu (Cobourg) National Park is the only Marine Park in the Northern Territory.

Although the draft NT Parks and Conservation Masterplan purported to identify the regionally, nationally and internationally significant areas of the NT to be considered for formal conservation (protected area) status, the lack of data to inform this process is an acknowledged impediment. Although the process assessed the terrestrial components of the Northern Territory, it did not address the conservation status of marine environments.

"At the core of the Masterplan is the identification of terrestrial areas of highest priority for the conservation of biodiversity. Areas of international and national significance are identified through analysis of:

- **concentrations of threatened plant and animal species**
- **concentrations of endemic and restricted range species**
- **wetland habitats**
- **important aggregations of wildlife**
- **sites of botanical significance."**

Draft NT Parks and Conservation Masterplan, NRETA 2005

The draft Parks and Conservation Masterplan inexplicably failed to identify the Gunn Peninsula area as being of 'international conservation significance' despite finding the coastal region immediately east and west (south) of Gunn Peninsula to be of international conservation significance. It almost appears that the Gunn Peninsula was specifically omitted because of the government's industrial and related development plans for the region.

Notwithstanding the area's omission from the Masterplan's list of areas of international significance, the Masterplan did identify the Gunn Peninsula/Glyde Point coast as being of national significance for marine turtle nesting (NRETA 2005b). The plan also identified the rainforest patches of the Gunn Peninsula but said that no assessment of sites of botanical significance had been conducted in the region.

7.3 Sustainable options for the Gunn Peninsula/Vernon Islands area

The preliminary assessment set out in this report shows that the Gunn Peninsula/Vernon Island area is of regional, national and probably international conservation significance, combining many important discrete attributes and values (e.g. endangered species, restricted vegetation communities, rainforest patches, coral reefs, cultural sites) and is likely to form an integral part of a regional environment (Van Diemen Gulf/Beagle Gulf) that is of international significance.

In accordance with government planning documents and policies as discussed above, and in recognition of the conservation values of the study area identified in this report, a range of options exist to provide secure long term protection and management for the GPVI area.

These options are based on the principles of:

- Formal recognition of Indigenous land and sea title and ongoing cultural activities;
- Formal conservation status;
- Appropriate ongoing conservation and environmental protection planning and action (e.g. removal of invasive species; fire protection; management of fishing, recreational and tourism activity), wherever possible involving Indigenous land and sea rangers programs; and
- Planning for ecologically sustainable economic activity including nature-based and cultural tourism.

All of the following options rely on government willingness to support land and sea managers in an effort to maintain and protect the biodiversity harboured in the region. Tourism is frequently hailed as an important part of the Territory's economic future: there is a need for government to ensure that there is adequate provision of resources, infrastructure and support for areas that are exposed to tourism so as to protect areas that attract local, national and international visitors.

"…in other news, both fishermen and environmentalists have expressed fury over plans to clear mangroves and reclaim land at pristine Glyde Point for another NT gas plant…

The Glyde Point/Gunn Point region is one of the few coastal areas outside of Darwin that is easily accessible to average Territorians…and there is considerable anger now it looks like becoming a centre for heavy industry."

Matt Flynn's Northern Territory fishing report, June 13, 2004

The protection of the marine area around the Vernon Islands would also ensure that the recreational fishing in the region is carried out in a sustainable manner – at the very minimum the need to improve knowledge of the marine wildlife and their status in the area is crucial to an assessment of sustainable yields.

Inviting people to walk in and experience the Gunn Peninsula for short periods of time would be a unique and valuable addition to other tourism experiences available in the Darwin region. Being a short distance from the CBD people could choose to experience and appreciate a variety of types of landscape in a way that has low impact on the Gunn Peninsula and high returns into the future.

Consultation with all Larrakia and Tiwi interests should be undertaken to consider joint management options of the area in the future. The archaeological surveys conducted in the area (Sinclair, Knight and Mertz 2004) identified 25 archaeological sites at Hope Inlet, Glyde Point and Murrumujuk. Depending on the sensitivity of the sites and the willingness of the Traditional Owners, the opportunity for cultural tourism managed by Traditional Owners through interpretation of the area is substantial.

7.4 Direct from Darwin – placing people on the Peninsula appropriately

The proximity from Darwin of Gunn Peninsula/ Vernon Islands and the density of sites of interest within a small area make it an attractive tourist and recreational option for the Darwin region.

The lack of groundwater and the fragile nature of many of the attractions of the Peninsula, such as chenier dunes and monsoon rainforests, restricts the activities suitable for the area. This prompted planning in the 1990s to concentrate on short term use of the Peninsula, for day use and weekend use rather than long term visitation or habitation. The reasons for this continue to prevail in the study area. Although many sites lend themselves as ideal recreational and tourism sites, long term habitation with high density populations is not compatible with the values of the Peninsula.

The nature and culture based tourism potential for the GPVI area is great and untapped. With the full involvement of the local Indigenous people, the area would help meet the growing need for ecologically and culturally rewarding tourism experiences within an hour's drive of Darwin.

This opportunity would provide for the recognition of Indigenous rights and responsibilities; protection of a diverse array of high conservation value ecosystems and environments; and numerous opportunities for Indigenous and non-Indigenous economic activity based on the area's many natural and cultural values.

All future options should be based around the aspirations and legal rights of the Traditional Owners of the area.

7.5 Future options for conservation management

Protected areas should be nominated and established in consultation with Traditional Owners and landholders to manage and conserve the environmental and cultural heritage of Gunn Peninsula/Vernon Islands area. Protected area options include, *inter alia*, Indigenous Protected Areas and/or other forms of negotiated land use agreements with a conservation priority; national parks/marine parks; nature reserves; and essential habitat declarations.

7.5.1 Indigenous Protected Areas

These are areas where 'Aboriginal owners have entered into a voluntary agreement for the purposes of promoting biodiversity and cultural resource conservation' (DEH 2005). They allow for the protection of high conservation land without diminishing the authority of the Traditional Owners to make decisions about that land. The Northern Territory Government has shown little enthusiasm for IPA`s, with the Dhimurru IPA in East Arnhem Land the only existing agreement. In the draft NT Parks and Conservation Masterplan another three IPA`s are flagged for Laynhapuy, Groote Eylandt and the Arafura Swamp. An Indigenous Protected Area may be a viable option for the Gunn Peninsula/Vernon Islands, but would require extensive consultation and agreement between parties.

IPA program funding is available from the Commonwealth government for Indigenous Organisations to enable them to carry out the following activities:

- Consideration of an IPA declaration;
- Development of a management plan for the property;
- Implementation of the management plan (eg. weed and feral animal controls, cultural and natural heritage conservation activities or the establishment of infrastructure to control visitor access); and
- Monitoring (usually in conjunction with other agencies).

An IPA on the Gunn Peninsula would involve the Larrakia people as Traditional Owners of the area, and also likely, the Tiwi and the Wulna people. Negotiations would need to take place directly with these peoples. In the case of Dhimurru this was achieved via the mechanism of a Section 73 agreement with the Parks and Wildlife department under the *Territory Parks and Wildlife Conservation Act*. It is not known what level of support there is from Traditional Owners for an IPA in the Gunn Peninsula/Vernon Islands area.

7.5.2 Marine Protected Area (MPA)

Marine Protected Areas are being established worldwide in response to a growing recognition of the vital need to protect the health of our coasts and oceans. There is a growing body of documentation that an effective MPA system is not just of crucial importance for biodiversity conservation, but also provides economic and social benefits to the whole community from key marine-based industries including tourism and fisheries. At the heart of Marine Protected Areas are 'sanctuary' zones. These zones within MPAs, like National Parks'on land, are places where we can enjoy activities like swimming, boating and snorkelling, and where extractive activities are not allowed.

The NT has only one MPA straddling the boundaries of 2 marine bioregions, while 11 other marine bioregions exist in NT waters without any form of MPA protection (although the Bynoe Marine Park is being developed). The Vernon Islands, with rich and diverse marine environments, provide an opportunity to form the centrepiece of a regional marine protected area, which could extend to include areas such as Shoal Bay, the Blue Holes and Glyde Point. Indigenous cultural rights, obligations and knowledge must be recognised in planning and management of MPAs.

The original plans for the Beagle Gulf Marine Park included the Vernon Islands in its range (CCNT nd.). The variety of habitats of significance in the Darwin region supported by the Vernon Islands and their importance to traditional owners, endangered wildlife and fishers should ensure that they are included in a Marine Protected Area proposal. Combined with a coastal park on the Gunn Peninsula and appropriate consultation with the Traditional Owners of the area, this represents the best option for the conservation and appreciation of the Vernon Islands and the surrounding marine area.

The Northern Territory Government has begun the process of identifying appropriate areas for ongoing protection. With no set timelines this process may be lengthy. There is an urgency regarding the Vernon Islands due to the proposed development that should give this area precedence for selection as a Marine Park. Knowledge of marine wildlife and their status should be documented and assessed before heavy industry is permitted to risk the values of the area. The benefits of a Marine Park include enhancing tourism, productivity improvement for fisheries, and enhanced opportunities for Indigenous Sea Country management.

7.5.3 Indigenous Land Use Agreements

An Indigenous Land Use Agreement (ILUA) is a voluntary agreement covering the use and management of an area of land or water made between one or more native title groups and other parties, such as mining companies, pastoralists and governments. A registered ILUA is legally binding, under the *Native Title Act* on the people who are party to the agreement and all native title holders for that area.

These agreements provide a forum for developing community-based management and conservation plans with local Traditional Owners (Kiessling and Booth 2004).

The Native Title Claims in the area were all lodged between 1999 and 2002, and are unlikely to be resolved rapidly. Again, the opinions of the Traditional Owners in the area on this matter are unknown.

7.5.4 Heritage Nominations

There are already two NT Heritage nominations in the GPVI area, one for Ginger Palmers Jungle and the other for the Hope Inlet archaeological sites. Neither of these has yet been processed. There is considerable ministerial discretion within the provisions of the Act both to revoke listings and to allow works that will damage listed places (Scott 2006).

7.5.5 JAMBA and CAMBA Agreements

The presence of 36 species of migratory birds protected under the JAMBA and CAMBA Agreements triggered the EPBC Act and hence Commonwealth involvement in the assessment of the Glyde Point development proposal (See Table 1). The Gunn Peninsula area that would be affected by the Glyde Point development proposal is a short-term staging post for these birds, and it is not believed to contain highly important wetland habitat for these migratory birds. However, in close proximity to this area are the Melacca Swamp, Tree Point and Shoal Bay Conservation Reserves all protected due to their wetlands values (NRETA 2005b).

7.5.6 National Parks and Reserves

The protection of areas can assist in highlighting the values and mitigating the threats in a particular region. A range of legislative options are available, from local scale to region based arrangements seeking to protect the natural and cultural heritage of an area (Kiessling and Booth 2004). The Gunn Peninsula has listed species, threatened communities and botanically rich rainforest patches and mangroves ecosystems. Because the area has been little modified since European settlement the cultural and biodiversity values of the area are still largely intact. The area should be sufficient to satisfy the guidelines for establishing this area in the gazetted formal Reserve System.

7.5.7 Essential habitat declaration

Sections 37 – 42 of the *Territory Parks and Wildlife Conservation Act 2005* refer to Areas of essential habitat:

37 (1) "if there is an area of land that, on its own or together with another area of land or other areas of land, is a habitat that is essential for the survival in that area or those areas of wildlife generally or a species of wildlife, the Administrator may, by notice in the Gazette, declare the area to be an area of essential habitat."

8.0 Recommendations

The need to address gaps in knowledge around the Gunn Peninsula/Vernon Islands area is real. For an area so close to Darwin and with all the pressures that proximity entails, it is paramount that the area be comprehensively investigated and its values documented. There is already sufficient information to be sure that there is an abundance of values in the area. Active environmental stewardship of both the marine and terrestrial environments is warranted and Traditional Owners, current landholders, and government should all be included in maintaining those values, and coordinating sustainable land and sea use.

The current scope of the Environmental Impact Assessment on the Glyde Point Industrial Estate falls far short of being comprehensive. It does not include the impacts of the proposed industries that would operate in the area for the lifetime of the estate, impacts of water use, nor downstream impacts.

The proposal is inappropriately planned and inappropriately placed. Since the site was first considered for heavy industry we have improved knowledge on coastal development impacts and climate change risks. The current process should be halted and the criteria for site selection for heavy industry reassessed and made public.

It is recommended:

1. That the Northern Territory Government halt the current incomplete Glyde Point Environmental Impact Assessment process and withdraw plans for the Glyde Point industrial estate and residential development.
2. That the NTG establish an Independent Inquiry to:
    - further investigate and report on the natural and cultural values of the Gunn Peninsula/ Vernon Islands area, including its significance as part of the Van Diemen Gulf and Darwin Coastal Bioregion;
    - assess the benefits to the community of protecting (and where necessary restoring) the ecosystems and landscapes of the area, including sustainable tourism opportunities and 'ecosystem services' benefits such as fish habitat;
    - further examine the relative merits and benefits of a range of possible reservation, management, and sustainable economic activity options for the area (e.g. Indigenous Protected Area/Marine Park status combined with eco- and cultural tourism);
    - examine alternative sites for appropriate industrial (and residential) development away from sensitive and pristine coastal environments and based on appropriate, best practice and transparent site selection criteria.
3. That the NTG address as a matter of urgency the conservation and Indigenous concerns in the area, including protection of threatened areas of significant value such as *Callitris* and rainforest communities; resolution of native title claims; and support for the traditional custodians to protect and manage sites of cultural significance.
4. That in order to facilitate much needed and long overdue conservation management of the Gunn Peninsula area, and pending any final decision on the future ownership and management of the area (which must be negotiated with the Indigenous Traditional Owners), tenure/vesting of the area should be transferred from the NT Land Corporation to a body dedicated to and capable of conservation management.

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Appendix A: Letter from Chief Ministers Office re Glyde Point Industrial Estate Proposal

A/CHIEF MINISTER

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Ms Adele Pedder
Northern Marine Campaigner
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Peter and Adele

Dear Mr ~~Robertson~~ and Ms ~~Pedder~~

Thank you for your joint letter dated 4 October 2005 concerning your request for a broad inquiry into planning for industrialisation in the greater Darwin region. I note that you have written an identical letter to various other Ministers.

Government policy in relation to the development of offshore natural gas reserves is articulated in the strategy document *Bringing Gas Onshore* and is premised on realising the economic opportunities presented by additional LNG exports, onshore power generation and development of major resource projects, gas-based manufacturing and the potential to supply gas to the national energy grid. The strategy notes that land has been identified at Glyde Point as the preferred site for industrial gas based manufacturing in the Darwin region.

The potential for significant environmental impact resulting from the Glyde Point proposal is recognised and accordingly the Minister for Natural Resources Environment and Heritage has determined that an environmental impact statement (EIS) be prepared for this development. In addition, as you are aware, the Australian Government has determined that the proposal is a 'controlled action' pursuant to the Environment Protection and Biodiversity Conservation Act.

The EIS process is adequate to ensure that all potential environmental impacts are identified and addressed. The proponent will be required to provide justification for the location of this development and to provide a discussion of alternative locations and development scenarios. The Minister also has the ability to require additional information in the event that the EIS does not provide the level of detail necessary to undertake a thorough examination of the proposal.

Northern Territory Government

As you point out, there is not currently a proponent planning to build a plant a Glyde Point. However, the Government is of the view that an environmenta assessment of the industrial estate proposal at this time is a responsible action Not only will the process confirm the suitability or otherwise of the location, it wi add substantially to the community's knowledge of the marine and terrestria environment and ecosystems in the locality.

I understand and acknowledge your concerns and assure you that the Government is committed to environmentally responsible development However, the Government is of the view that an inquiry such as you envisage is not necessary. The identification of the Wickham (albeit gas based manufacturing is precluded) and the Glyde Point industrial estates were subjec to extensive community consultation in the course of preparing the *Litchfiel Planning Concepts and Land Use Objectives 2002* and the *Litchfield Area Pla 2004*.

Yours sincerely

4th Jan'06

SYD STIRLING

Appendix B: World Conservation Union (IUCN) Categories

Category Ia Strict Nature Reserve: Protected Area managed mainly for science

Area of land and/or sea possessing some outstanding or representative ecosystems, geological or physiological features and/or species, available primarily for scientific research and/or environmental monitoring.

Category Ib Wilderness Area: Protected Area managed mainly for wilderness protection

Large area of unmodified or slightly modified land and /or sea, retaining its natural character and influence, without permanent or significant habitation, which is protected and managed so as to preserve its natural condition.

Category II National Park: Protected Area managed mainly for ecosystem conservation and recreation

Natural area of land and/or sea designated to (a) protect the integrity of one or more ecosystems for this and future generations, (b) exclude exploitation or occupation inimical to the purposes of designation of the area and (c) provide a foundation for spiritual, scientific, educational, recreational and visitor opportunities, all of which must be environmentally and culturally compatible.

Category III Natural Monument: Protected Area managed for conservation of specific natural features

Area containing one or more specific natural or natural/cultural features which is of outstanding value because of its inherent rarity, representative or aesthetic qualities or cultural significance.

Category IV Habitat/Species Management Area: Protected Area managed mainly for conservation through management intervention

Area of land/sea subject to active intervention for management purposes so as to ensure the maintenance of habitats and/or to meet the requirements of specific species.

Category V Protected Landscape/Seascape: Protected Area managed mainly for landscape/seascape conservation and recreation

Area of land, with coasts and sea as appropriate, where the interaction of people and nature over time has produced an area of distinct character with significant aesthetic, cultural and/or ecological value, and often with high biodiversity. Safeguarding the integrity of this traditional interaction is vital to the protection, maintenance and evolution of such an area.

Category VI Managed Resource Protected Area: Protected Area managed mainly for the sustainable use of natural ecosystems

Area containing predominantly unmodified natural systems, managed to ensure long term protection and maintenance of biological diversity, while providing at the same time a sustainable flow of natural products and services to meet community needs.

Appendix C: Gunn Peninsula Coastal Park

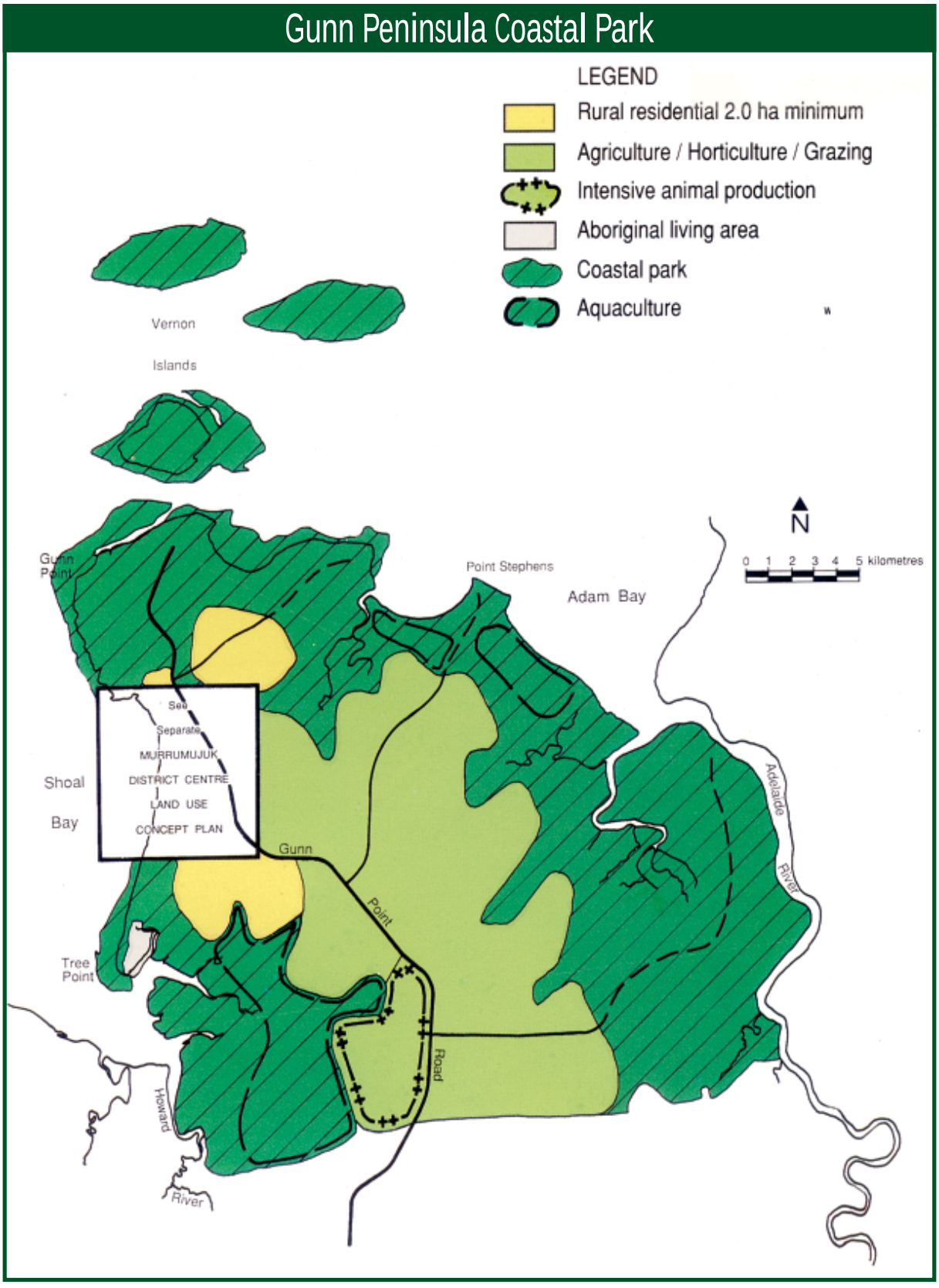

Figure 3: Proposed Gunn Peninsula Coastal Park; Department of Lands and Housing, 1990