

**INTERIM MANAGEMENT GUIDELINES
FOR NECESSARY OPERATIONS**

**BARROW ISLAND GROUP
(A11648 and C38728)**

**Department of Conservation and Land Management
PO Box 835, Karratha, 6714**

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INTERIM MANAGEMENT GUIDELINES FOR NECESSARY OPERATIONS
BARROW AND SURROUNDING ISLANDS

COMPILED BY: Ms F. Stanley RESERVES MANAGEMENT
DATE: OFFICER, PILBARA,

ENDORSED BY: Frank Batini MANAGER,
DATE: 23/7/99 ENVIRONMENTAL PROTECTION
BRANCH

ENDORSED BY: [Signature] 23/7/99 MANAGER,
DATE: CALMfire

APPROVED BY: K.J. Moran 20/8/99 DIRECTOR,
DATE: NATURE CONSERVATION

APPROVED BY: [Signature] 20/8/99 CHAIRMAN,
DATE: NATIONAL PARKS AND NATURE
CONSERVATION AUTHORITY

PREFACE

These Interim Management Guidelines for Necessary Operations on the Barrow Island group are intended to provide the basis for the protection of persons, property, flora, fauna and other natural values, in the absence of a Management Plan.

These guidelines were approved by the National Parks and Nature Conservation Authority at their meeting on 13 August 1999. They will be reviewed 5 years after the date of approval, unless preceded by the completion of a Management Plan.

In addition to Barrow Island (A11648), there are a number of smaller islands in the close vicinity of Barrow Island. The majority of these, namely Middle, Boodie, North and South Double, Boomerang and Pasco Islands, are vested in the NPNCA as Nature Reserves (C38728) (Figure 1). These islands have their own conservation values and their proximity to Barrow Island makes it important that they are included in a management programme.

West Australian Petroleum Pty Ltd (WAPET) have assisted with the production of this document by providing information on the natural environment of Barrow Island and their operations on the island. The management actions have often been produced after consultation with WAPET staff and the company supports the intentions of this document.

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1.0 INTRODUCTION

1.1 National Parks and Nature Conservation Authority (NPNCA)

The National Parks and Nature Conservation Authority was established by the *Conservation and Land Management Act 1984* (CALM Act). All terrestrial conservation reserves in Western Australia are vested in this body.

The NPNCA also develops policies for the management of these areas and all flora and fauna, promotes the appreciation of flora and fauna and advises the Minister for the Environment on such matters. Management plans for areas vested in the Authority must be approved by the Authority.

The Authority consists of four *ex officio* members and eleven people appointed by the Governor: two representatives of conservation organisations affiliated with the Conservation Council of Western Australia, two representatives of voluntary organisations with a special interest in flora and fauna, one representative from a tertiary education institute, one representative of bodies whose members are professionally concerned with nature conservation, two local government councillors, one representative of fishing interests, one employee of the Department whose duties relate principally to the management of land vested in the Authority and one representative of Aboriginal interests.

1.2 Department of Conservation and Land Management (CALM)

The Department of Conservation and Land Management was established by the CALM Act, and is responsible for managing lands and waters vested in the NPNCA, the Lands and Forest Commission and the Marine Parks and Reserves Authority (MPRA), and the associated flora, fauna and forest produce. The Department is also responsible for the conservation and protection of flora and fauna throughout the State and administers the *Wildlife Conservation Act 1950*.

CALM is responsible for producing and implementing management plans for areas vested in the NPNCA and the MPRA. Where no management plan exists for a nature reserve or a marine nature reserve, only necessary operations, that is those that are "necessary for the preservation or protection of persons, property, land, flora or fauna, or for the preparation of a management plan" may be carried out. Interim Management Guidelines for Necessary Operations may be written to cover such operations until such time as a management plan is produced.

1.3 Department of Environmental Protection (DEP)

The Department of Environmental Protection assists the Environmental Protection Authority (EPA) in the administration of the *Environmental Protection Act 1986*. This Act provides for the prevention, control and abatement of environmental pollution and the conservation, preservation, protection, enhancement and management of the environment.

The DEP is responsible for issuing and administering licences for pollution and waste. Development proposals may also be referred to the Department which then advises the EPA on a level of environmental assessment to be carried out by the proponent before approval for the project is considered.

1.4 Department of Minerals and Energy (DME)

The Department of Minerals and Energy assists the Minister in the administration of the *Mining Act 1978*, the *Petroleum Act 1967* and the *Petroleum (Submerged Lands) Act 1982*. It is responsible for granting and administering mining and petroleum tenements on lands, including submerged lands.

1.5 Department of Transport

The Department of Transport (DOT) is responsible for maintaining and enhancing the State's transport system, including land, air and marine transport. It assists the Minister for Transport in administering the *Transport Co-ordination Act 1967*. In addition, the Department administers many other statutes which cover all aspects of transport in WA. Those with relevance to this document include the *Marine and Harbours Act 1981*, *Pollution of Waters by Noxious Substances Act 1987*, *Ports (Functions) Act 1994*, *Western Australian Marine Act 1982* and *Western Australian Marine (Sea Dumping) Act 1981*.

1.6 West Australian Petroleum Pty Ltd (WAPET)

West Australian Petroleum Pty Ltd is the joint venture operator for a consortium of international oil and gas companies. WAPET has held Petroleum lease 1H which covers the majority of Barrow Island, since 1967 and have operated an oil and gas production facility on the island since that time.

WAPET is responsible for managing the environmental impacts of oil field operations. The company's activities are regulated by several government agencies including CALM, DME and DEP.

Oil field operations are conducted in accordance with WAPET environmental, health and safety policy (Appendix 1), DME lease and EPA licence conditions, and relevant legislation (eg. *Wildlife Conservation Act 1950*). Where a significant change or expansion in operating activities is proposed (eg. a new seismic program) WAPET will consult with the appropriate regulatory agencies over the need for approvals.

Internally WAPET has established a range of procedures to minimise the impact of oil field activities on the environment (eg. Earthworks Procedures). Compliance with these and other requirements is audited by WAPET staff and consultants on a regular basis.

2.0 DESCRIPTION

2.1 Location

Barrow Island is located approximately 1300 km north of Perth and 56 km from the mainland. The nearest towns are Onslow and Dampier. The island lies between latitudes of 20°40'S to 20°54'S and longitudes of 115°24'E to 115°29'E and covers an area of 23 483 hectares. It is approximately 25 km long and 10 km wide. The highest point on the island is 65 m above sea level.

A number of much smaller islands, including Middle, Boodie, Pasco, North and South Double, Boomerang, Mushroom, Prince and Pelican Islands, exist in the close vicinity of

Barrow Island (Figure 1). The largest of these is Middle Island which is approximately 600ha, 4.7 km long and 1.3 km wide, while Boodie Island is approximately 400ha, 3 km long and 1.3 km wide.

2.2 Climate

The climate of Barrow Island (and neighbouring islands) is tropical arid with average maximum temperatures being 34.2°C in summer (December - February) and 25.2°C in winter (June - August) while average minima are 24.8°C in summer and 17.1°C in winter.

The median rainfall for the island is 312 mm, although rainfall is highly variable from year to year. There are two peak periods of rainfall, February to March, when approximately 40% of the annual rain falls, and May to June, when a further 35% falls. Dew is an important component of the island's moisture with 90-200 dew days per year.

From September to February the winds are predominantly from the south and south west. This is followed by a period of light, variable winds until May, when the winds turn predominantly easterly or southerly. Cyclones may affect the weather experienced at Barrow Island between November and May. An average of 2 cyclones per year crosses the WA coast with a third approaching close enough to affect coastal areas. Cyclones are often severe and their passage may result in gale force winds and torrential rain.

2.3 Flora and Vegetation

Eight main habitat units have been identified on Barrow Island (Appendix 2), including sand dunes, limestone ridges, claypans, creek beds, and tidal areas. The island's flora is generally dominated by *Triodia* grasslands, of which there are three species. There are also a variety of mixed herb and grass assemblages. Over 250 species of native plants, and four introduced species, have been recorded on the island to date (WAPET, 1989), although not all have voucher specimens in the Western Australian Herbarium (Appendix 3). This situation is being remedied as new collections are made.

One species of *Corchorus* on the island is of conservation significance. *Corchorus interstans* is listed on the Priority Flora List as P3 (known from several populations and not under immediate threat). Twenty seven species have been identified as geographically or habitat restricted and/or requiring further research to determine their status (Appendix 3).

Four introduced species are known to exist on the islands. *Eucalyptus* trees and lawn have been planted around the amenities buildings on Barrow Island. Buffel grass (*Cenchrus ciliaris*) exists around the camp facility, the airstrip and on Boodie Island and there are localised populations of kapok (*Aerva javanica*) on Middle Island. A number of weed species have also been detected and eradicated on Barrow Island, including lantana, capeweed, blackberry-nightshade, double-gee, melons and tomatoes.

2.4 Fauna

Fourteen terrestrial native mammals are found on Barrow Island (Appendix 4, Table 1), five of which are of special significance. All native fauna are protected and cannot be taken without permission under the *Nature Conservation Act 1950*. The Burrowing Bettong or Boodie (*Bettongia lesueur*), Barrow Island Euro (*Macropus robustus isabellinus*), Black-footed Rock Wallaby (*Petrogale lateralis*) and Spectacled Hare-Wallaby (*Lagorchestes*

conspicillatus conspicillatus) are declared as "likely to become extinct" under Section 14 (2) (bu) of the *Wildlife Conservation Act 1950* and are protected throughout the whole of the State at all times. In addition, the Golden Bandicoot (*Isoodon auratus barrowensis*) because of its restricted range and limited population has been placed on CALM's Priority Fauna list (P4).

The Barrow Island Mouse (*Psusedomys nanus ferculinus*) is only known from the island, although it may also occur on other islands in the area. Three species of bat occur on Barrow Island, although one dead specimen of a fourth species was collected from the airport in 1988. The two most common, the Sheath-tailed Bat (*Taphozous georgianus*) and the Little Bat (*Eptesicus finlayson*) occur mostly in caves in or near to the rugged western coastline.

Dugong, six species of dolphin and three species of whale have been recorded in the waters surrounding the Barrow Island group. Dugong are specially protected under Schedule 4 of the *Wildlife Conservation (Specially Protected Fauna) Notice 1998*. The Humpback Whale (*Megaptera novaeangliae*) and Blue Whale (*Balaenoptera musculus*) are declared 'rare or likely to become extinct' in WA while the Sperm Whale (*Physeter macrocephalus*) is listed on CALM's Priority Fauna List (P4).

One hundred and ten species of birds have been recorded on Barrow Island (Appendix 4, Table 2), thirty two of which breed on the island. The majority of these species are migrants. There is one endemic subspecies, the Black and White Fairy-wren (*Malurus leucopterus edouardi*), which is also declared 'rare or likely to become extinct'. A number of species of seabirds have been recorded breeding on the smaller islands surrounding Barrow (Appendix 4).

Fifty four species of reptiles have been recorded on Barrow Island (Appendix 4, Table 3). These include four turtle species, 10 species of sea snake, 6 terrestrial snakes and 34 species of terrestrial lizard. There is one endemic lizard, *Ctenotus pantherinus acripes*. One frog species (*Cyclorana maini*) has also been recorded. There are few species of terrestrial reptiles on Barrow Island relative to comparable habitats on the Australian mainland. This is believed to be due to insularity and it is commonly reported that species diversity of lizards is reduced on islands when compared to the mainland (Heatwole and Butler, 1981).

The beaches on Barrow Island provide nesting sites for three species of marine turtle. The western beaches are a major breeding ground for Green Turtles (*Chelonia mydas*). The beaches on the eastern side of the island are utilised by Flatback turtles (*Natator depressus*), a species which only nests on Australian beaches and Hawksbill turtles (*Eretmochelys imbricata*).

A very diverse subterranean fauna, of both terrestrial and aquatic species, is known to exist in the caves and shallow groundwaters of Barrow Island. This fauna is not well understood although it shares some elements with the subterranean fauna found on North West Cape (Humphreys, 1993). The fauna on Barrow Island consists of ancient Tethyan and rainforest relict elements, is extremely diverse by national and international standards, and contains species now listed as threatened, at both State and Federal levels.

A number of species have been introduced and eradicated from both Barrow Island and the smaller surrounding islands. These have included the removal of a cat which escaped from the barge, eradication of domestic mice introduced in cargo, eradication of black rats from the

south end of Barrow Island, Middle and Boodie Islands and the other neighbouring islands, and eradication of a bee hive introduced in cargo.

2.5 Intertidal Region

The eastern and western shores of Barrow Island are very different in terms of both energetics and habitats. The western side of the island has many steep cliffs and is exposed to moderately strong wind and wave action, while the eastern side is more protected by the extensive shallow areas between Barrow and the nearby Lowendal Islands. Surveys have been carried out on both the eastern shores (LeProvost Environmental Consultants, 1991) and the western shores (Bowman, Bishaw and Gorham, 1996) of Barrow Island.

Many of the beaches and rocky shores on Barrow Island are fronted by rock platforms, which are typically characterised by low visor/notch cliffs. The high tidal portion is covered in films of blue-green algae while short algal turf covers the area between mid and low tide. Fauna includes rock oysters, barnacles, crabs and other small crustaceans, chitons, limpets and gastropod molluscs. On the western shore, stacks may occur on wider portions of the rock platform, for example Max's Beach.

Narrow sandy beaches are widely distributed on both the east and west coasts, although the beaches are steeper on the west coast. The beach fauna is generally depauperate with polychaetes and gastropods making up the majority. Ghost crabs are common on the west coast. The sheltered eastern beaches provide resting areas for a wide variety of wading birds and nesting sites for flatback turtles, while the beaches on the west coast are used by green turtles for nesting.

On the east coast, very high tidal (samphire) flats are subject to occasional and partial inundation and are covered in halophytic succulent vegetation. Fauna is sparse in this habitat with the most commonly recorded fauna being crabs.

Small stands of mangroves (*Avicennia marina*) are found at the mouths of several creek systems. They can be separated into those on a muddy substrate in which gastropods and crabs are found and those on a rocky or sandy substrate which supports oysters, crabs and sea urchins.

Two broad types of limestone platform exist on the eastern coast of the island, those veneered with sediment and those covered with algae. The latter habitat contains the most diverse assemblages of flora and fauna, with the extent of macroalgae cover increasing from mean sea level onwards to deeper water. Benthic organisms include 87 species of gastropods, sponges, sea anemones, seapens, crabs, octopus, starfish and sea cucumbers. Benthic fauna is also diverse on the veneered platform with polychaete worms, crustaceans, brachiopods and ostracods. These platforms provide foraging areas for many species of wading and other seabirds.

A large coral reef exists in Turtle Bay on the west coast of the island. Biggada Reef has a rich fauna, much of which is also found at the nearby Montebello Islands.

2.6 Conservation Significance

Barrow Island is an A Class Nature Reserve of outstanding conservation significance, by virtue of the number of threatened or restricted species present and its ecosystem values.

Barrow Island has one of the most valuable mammal assemblages in Australia, and supports endemic sub-species of mammal, skink and bird. There are currently no known species of feral animals present on any of the islands, although exotic plants do occur in places. Barrow Island is recorded as the largest land mass in Australia that does not have established populations of the black rat *Rattus rattus*. The islands were cut off from the mainland approximately 8000 years ago when the sea levels rose. Thus, they represent remnant examples of the mainland vegetation and fauna assemblages occurring in a natural state without the influences of exotic species.

Middle, Boodie, Double, Boomerang and Pasco Islands are C Class Nature Reserves. These islands provide nesting sites for both turtles and numerous seabird species. Their proximity to Barrow Island increases their significance and that of the other small islands in the area.

2.7 Archaeological Significance

The archaeological significance of Barrow Island is undocumented. Evidence of pre-European occupation is present on Barrow, but no comprehensive survey or dating has been undertaken. A cave occupation site, containing evidence of occupation both prior to and after the area became inundated has been discovered on the nearby Montebello Islands. As Barrow Island contains a number of large caves, it is probable that these may contain deposits of similar significance.

2.8 Past History

Barrow Island was first sighted by an expedition, led by Frenchman Nicholas Baudin, undertaken between 1801 and 1803. However, they assumed that it was part of the mainland and only named some of the capes and bays. Lieutenant Phillip Parker King named the island 'Barrows Island' during a survey of the north west coast in June 1818, in commemoration of John Barrow, a Secretary of the Admiralty at the time.

Commander John Wickham and Lieutenant John Stokes visited Barrow Island in 1840 in the *Beagle* and made observations and collections of the fauna. The island was leased as a pastoral property in 1873 but stock was never introduced due to the lack of surface water.

John Tunney, a naturalist, spent two months on Barrow Island collecting birds and mammals. The collection raised sufficient interest to have the island declared a reserve in 1908 and gazetted as an A Class Reserve for the protection of flora and fauna in 1910. In 1985, the reserve was extended to the low water mark and the vesting was changed from 'protection' to 'conservation' of flora and fauna. It is now vested in the National Parks and Nature Conservation Authority (NPNC).

British atomic weapons testing took place at the nearby Montebello Islands in 1952, and again in 1956. Following the first test, the Federal Government proclaimed an area within a 72 km radius of the test site as a 'protected' area under the *Defence Act 1903*. This excised Barrow Island and surrounding waters from petroleum exploration permits originally issued to Ampol in 1947, and transferred to WAPET in 1952. It was not until May 1963 that the area was restored to WAPET tenure, and drilling on Barrow Island began soon after.

Oil was first discovered on Barrow Island in July 1964. The oilfield was declared to be commercially viable in May 1966 and the first shipment of oil left the island in April 1967. WAPET was granted Petroleum Lease 1H in 1967 which covers the majority of Barrow

Island and all but the very southern tip of Middle Island. This lease was renewed for a further 21 years in 1988. WAPET Production licences TL/3 and L10 cover most of Boodie Island and the surrounding waters. Boodie Island and the south-west corner of Barrow Island, and the waters to the south-west and south, are covered by Oil Exploration Permit TP/2 (Figure 2 (from WAPET, 1988)).

Middle, Boodie, Double, Boomerang and Pasco Islands are C Class Nature Reserves (C38728), declared for the conservation of flora and fauna in April 1984 and vested in the NPNCA to low water mark. Also in the area are Cormorant, Mushroom, Pelican, and Prince Islands, all of which are vacant crown land. The origins of their names are as follows:

Boodie Island - name was suggested by the then Department of Fisheries and Fauna, after the animal of the same name that inhabits the island.

Boomerang Island - named by WAPET staff because of its shape.

Cormorant Island - named by F.L. Whitlock in 1918, because a large colony of pied cormorants was present on the island at the time of his visit.

Double Island - origin of name is unknown but the name appeared on Admiralty chart 1055 after Wickham's and Stokes' survey of the area. The formation consist of two islands separated by a narrow channel.

Middle Island - named because it lies between Boodie and Barrow Islands.

Mushroom Island - named by the Australian Hydrographic Service during a survey of the area in 1963.

Pasco Island - named after Lieutenant F.C.C. Pasco, who assisted in a survey of the area by Commander J.W. Combe in 1899-1900.

Pelican Island - origin of the name unknown but presumably the island was named after the bird.

Prince Island - name used by WAPET personnel, originated from the Prince Launch Service which provided the sole means of transport to Barrow Island before the airstrip was constructed.

A substantial amount of research has been carried out on Barrow Island. Past projects have included aquatic, marine and terrestrial biological inventory surveys, fauna population monitoring, monitoring of vegetation re-establishment on disturbed sites, palaeontological surveys, archaeological surveys, macropod physiological and genetic studies and soil remediation studies.

2.9 Existing Use

The majority of the islands of the Barrow group are conservation reserves vested in the NPNCA. Barrow and Middle Islands are also covered by a petroleum lease operated by WAPET. Boodie Island is covered by an exploration permit. Exploration activities, including seismic, have been carried out on both Middle and Boodie Islands.

The majority of Barrow Island is an operating oil and gas production facility and infrastructure includes accommodation and amenities buildings, office blocks and oil and gas production equipment, the most visually obvious of which are the oil storage tanks and oil well production pumps. Approximately 3% of the island is covered by infrastructure, with another 1-2% being affected by seismic exploration. These are numerous roads, an all-weather airstrip and a landfill on the island (Figure 3).

Barrow Island's port facility is registered with the Department of Transport and port limits are indicated on Admiralty chart Aus 742 (Rosemary Island to Barrow Island). A navigation beacon is located on North Double Island. Periodic Defence force training occurs on the islands. The airstrip may also be used by non-company aircraft when an emergency need arises and by charter aircraft servicing other producers in the area. Recreation by WAPET staff and contractors occurs under strict company guidelines governing a range of activities including fishing. Research projects are also carried out on the island, both by WAPET staff and others.

3.0 MANAGEMENT ARRANGEMENTS

3.1 Liaison

The NPNCA visits Barrow Island approximately every two years. Additional visits are made by CALM personnel at their request or as requested by WAPET. In the latter case WAPET will support the logistical costs of any visit.

WAPET liaises with a number of government departments on a variety of issues relevant to the operation of Barrow Island. These include the DME on matters to do with the operation of the oil and gas production facility and petroleum lease, the DEP on environmental issues, including waste disposal and control of pollution and emissions, and CALM on the management of the reserve and protection of flora and fauna.

The WAPET Environmental Consultant is the point of contact between the company and CALM. When CALM staff visit Barrow Island they are either accompanied by the Environmental Consultant or liaise with the Field Superintendent. Communications and contact procedures have also been established for use during incidents. The contact numbers of relevant CALM and WAPET offices are included in Appendix 5.

WAPET will provide an annual summary environmental report to both CALM and the DEP similar to that produced for operations on Thevenard Island

3.2 Access

The issue of access to Barrow Island is more complex than on most nature reserves. Both CALM as managers of the nature reserve, and WAPET as operators of the oil and gas production facility, have interests and legal obligations on the island. Under the *Schedule of Onshore Petroleum Exploration and Production Requirements* of the *Petroleum Act 1967*, all visitors to the petroleum lease must gain approval from the Person In Charge (Field Superintendent, WAPET) prior to going on site (majority of Barrow Island). In addition, persons intending to stay overnight outside WAPET facilities, need written permission from the Executive Director of CALM. Applications for such approval should be directed to CALM's Pilbara Regional Manager at Karratha.

Approvals for access to Middle Island must be sought from both WAPET and CALM as this island is also covered by the petroleum lease. Access to Boodie, Double, Boomerang and Pasco Islands is permitted for day visits only. Permission must be sought from the Executive Director of CALM, through the Pilbara Regional Manager, to stay on these islands overnight.

3.3 WAPET Induction

All persons working on or visiting the petroleum lease must undertake an induction which covers major safety and environmental information. The WAPET induction covers topics such as:

- the conservation status of the island
- clothing requirements
- hazardous areas
- Permit to Work system
- waste management requirements
- prohibited activities (eg. driving off road)
- mandatory activities (eg. spill reporting)
- recreational activities (eg. fishing regulations)
- safe working practices.

4.0 GENERAL MANAGEMENT OBJECTIVES

Given that Barrow Island is one of Australia's most important nature reserves and an operating oil and gas production facility and that the surrounding islands also have important conservation values, the general management objectives are:

- to protect life and property;
- to protect and conserve native flora and fauna and their habitats; and
- to manage recreational and commercial activities in order to achieve the first two objectives.

To achieve these objectives, the following issues will be covered:

quarantine; fauna and flora monitoring; scientific research; waste management; contaminated sites; safety; emergency management; fire management; recreation and heritage.

5.0 QUARANTINE

5.1 Introduction

Several introduced animal eradication programmes have been undertaken on Barrow Island and the smaller surrounding islands. These have included the removal of a cat which escaped from the barge, eradication of domestic mice (*Mus domesticus*) introduced in cargo, and eradication of black rats from the south end of Barrow Island, Middle and Boodie Islands and the other neighbouring islands.

A number of weeds species have also been detected and eradicated on Barrow Island. These include lantana, capeweed, blackberry-nightshade, melons and tomatoes. *Eucalyptus* trees and lawn have been planted around the amenities buildings. Control of buffel grass (*Cenchrus ciliaris*) around the camp facility and airstrip is ongoing.

There are localised populations of kapok (*Aerva javanica*) on Middle Island and buffel grass (*Cenchrus ciliaris*) on Boodie Island. WAPET and CALM are working co-operatively to combat the problem of introduced weeds. At CALM's suggestion and with their advice, WAPET began to remove kapok from Middle Island in early 1996. This involved spraying, hand pulling and destroying the plants. The site is monitored regularly and any emergent seedlings are removed and destroyed. No management of buffel grass has been undertaken on Boodie Island.

5.2 Objectives

- Prevent the introduction of non-endemic plant and animal species, genetic strains and diseases.
- Control and attempt to eradicate existing weed populations
- Control and eradicate any future infestations of feral animals or weeds

5.3 Policies and Strategies

WAPET Quarantine of Supply procedures (Appendix 6) are prepared and periodically reviewed in consultation with CALM and apply to all visitors to the islands. Contingency plans are in place to deal with the discovery of a feral animal species on the island. If an outbreak occurs, WAPET is required to notify CALM immediately. Extra care is taken with equipment travelling from Thevenard Island to Barrow Island to prevent the transfer of domestic mice and buffel grass seeds.

Any weed species introduced as a result of oil and gas production facility operations will be contained and eradicated by WAPET. Control of existing weeds may arise as an issue during the planning stages of an exploration or other programme, particularly on islands other than Barrow. In this case, WAPET may undertake weed control as part of that programme or allocate time and expenditure to a specific weed control programme.

5.4 Management Actions

WAPET Quarantine of Supply procedures will be followed by approved visitors to all islands in the group, and will be applied to all vehicles, boats and stores transported.

Quarantine procedures and contingency plans will be reviewed periodically, by both WAPET and CALM, to incorporate best practice. WAPET will be responsible for maintaining equipment for feral animal control. A breach of quarantine resulting in an introduction will be reported immediately to CALM's Pilbara Regional office and then the Environmental Protection Branch, Como. CALM and WAPET should then liaise on how best to approach the situation.

Any future landscaping of facilities on Barrow Island will take place only under plans approved by CALM, which will include reasons for landscaping and the species to be used.

The eradication programme for kapok on Middle Island will continue under current arrangements with WAPET which has undertaken kapok removal in January 1996 and continues to monitor and destroy the emerging seedbank. A control plan for buffel grass on Boodie Island should be implemented in the near future. Results of these programmes should be included in WAPET's annual report to government departments .

A review of fauna and flora monitoring will be carried out (see section 6) and will include the need for monitoring areas and activities where the potential for species introduction is high. A survey of all the islands in the group will be undertaken to determine the existence and extent of any populations of introduced plant species. Areas of the islands particularly prone to invasion by weeds, such as the creek behind WAPET landing, will be regularly inspected and the appropriate action taken.

Live animals will not be removed from the islands except under a licence or approval from CALM. Any animals removed from the islands will not be returned, in order to minimise the opportunity for the introduction of disease.

6.0 MONITORING OF NATIVE SPECIES

6.1 Introduction

The diverse mammal fauna, several of which are threatened species (Table 1), is one of the values that makes Barrow Island one of the most important conservation reserves in Australia. Several of the surrounding islands also support threatened mammal species. Barrow Island is also one of the most important marine turtle rookeries in WA.

CALM has an obligation to ensure the continued persistence of these and other fauna on the islands. Spotlight monitoring of mammals has been undertaken every two years since 1969, however this work was not designed to provide high quality monitoring data and interpretation of these data is difficult. Other monitoring of the fauna has been associated with research programmes (eg. CSIRO Boodie study, UWA small mammal study) or introduced rodent eradication programmes, and has not been continued.

6.2 Objective

To establish and implement monitoring protocols that will provide sufficient information to determine the status of fauna populations.

6.3 Policies and Strategies

WAPET has an obligation to ensure that their activities do not detrimentally impact on the native fauna of Barrow and surrounding islands. While there have been reviews of the environmental management of Barrow Island and support for short and medium term research programmes, no robust, longer term monitoring programmes have been devised or implemented.

CALM has policies on monitoring (Policy #28) and for translocating native fauna (Policy #29). Both refer to the need to monitor fauna, particularly where there is disturbance of some form, or animals are removed from source populations for translocation programmes.

6.4 Management Actions

- Establish protocols for terrestrial fauna monitoring on Barrow Island. These need to include:

- a) monitoring of mammal populations inside and outside the oilfield with a combination of spotlight transects and trapping;
 - b) monitoring fauna recovery where rat eradication was undertaken (south end); and
 - c) monitoring to ensure that feral animals, especially rodents and cats, do not establish.
- Establish protocols for determining the impact, if any, of road kills on mammal populations.
 - Monitor the reintroduced population of Boodie *Bettongia lesueur* on Boodie Island.
 - Continue monitoring the marine turtle rookeries on the west and east coasts of Barrow Island.

7.0 SCIENTIFIC RESEARCH

7.1 Introduction

There is a long history of environmental research on Barrow Island and WAPET has supported or initiated many and varied studies (Appendix 7). Less research has been carried out on the other islands, although they were included in a survey of dragonflies, damselflies and butterflies (Smithers and Butler, 1985), and work on the Boodie was extended to the population on Boodie Island (Short and Turner, 1989).

Research supported by WAPET is most likely to be related to the operation of the oil and gas production facility and be of benefit to WAPET in management of environmental impacts associated with their activities. In the event that WAPET support should be reduced or discontinued, alternative arrangements may be required so that research projects can proceed.

Barrow Island is an area of outstanding scientific value and will continue to be a site for academic and management-oriented research. This research is of great value as it provides knowledge and understanding of the island's natural values which are important to ongoing management and to the wider scientific community.

Past research has included aquatic, marine and terrestrial biological inventory surveys, fauna population monitoring, monitoring of vegetation re-establishment on disturbed sites, palaeontological surveys, archaeological surveys, macropod physiological and genetic studies and soil remediation studies.

7.2 Objective

To support and conduct research that will assist in improving management practices or which will contribute usefully to the wider scientific community.

7.3 Policies and Strategies

CALM is responsible for authorising (through permits and licences), encouraging and supporting studies which are significant to the understanding and management of the Barrow Island environment. CALM will continue to work with WAPET to support research projects and this liaison will continue to enable co-operative support for research endeavours. There is scope, however, for research to be carried out without WAPET financial support.

Consultation between CALM and WAPET over scientific research may assist in identifying priorities and ways to maximise the benefits of research efforts.

Should WAPET not continue their support for research projects, options for the use of WAPET facilities on a commercial/cost recovery basis, or for CALM to provide its own facility will be investigated.

7.4 Management Actions

A liaison committee will be set up consisting of a representative from CALM Science, Pilbara Regional Manager and a WAPET Environmental staff member. The committee will meet at least every 12 months to assess research priorities for the following year. It will also assist with timetabling for WAPET logistical support.

The framework for setting research priorities and approving project proposals should consider:

- the importance of the research either to the management of the islands or to the wider scientific community;
- the cumulative impacts of research activities;
- safety considerations;
- logistical implications to WAPET oil field operations; and
- whether it is necessary to recover transport, accommodation and other costs.

Approval would be required from both CALM, for the research programme, including any licences required, and WAPET for access to the petroleum lease.

Much of the research undertaken to date has been focussed on Barrow Island. Research projects, including inventory surveys, should be promoted on the smaller islands surrounding Barrow.

8.0 WASTE MANAGEMENT

8.1 Introduction

WAPET waste management is regulated by their EPA Prescribed Premises licence as administered by the DEP. Occasionally, wastes not attributable to WAPET appear on the island, particularly along the coast.

Waste generated by WAPET on Barrow Island is managed through the company's Waste Disposal Directions (Appendix 8). These are displayed at the "worksites and/or office of each workgroup" and activities are controlled through the Workgroup Safety and Environment Plan. The directions cover methods of disposal for all types of waste generated on Barrow Island, and encourage recycling and other waste minimisation strategies.

Combustible waste, including pallets, rags, paper, boxes, and wood is burnt and buried at the landfill located at R73 (Figure 3). Plastics are buried separately at the R73 landfill site. Recyclable items, such as 200 L drums, scrap steel, tyres and tubes and vehicle batteries are sorted and stored at the old airport before being returned to the mainland for reuse or disposal. Chemicals, dry cell batteries, tyres, and waste oils are returned to central locations

and stored until they can be returned to the mainland for disposal. Putrescible and office wastes are burnt in a dedicated incinerator.

8.2 Objectives

- To manage and dispose of all wastes such that there are minimal environmental impacts to the reserves or adjacent marine environment.
- To minimise the amount of waste produced.

8.3 Policies and Strategies

All people working or visiting Barrow Island will be required to follow the Barrow Island Waste Management Plan (Appendix 8) and should liaise with the WAPET Person-In-Charge. On all other islands in the group, all rubbish will be removed.

WAPET shall manage and monitor its wastes and products in accordance with its EPA license.

WAPET will continue to encourage waste minimisation, both by the supplier, and at the end point by recycling and reuse.

8.4 Management Actions

All waste produced by WAPET and other visitors to the island will be managed under the WAPET Barrow Island Waste Management Plan. WAPET will reuse or recycle as much waste as practical.

Any new waste disposal issues that may arise will be dealt with on a case by case basis in consultation with CALM and the DEP. Approvals may need to be sought for methods of disposal.

9.0 SOIL AND GROUNDWATER CONTAMINATION

9.1 Introduction

Soil and groundwater contamination can occur from leaked, spilled or inappropriately disposed substances. Contamination is managed by WAPET with levels of protection and remediation in accordance with the requirements of the DEP.

9.2 Objectives

- Minimise the risk of contamination.
- Prompt and effective management of any contamination which does occur.

9.3 Policies and Strategies

WAPET will apply continuing improvements through its Environmental Management System (EMS) to minimise risk of contamination. Risk is reduced by continual improvement of the corrosion protection system, by strict adherence to their waste disposal procedure, by appropriate storage and containment of hazardous substances, by strict adherence to incident

reporting, investigation and follow-up procedures, through adherence to industry codes of practice, and through compliance with its EPA Prescribed Premises License conditions.

Contingency plans will be prepared and maintained.

9.4 Management Actions

Development of the WAPET EMS will be an ongoing process. This includes: integration of "environment" into the existing Safety Management System, rationalisation of existing documentation and preparation of new documentation, improved integration of "environment" into internal communications meetings, environmental training, and audits of compliance and of the EMS itself.

WAPET has embraced the relevant components of the ISO 14001 standard, although it does not intend to seek certification under this standard.

WAPET will maintain the marine oil spill contingency plan, which has been reviewed by CALM, DEP and DME. WAPET undertakes regular testing and improvement of its plan.

10.0 SAFETY

10.1 Introduction

WAPET is responsible for the safety of all persons on the petroleum lease. Entry to Barrow Island normally occurs through controlled points. Workers and approved visitors to the lease currently attend an induction which covers all the safety information relevant to that person's needs. WAPET also sets minimum clothing requirements which include natural fibre clothing, long trousers, steel capped boots and hard hats. Contractors working on Barrow Island have their safety standards checked by WAPET prior to arriving on the island.

10.2 Objective

All activities be conducted in a way that minimises the risk of injury.

10.3 Policies and Strategies

No one can come onto the Barrow Island petroleum lease without the approval of the WAPET Person-In-Charge of oil field operations (as outlined in 2.11).

Everyone visiting or working on the lease must complete the WAPET induction and must meet the minimum clothing requirements.

WAPET has presented a Safety Case to DME which covers the issues involved in safety management on the lease, including contractor pre-requirements.

Prior to any projects being undertaken on the petroleum lease by WAPET, CALM or any other party, a safety plan must be approved by WAPET. The plan should identify the important safety hazards associated with the project and how they will be managed.

Activities carried out by CALM on areas outside the lease, including the other islands in the group, will require a Job Safety Analysis approved by the CALM Regional Manager.

10.4 Management Actions

WAPET will continue to operate the oil and gas production facility in accordance with the Safety Case submitted to DME and will periodically review all practices to ensure they are safe.

11.0 EMERGENCY MANAGEMENT

11.1 Introduction

WAPET has emergency procedures for oil field and associated activities, which include support for surrounding areas. Under company policy WAPET ensures these procedures are up to date, and continuously improved through regular emergency response exercises and the maintenance of equipment. Environmental impacts such as a major oil spill, quarantine breach, cyclone or wildfire are covered by these plans.

11.2 Objective

To counter emergency situations on Barrow Island and surrounding areas efficiently and safely.

11.3 Policies and Strategies

WAPET Emergency Procedures will be used as appropriate during any emergency in which the company is involved.

11.4 Management Actions

In the event of an environmental emergency, both CALM's Karratha Regional office and Environmental Protection Branch will be notified immediately. Additional advice can be sought from CALM and other experts on how best to deal with the situation.

A review of WAPET Emergency Procedures will be carried out in consultation with CALM.

WAPET Emergency Management team regularly carry out exercises to maintain a state of readiness for an emergency.

12.0 FIRE MANAGEMENT

12.1 Introduction

WAPET perceives fire as a potentially serious threat in the oilfield environment, and acts to promptly suppress all wildfires. The sixteen wildfires recorded on Barrow Island between 1968 and 1995 (WAPET Barrow Island Oilfield Environmental Review 1992-96) were all

confined to a small area. There are also records of large fires prior to WAPET occupation of Barrow, which burnt the majority of the island (*op cit*).

Fire is a natural occurrence on the islands. Whilst the historic fire frequency is probably low, it is likely that fire patterns varied in extent, frequency, and intensity, resulting in a mosaic of fuel/vegetation ages. Such variability results in refuges remaining even in large fires. Active fire suppression reduces this variability, and allows fuels to build up, increasing the probability of large, intense fires occurring. However, it can be argued that the disturbance resulting from WAPET activities and the different stages of rehabilitation present on Barrow Island result in a mosaic effect.

It is undesirable that the majority of an island is burnt in a single intense fire, which will result in fewer refuges remaining.

12.2 Objectives

- To protect life.
- To maintain vegetation community structure and floristic diversity consistent with conservation values of the reserve.
- To protect oilfield assets.

12.3 Policies and Strategies

Wildfires pose a potential threat to the oilfield and will be suppressed.

Low fuel areas and firebreaks will be maintained around key installations.

Prescribed fire may be used in the future to:

- reduce fuels around installations;
- provide strategic breaks to restrict the major spread of wildfire; and
- promote diversity in fuel/vegetation classes.

There will be no prescribed use of fire during the first 5 years after the date of approval of these guidelines.

12.4 Management Actions

WAPET will maintain an effective fire suppression capability on Barrow Island.

CALM will prepare detailed wildfire threat analysis prior to consideration of any proposals for burning for either protection or biodiversity conservation.

Active fire management (suppression/burning) will only be implemented on the smaller islands of the Barrow group if specific values requiring intervention are identified in the future. Remoteness makes suppression impractical, and burning on these small sandy islands is undesirable.

13.0 RECREATION

13.1 Introduction

Recreation by WAPET staff and contractors on Barrow Island is regulated under strict WAPET guidelines. A map of the island showing areas where fishing and shell collecting are not permitted is provided during the induction. Bag limits set by Fisheries Western Australia are followed as a minimum standard for a variety of species of fish, and live shell collecting is prohibited.

The use of contained barbeques is a common occurrence amongst recreational users of the island. These have the potential to cause vegetation damage and leave visible scars on the ground. However, WAPET provides firewood at these sites. The use of vehicles off road can also cause harm to the environment by damaging vegetation and enhancing erosion.

13.2 Objective

Recreation activities be managed such that they do not diminish the conservation and heritage values of Barrow Island.

13.3 Policies and Strategies

All people working on or visiting the island will attend WAPET induction, which covers relevant safety and environmental considerations.

Existing WAPET recreational policies will be retained and reviewed periodically in consultation with CALM. Changes will be made in view of identified impacts with particular reference to site specific management of beach access sites.

Driving off road on Barrow Island requires a permit under the Permit-to-Work system. This covers all off road driving within the oilfield.

13.4 Management Actions

WAPET will manage recreational sites in consultation with CALM. An audit of all recreational sites will be carried out by representatives from both organisations, to determine site status and the need for management controls such as restrictions on vehicle access, the use of barbeques and signage. Periodic site visits, by both WAPET and CALM, will then continue in order to maintain the management of these sites. Updates on the progress of initiatives will be included in the WAPET annual report to government departments.

14.0 CULTURAL HERITAGE

14.1 Introduction

14.1.1 Aboriginal heritage

Barrow Island is already known to carry low-intensity evidence of pre-inundation human occupation. Low level artefact and food debris are apparent at a number of locations on the island. Aborigines were also involved in pearling activities in the late 1800s and are known to have camped on the island. Quartermaine (1994) identified a number of moderately significant Aboriginal sites.

14.1.2 European heritage

A variety of artefacts are displayed in the museum on Barrow Island, including bottles, nails, and bullet shells. These have been collected from sites all over the island, indicating that there have been a number of European visitors. The remains of a rock wall exist on Middle Island. This is thought to have been constructed by pearlers in the late 19th century to provide shelter from the wind.

14.1.3 Legislation

A variety of legislation protects different types of heritage, depending on its location and its origin. Aboriginal sites are covered by the *Aboriginal Heritage Act 1972*, while the *Heritage of Western Australia Act 1990* covers other cultural heritage. Under these Acts, CALM has a responsibility to ensure the protection of archaeological and historical sites occurring within conservation reserves. Both archaeological and historical sites are known to occur on Barrow Island, although there are no heritage sites listed for the island. Section 18 clearance under the *Aboriginal Heritage Act 1972* must be obtained prior to disturbance of archaeological sites.

14.2 Objectives

- To conserve the cultural heritage of Barrow Island.
- To ensure that significant historical and archaeological sites remain undisturbed.

14.3 Policies and Strategies

Development within areas with high potential for presence of archaeological and historic sites should not proceed until a survey to comply with the *Aboriginal Heritage Act 1972* is complete.

Any clearing or ground disturbance in the oil field area must be approved through WAPET's Earthworks Approval procedure (Appendix 9). Where disturbance is likely to impact an important area, the WAPET Environmental Consultant will examine alternatives to disturbing the area and, if necessary, seek approval for the preferred alternative from the relevant authority.

14.4 Management Actions

Undertake site surveys of historical and archaeological values prior to disturbance.

Continue to document and protect sites of historical and archaeological significance.

WAPET to record the history of the oil and gas production facility on Barrow Island.

15.0 REFERENCES

- Bowman, Bishaw and Gorham (1996) Barrow Island Intertidal Survey: 1995. Unpublished report prepared for West Australian Petroleum Pty Ltd.
- Butler, W.H. (1970) A summary of the vertebrate fauna of Barrow Island. West. Aust. Nat. **11**: 149-160.
- Buckley, R.C. (1983) The flora and vegetation of Barrow Island, Western Australia. J. Roy. Soc. W.A. **66(3)**: 91-105.
- Heatwole, H. and Butler, W.H. (1981) Structure of an assemblage of lizards on Barrow Island, Western Australia. Aust. J. Herpetology **VI(2)**: 37-44.
- Humphreys, W.F. (1993) The significance of the subterranean fauna in biogeographical reconstruction: examples from Cape Range peninsula, Western Australia. Records of the Western Australian Museum Supplement **45**: 165-192.
- LeProvost Environmental Consultants (1991) Shallow marine habitats and biotic assemblages of Barrow Island. Unpublished report, prepared for West Australian Petroleum Pty Ltd.
- Mattiske Consulting Pty Ltd (1997) Assessment of revegetation on seismic lines, Barrow Island. Unpublished report, prepared for West Australian Petroleum Pty Ltd.
- Quartermaine Consultants (1994) Report on an archaeological survey program, Barrow Island. Unpublished report for West Australian Petroleum.
- Short, J. and Turner, B. (1989) The distribution and relative abundance of rare macropods and bandicoots of Barrow, Boodie and Dorre Islands. (Progress report to National Kangaroo Monitoring Unit, ANPWS.) CSIRO, Division of Wildlife and Ecology.
- Smithers, C.N. and Butler, W.H. (1985) Dragonflies and damselflies (Odonata) from Barrow and nearby islands off the coast of Western Australia. J. Aust. Entomological Mag. **12(1)**: 9-12.
- West Australian Petroleum Pty Ltd (1988) Barrow Island Oilfield Environmental Review 1963-1988.
- West Australian Petroleum Pty Ltd (1992) Barrow Island Oilfield Environmental Review 1988-1991.
- West Australian Petroleum Pty Ltd (1997) Barrow Island Oilfield Environmental Review 1992-1996.

APPENDIX 2: SUMMARY OF HABITAT AND VEGETATION UNITS ON BARROW ISLAND (from Butler, 1970 and Buckley, 1983)

Habitat Units	Larger Scale Vegetation Unit	Smaller Scale Vegetation Unit
White sand foredune	<i>Spinifex longifolius</i> assemblage	<i>Ipomoea pes-caprae</i> and <i>Salsola kali</i> on strand line, with <i>Spinifex longifolius</i> on white foredunes.
Red sand dunes	<i>Triodia epactia</i> assemblage	<i>Triodia epactia</i> with <i>Acacia coriacea</i> and <i>Scaevola cunninghamii</i> .
Limestone ridges	<i>Triodia wiseana</i> assemblages	<ol style="list-style-type: none"> 1. <i>Triodia wiseana</i> with <i>Ficus platypoda</i>, <i>Melaleuca cardiophylla</i> and mixed shrub species on ridges and caprock plateaus. 2. <i>Triodia wiseana</i> with mixed shrub species on lower ridges and slopes with limestone rubble. 3. <i>Triodia wiseana</i> with mixed shrubs on steep gullies and limestone solution hollows. 4. <i>Triodia wiseana</i> with emergent <i>Eucalyptus xerothermica</i> (ms). 5. Mixed <i>Triodia wiseana</i>, <i>T. angusta</i> and <i>T. epactia</i> on limestone ridges, white and red sands.
Clay pans	Mixed forb assemblages	<ol style="list-style-type: none"> 1. <i>Sporobolus australasicus</i> and mixed herbs on red sands and clayey soils. 2. Mixed herbs with <i>Streptoglossa bubakii</i> and <i>Pterocaulon sphacelatum</i> on scalds and flood channels.
Red earth creekbeds	<i>Triodia angusta</i> assemblages	<ol style="list-style-type: none"> 1. <i>Triodia angusta</i> on narrow dissecting water-courses in upland limestone. 2. <i>Triodia angusta</i> and <i>Gossypium robinsonii</i> on broader flat floors. 3. <i>Triodia angusta</i> with <i>Acacia bivenosa</i> on extensive lowland plains. 4. Mixed <i>Triodia angusta</i>-<i>T. pungens</i> with <i>Acacia coreacea</i> on near coastal sand plain. 5. <i>Triodia angusta</i> with <i>Erythrina vespertilio</i> in near coastal sands. 6. <i>Triodia angusta</i> with <i>Acacia victoriae</i> on red sands.
Tidal muds	Mangroves	<i>Avicennia marina</i> and chenopods in mud pockets and flats swamped by sand.

Coastal rock substrates	Mixed grass/herb/shrub assemblages	<ol style="list-style-type: none"> 1. <i>Triodia epactia</i> and <i>Capparis spinosa</i> on coastal limestone. 2. <i>Triodia angusta</i> and <i>Frankenia pauciflora</i> on exposed cliffs. 3. <i>Frankenia pauciflora</i> on exposed headlands. 4. <i>Frankenia pauciflora</i>, <i>Spinifex longifolius</i> and <i>Acacia bivenosa</i> on strandline of pebble beaches. 5. <i>Frankenia pauciflora</i> and chenopods on low coastal limestone.
Salt flats	<i>Halosarcia</i> assemblage	<i>Halosarcia</i> spp. and chenopods on salt flats.

APPENDIX 3: LIST OF FLORA SPECIES RECORDED ON BARROW ISLAND (includes comments on species that have been identified as needing special attention).

Species Name	Comments
POTAMOGETONACEAE	
<i>Ruppia maritima</i>	
POACEAE	
<i>Aristida contorta</i>	
<i>Aristida holathera</i> var. <i>holathera</i>	
<i>Bothriochloa bladhii</i>	
<i>Brachyachne</i> sp.	
<i>Cenchrus ciliaris</i>	Introduced
<i>Chrysopogon fallax</i>	
<i>Cymbopogon ambiguus</i>	
<i>Cymbopogon procerus</i>	
<i>Cynodon dactylon</i>	
<i>Dactyloctenium radulans</i>	
<i>Dichanthium sericeum</i> subsp. <i>humilis</i>	On south-east edge of island, north of Perentie Island
<i>Enneapogon caeruleus</i> var. <i>caeruleus</i>	
<i>Enneapogon oblongus</i>	
<i>Enneapogon polyphyllus</i>	
<i>Eragrostis cunningii</i>	
<i>Eragrostis falcata</i>	
<i>Eragrostis xerophila</i>	
<i>Eriachne flaccida</i>	
<i>Eriachne mucronata</i>	
<i>Eulalia aurea</i>	
<i>Iseilema dolichotrichum</i>	
<i>Paspalidium tabulatum</i>	
<i>Setaria dielsii</i>	
<i>Spinifex longifolius</i>	
<i>Sporobolus australasicus</i>	
<i>Sporobolus mitchelli</i>	Only recorded opportunistically on sunken cave area south of main road to south-west corner of island in F block. This location heavily grazed and species may be in other similar sites. Needs more research.
<i>Sporobolus virginicus</i>	
<i>Triodia angusta</i>	
<i>Triodia epactia</i>	
<i>Triodia wiseana</i>	
<i>Triraphis mollis</i>	
<i>Whiteochloa airoides</i>	On western coastal area and inland upland area. Appears that this species may be grazed in some areas and may, therefore, be more widespread. Needs more research.
<i>Yakirra australiensis</i>	
CYPERACEAE	
<i>Bulbostylis barbata</i>	
<i>Cyperus cunninghamii</i> subsp. <i>cunninghamii</i>	
<i>Fimbristylis schultzei</i>	
COMMELINACEAE	
<i>Commelina ensifolia</i>	
DASYPOGONACEAE	
<i>Acanthocarpus verticillatus</i>	
ANTHERICACEAE	
<i>Corynotheca flexuosissima</i>	
MORACEAE	
<i>Ficus opposita</i> var. <i>aculeata</i>	
<i>Ficus opposita</i> var. <i>micracantha</i>	Formerly known from only one location in south-west section of island. Despite searching, plant has not been

Ficus platypoda var. *cordata*
Ficus virens var. *virens*

PROTEACEAE

Grevillea leucodendra
Hakea lorea subsp. *cunninghamii*
Hakea suberea

SANTALACEAE

Santalum murrayanum

CHENOPODIACEAE

Atriplex isatida
Atriplex semilunaris
Chenopodium melanocarpum forma *leucocarpum*
Dysphania kalpari

Dysphania plantaginella
Dysphania rhadinostachya subsp. *inflata*
Dysphania sericeum subsp. *humilis*

Enchylaena tomentosa var. *tomentosa*
Eremophea spinosa
Halosarcia halocnemoides
Halosarcia indica subsp. *leiostachya*

Neobassia astrocarpa
Rhagodia latifolia var. *latifolia*
Rhagodia preissii subsp. *obovata*
Salsola kali

Threlkeldia diffusa

AMARANTHACEAE

Amaranthus mitchelli
Amaranthus pallidiflorus
Amaranthus sp. Barrow Island (R. Buckley 6884)
Gomphrena conferta
Hemichroa diandra
Ptilotus clementii
Ptilotus exaltatus var. *exaltatus*
Ptilotus fusiformis
Ptilotus obovatus
Ptilotus villosiflorus

NYCTAGINACEAE

Boerhavia burbridgeana
Boerhavia coccinea
Boerhavia gardneri
Boerhavia aff. *repleta*

Commicarpus australis

GYROSTEMONACEAE

Codonocarpus cotinifolius

AIZOACEAE

Sesuvium portulacastrum

PORTULACACEAE

Calandrinia polyandra
Calandrinia aff. *polyandra*

CARYOPHYLLACEAE

Polycarpaea longiflora

LAURACEAE

relocated. Needs further searching. Difficult to differentiate so relocation will be opportunistic.

Known from both the cliff faces near E and F blocks and limestone fault and near Biggada Creek on Y53. Appears to occur on edges of central limestone plateau.

Scattered populations in the middle section of the island.

Scattered populations in the middle section of the island.

Restricted to one localised population near R47.

At northern end of island in sand dunes, Terminal Creek and in gully east of F24. Needs further research.

On south-east edge of island, north of Perentie Island. Needs further research.

Restricted to tidal flood areas, collected on north-eastern section of island. Potentially on other tidal flood areas.

Cassytha capillaris

Creeper on *Triodia* and occasional *Ficus* tree. Near seismic line 68; south-west corner of island and near Biggada Creek on coastline. Needs further research to determine extent of species.

CAPPARACEAE

Capparis lasiantha

Capparis spinosa

Cleome viscosa

BRASSICACEAE

Lepidium platypetalum

PITTOSPORACEAE

Pittosporum phylliraeoides

SURIANACEAE

Stylobasium spathulatum

MIMOSACEAE

Acacia bivenosa

Acacia coriacea subsp. *coriacea*

Acacia cowleana

Restricted to one small population or a few shrubs near F24.

Acacia gregorii

Acacia inequilatera

Dwarf form of mainland species. Restricted to south-west corner of island.

Acacia pyrifolia

Acacia synchronica

Restricted to south-east section of island and north-east of airstrip. Habitat specific with associated range of annual species and *Triodia angusta*.

CAESALPINIACEAE

Petalostylis labicheoides

Senna artemisioides subsp. *oligophylla*

Senna glutinosa subsp. *pruinosa*

Senna notabilis

PAPILIONACEAE

Canavalia rosea

Crotalaria medicaginea

Cullen lachnostachys

Cullen leucanthum

Erythrina vespertilio

Restricted to 5 main populations and localised scattered trees.

Indigofera boviparda

Indigofera colutea

Indigofera linifolia

Indigofera monophylla

Indigofera trita

Isotropis atropurpurea

Localised in occurrence near road to John Wayne Country and near *E. xerothermica* (ms) stand in Y block. Needs further searching to locate additional populations.

Lotus cruentus

Psoralea leucantha

Psoralea patens

Near J68 and old road to The Chair. Prostrate *Psoralea*. Needs further searching to locate more populations.

Psoralea pustulata

*Rhynchosia minima**

Sesbania cannabina

Swainsona kingii

Swainsona pterostylis

Tephrosia rosea

Tephrosia rosea var. *clementii*

ZYGOPHYLLACEAE

Tribulus cistoides

Tribulus occidentalis

Tribulus terrestris

EUPHORBIACEAE

Adriana tomentosa var. *tomentosa*

Euphorbia alsiniflora

Euphorbia australis

Euphorbia australis subsp. *vaccaria*

Euphorbia coghlanii

Euphorbia drummondii subsp. *drummondii*

Euphorbia myrtoides

Euphorbia tannensis subsp. *eremophila*

Euphorbia sp.A

Found near entrance to Biggada Creek. Needs further research and in meantime entrance to Biggada Creek needs protection.

Flueggea virosa subsp. *melanthesoides*

Mallotus didmochryseus

Localised in occurrence, near Y53 and patch of *E. xerothermica* (ms) in Y block. Needs further searching to locate more populations.

Mallotus nesophilus

Phyllanthus maderaspatensis

Phyllanthus sp.

STACKHOUSIACEAE

Stackhousia muricata

SAPINDACEAE

Diplopeltis eriocarpa

Dodonaea lanceolata

RHAMNACEAE

Ventilago viminalis

TILIACEAE

Corchorus parviflorus

Corchorus walcottii

Corchorus sp. Barrow (B. Clay & M. Yardar s.n. 21/11/65)

Of conservation significance P3

Corchorus sp. Burrup subsp. Barrow

recommended as P3 taxon

Triumfetta clementii

Triumfetta ramosa

Triumfetta sp. Rudall

MALVACEAE

Abutilon cunninghamii

Abutilon exonemum

Abutilon indicum var. *australiense*

Abutilon otocarpum

Gossypium australe

Only collected in Terminal Creek. Needs further research. Known from studies by Trudgen (1989); near R47 and R57 wells. Needs further field studies and protection from disturbance (gully vegetation - *Triodia wiseana*/*Triodia angusta*).

Gossypium robinsonii

Hibiscus burtonii

Hibiscus coatesii

Hibiscus leptocladus

Hibiscus sturtii var. *platychlamys*

Located on edges of red sand areas and in gullies on western and northern edges of island.

Lawrenzia viridigrisea

Malvastrum americanum

Introduced.

Sida fibulifera

Sida micracantha

On coastal red sands and valley system on road to John Wayne Country. Needs further searching to locate more populations.

STERCULIACEAE

Hannafordia quadrivalvis
Melhania oblongifolia
Waltheria indica
FRANKENIACEAE
Frankenia ambita
Frankenia pauciflora
VIOLACEAE
Hybanthus aurantiacus

Located on a disturbed site near BB52J on northern section of island. Needs further research to locate more populations. Location on disturbed site may indicate that it is an opportunistic species.

CYMODOCEACEAE
Halodule uninervis
PASSIFLORACEAE
Passiflora foetida var. *hispida*
MYRTACEAE
Eucalyptus xerothermica (ms)

Melaleuca cardiophylla

Restricted to three main small populations and a few scattered trees; north 100m from R68.
Widespread in central part of island on upland limestone areas. Apparently difficult to regenerate after disturbance. Needs further research on regeneration requirements.

HALORAGACEAE
Haloragis gossei
PLUMBAGINACEAE
Muellerolimon salicorniaceum
Plumbago zeylanica
GENTIANACEAE
Centaurium erythraea
ASCLEPIADACEAE
Cynanchum floribundum
Marsdenia sp.
Sarcostemma viminale subsp. *australe*
Tylophora flexuosa
CONVOLVULACEAE
Evolvulus alsinoides var. *decumbens*
Polymeria ambigua
Polymeria sp.
CUSCUTACEAE
Cuscuta sp.
BORAGINACEAE
Cordia subcordata
Heliotropium crispatum
Heliotropium cunninghamii
Heliotropium glanduliferum
Heliotropium inexplicitum
Heliotropium ovalifolium
Trichodesma zeylanicum
VERBENACEAE
Clerodendrum tomentosum
AVICENNIACEAE
Avicennia marina subsp. *marina*
SOLANACEAE
Nicotiana benthamiana
Nicotiana occidentalis subsp. *occidentalis*
Solanum cf. *horridum*
Solanum cleistogamum
Solanum diversiflorum
Solanum esuriale
Solanum lasiophyllum

SCROPHULARIACEAE

Stemodia glabella

Relatively widespread and opportunistic species on top of hill near turnoff to airport on Camp Road and on *Triodia* slopes on south-west corner near flats south of The Chair. Needs more research to clarify *Stemodia glabella* and *S. grossa*.

ACANTHACEAE

Dicladanthera forrestii

Dipteracanthus australasicus

Dipteracanthus australasicus subsp. cf. *corynothecus*

MYOPORACEAE

Eremophila forrestii subsp. *forrestii*

Myoporum acuminatum

Myoporum montanum

RUBIACEAE

Hedyotis crouchiana

Oldenlandia crouchiana

Synaptantha tillaeacea var. *tillaeacea*

CUCURBITACEAE

Mukia maderaspatana

CAMPANULACEAE

Wahlenbergia

GOODENIACEAE

Goodenia microptera

Scaevola amblyanthera var. *amblyanthera*

Scaevola cf. *aemula*

Scaevola crassifolia

Scaevola cunninghamii

Scaevola spinescens

Scaevola sp.

ASTERACEAE

Centipeda minima

Flaveria australasica

Helichrysum oligochaetum

Olearia dampieri subsp. *dampieri*

Pentalepis trichodesmoides

Pluchea rubelliflora

Pluchea squarrosa

Pluchea tetranthera

Pluchea sp.

Pterocaulon sphacelatum

Streptoglossa adscendens

Streptoglossa bubakii

Streptoglossa decurrens

Streptoglossa macrocephala

Vittadinia arida

Vittadinia obovata

APPENDIX 4: LIST AND STATUS OF FAUNA ON BARROW ISLAND

Table 1: Mammal species on Barrow Island

Scientific Name	Common Name	WA status	IUCN Red List Category
<i>DASYURIDAE</i>			
<i>Pseudantechinus macdonnellensis</i>	Fat-tailed Antechinus		LR(lc)
<i>Planigale maculata maculata</i>	Common Planigale		LR(lc)
<i>PERAMELIDAE</i>			
<i>Isoodon auratus barrowensis</i>	Golden Bandicoot	P4	VU (D2)
<i>PHALNGERIDAE</i>			
<i>Trichosurus arnhemensis</i>	Northern Brushtail Possum		LR(lc)
<i>MACROPIDIDAE</i>			
<i>Macropus robustus isabellinus</i>	Barrow Island Euro	T	VU (D2)
<i>Lagorchestes conspicillatus conspicillatus</i>	Spectacled Hare-wallaby	T	LR(lc)
<i>Petrogale lateralis lateralis</i>	Black-flanked Rock Wallaby	T	VU (B1 + B2a,b,c,e, C2a)
<i>POTOROIDAE</i>			
<i>Bettongia lesueur</i> unnamed subspecies	Boodie, Burrowing Bettong	T	VU (D2)
<i>EMBLONURIDAE</i>			
<i>Taphozous georgianus</i>	Common Sheathtail Bat		LR(lc)
<i>MOLLOSIDAE</i>			
<i>Tadarida australis australis</i>	Mastiff Bat		
<i>VESPERTILIONIDAE</i>			
<i>Vespadelus finlaysoni</i>	Finlayson's Cave Bat		LR(lc)
<i>PTEROPODIDAE</i>			
<i>Pteropus alecto</i>	Little Red Flying Fox		
<i>MURIDAE</i>			
<i>Pseudomys nanus ferculinus</i>	Barrow Island Chestnut Mouse		VU (D2)
<i>Zyomys argurus</i>	Djoorri, Common Rock Rat		LR(lc)
<i>Hydromys chrysogaster caurinus</i>	Rakali, Water Rat		LR(lc)
<i>DUGONGIDAE</i>			
<i>Dugong dugon</i>	Dugong	SP	VU
<i>DELPHINIDAE</i>			
<i>Pseudorca crassidens</i>	False Killer Whale		
<i>Sousa</i> sp.	Dolphin		
<i>Steno bredanensis</i>	Rough-toothed Dolphin		
<i>Tursiops truncatus aduncus</i>	Bottle-nosed Dolphin		
<i>Grampus griseus</i>	Risso's Dolphin		
<i>Delphinus delphis dussumieri</i>	Common Dolphin		
<i>PHYSETERIDAE</i>			
<i>Physeter macrocephalus</i>	Sperm Whale	P4	
<i>Megaptera novaeangliae</i>	Humpback Whale	T	
<i>BALANOPTERIDAE</i>			
<i>Balaenoptera musculus</i>	Blue Whale	T	

NOTE: T = threatened fauna under *Wildlife Conservation Act 1950*

SP = specially protected fauna under *Wildlife Conservation Act 1950*

P4 = priority 4 (in need of monitoring) on CALM's Priority Fauna List

VU = vulnerable on IUCN Red List

LR(lc) = lower risk (least concern) on IUCN Red List

Table 2: Bird species on Barrow Island

Scientific Name	Common Name	Status	Breeding records
<i>PODICEPIDIDAE</i>			
<i>Tachybaptus novaehollandiae</i>	Australasian Grebe		
<i>DIOMEDEIDAE</i>			
<i>Diomedea chlororhynchos</i>	Yellow-nosed Albatross		
<i>PROCELLARIDAE</i>			
<i>Puffinus pacificus</i>	Wedge-tailed Shearwater		Boodie, N. Double, S. Double, Middle
<i>PELECANIDAE</i>			
<i>Pelecanus conspicillatus</i>	Australian Pelican		
<i>SULIDAE</i>			
<i>Sula dactylatra</i>	Masked Booby		
<i>Sula leucogaster</i>	Brown Booby		
<i>PHALACROCORACIDAE</i>			
<i>Phalacrocorax varius</i>	Pied Cormorant		
<i>Phalacrocorax carbo</i>	Great (Black) Cormorant		
<i>FREGATIDAE</i>			
<i>Fregata ariel</i>	Lesser Frigate Bird		
<i>PHAETHONTIDAE</i>			
<i>Phaethon rubricauda</i>	Red-tailed Tropic Bird	P4	
<i>ARDEIDAE</i>			
<i>Ardea novahollandiae</i>	White-faced Heron		
<i>Egretta garzetta</i>	Little Egret		
<i>Egretta sacra</i>	Eastern Reef Heron		Boodie, N. Double, S. Double
<i>Butorides striatus</i>	Mangrove Heron		
<i>Nycticorax caledonicus</i>	Rufous Night Heron		
<i>ANATIDAE</i>			
<i>Cygnus atratus</i>	Black Swan		
<i>Tadorna tadornoides</i>	Australian Shelduck		
<i>Anas gibberifrons</i>	Grey Teal		
<i>Chenonetta jubata</i>	Maned (Wood) Duck		
<i>PANDIONIDAE</i>			
<i>Pandion haliaetus</i>	Osprey		Boodie, Boomerang, S. Double, Middle
<i>ACCIPITRIDAE</i>			
<i>Elanus notatus</i>	Black-shouldered Kite		
<i>Milvus indus</i>	Brahminy Kite		Middle
<i>Milvus sphenurus</i>	Whistling Kite		
<i>Lophoictinia isura</i>	Square-tailed Kite	P4	
<i>Hamirostra melanostrerna</i>	Black-Breasted Buzzard	P4	
<i>Haliaeetus leucogaster</i>	White-breasted Sea Eagle		Boodie, S. Double, Pascoe
<i>Aquila audax</i>	Wedge-tailed Eagle		
<i>Circus assimilis</i>	Spotted Harrier		
<i>FALCONIDAE</i>			
<i>Falco longipennis</i>	Australian Hobby		
<i>Falco berigora</i>	Brown Falcon		

<i>Falco cenchroides</i>	Australian Kestrel		
<i>PHASIANIDAE</i>			
<i>Coturnix ypsilophora</i>	Brown Quail		
<i>OTIDIDAE</i>			
<i>Areaotis kori</i>	Kori (Australian) Bustard		
<i>BURHINIDAE</i>			
<i>Esacus magnirostrus</i>	Beach Stone-curlew	P4	N. Double, S. Double, Middle
<i>HAEMATOPODIDAE</i>			
<i>Haemotopus ostralegus</i>	Pied Oystercatcher		Double, Middle
<i>Haemotopus fuliginosus</i>	Sooty Oystercatcher		Boomerang, Double, Middle
<i>CHARADRIIDAE</i>			
<i>Pluvialis sqatarola</i>	Grey Plover		
<i>Pluvialis dominica</i>	Lesser (Pacific) Golden Plover		
<i>Charadrius leschenaultii</i>	Large Sand Plover		
<i>Charadrius veredus</i>	Oriental Plover		
<i>Charadrius ruficapillus</i>	Red-capped Plover		
<i>RECURVIROSTRIDAE</i>			
<i>Himantopus himantopus</i>	Black-winged Stilt		
<i>Cladorhynchus leucocephalus</i>	Banded Stilt		
<i>SCOLAPACIDAE</i>			
<i>Arenaris interpres</i>	Ruddy Turnstone		
<i>Numenius madagascariensis</i>	Eastern Curlew		
<i>Numenius phaeopus</i>	Whimbrel		
<i>Numenius minutus</i>	Little Whimbrel		
<i>Tringa glareola</i>	Wood Sandpiper		
<i>Tringa brevipes</i>	Grey-tailed Tattler		
<i>Actitis hypoleucos</i>	Common Sandpiper		
<i>Tringa nebularia</i>	Greenshank		
<i>Xenus cinereus</i>	Terek Sandpiper		
<i>Limosa limosa</i>	Black-tailed Godwit		
<i>Limosa lapponica</i>	Bar-tailed Godwit		
<i>Calidris canutus</i>	Red Knot		
<i>Calidris tenuirostris</i>	Great Knot		
<i>Calidris acuminata</i>	Sharp-tailed Sandpiper		
<i>Calidris ruficollis</i>	Red-necked Stint		
<i>Calidris ferruginea</i>	Curlew Sandpiper		
<i>Calidris alba</i>	Sanderling		
<i>GLAREOLIDAE,</i>			
<i>Stiltia isabella</i>	Australian Pratincole		
<i>LARIDAE</i>			
<i>Larus novahollandiae</i>	Silver Gull		Boodie, Middle
<i>Chlidonias leucoptera</i>	White-winged Black Tern		
<i>Sterna caspia</i>	Caspian Tern		Boodie, Middle
<i>Sterna nilotica</i>	Gull-billed Tern		

<i>Sterna hirundo longipennis</i>	Common Tern		
<i>Sterna dougalli</i>	Roseate Tern		
<i>Sterna anaethetus</i>	Bridled Tern		
<i>Sterna nereis</i>	Fairy Tern	P4	Middle
<i>Sterna bergii</i>	Crested Tern		
<i>Sterna bengalensis</i>	Lesser Crested Tern		
<i>Anous tenuirostris</i>	Lesser Noddy	T	
COLUMBIDAE			
<i>Geopelia placida</i>	Peaceful Dove		
<i>Geopelia humeralis</i>	Bar-shouldered Dove		
<i>Geophaps lophotes</i>	Crested Pigeon		
CACATUIDAE			
<i>Cacatua roseicapilla</i>	Galah		
<i>Cacatua pastinator</i>	Little Corella		
POLYTELITIDAE			
<i>Leptolophus hollandicus</i>	Cockatiel		
PLATYCERCIDAE			
<i>Melopsittacus undulatus</i>	Budgerigar		
CUCULIDAE			
<i>Cuculus pallidus</i>	Pallid Cuckoo		
<i>Chrysococcyx osculans</i>	Black-eared Cuckoo		
<i>Chrysococcyx basalis</i>	Horsfield's Bronze Cuckoo		
STRINGIDAE			
<i>Ninox novaeseelandiae</i>	Boobook Owl		
TYTONIDAE			
<i>Tyto alba</i>	Barn Owl		
APODIDAE			
<i>Hirundapus caudacutus</i>	White-throated Needletail		
<i>Apus pacificus</i>	Fork-tailed Swift		
ALCEDINIDAE			
<i>Todirhamphus pyrrhopygia</i>	Red-backed Kingfisher		
<i>Todirhamphus sancta</i>	Sacred Kingfisher		
HIRUNDINIDAE			
<i>Hirundo neoxena</i>	Welcome Swallow		
<i>Hirundo nigricans</i>	Tree Martin		
<i>Hirundo ariel</i>	Fairy Martin		
MOTACILLIDAE			
<i>Anthus novaeseelandiae</i>	Richard's Pipit		
CAMPEPHAGIDAE			
<i>Coracina novaehollandiae</i>	Black-faced Cuckoo Shrike		
<i>Lalage tricolor</i>	White-winged Triller		
MONARCHIDAE			
<i>Rhipidura leucophrys</i>	Willie Wagtail		
SYLVIDAE			
<i>Eremiornis carteri</i>	Spinifexbird		
<i>Cinclorhampus cruralis</i>	Brown Songlark		
MALURIDAE			

<i>Malurus leucopterus edourdi</i>	Black and White Fairy-wren	T
<i>MELIPHAGIDAE</i>		
<i>Acanthagenys rufogularis</i>	Spiny-cheeked Honeyeater	
<i>Lichenostomus virescens</i>	Singing Honeyeater	
<i>EPHTHIANURIDAE</i>		
<i>Epthainura tricolor</i>	Crimson Chat	
<i>ZOSTEROPIDAE</i>		
<i>Zosterops lutea</i>	Yellow White-eye	
<i>PLOCEIDAE</i>		
<i>Emblema pictum</i>	Painted Firetail	
<i>Poe-phila guttata</i>	Zebra Finch	
<i>GRALLINIDAE</i>		
<i>Grallina cyanoleuca</i>	Australian Magpie-lark	
<i>ARTAMIDAE</i>		
<i>Artamus leucorhynchus</i>	White-breasted Woodswallow	
<i>Artamus personatus</i>	Masked Woodswallow	
<i>Artamus cinereus</i>	Black-faced Woodswallow	
<i>CORVIDAE</i>		
<i>Corvus bennetti</i>	Little Crow	

NOTE: T = threatened fauna under *Wildlife Conservation Act 1950*

SP = specially protected fauna under *Wildlife Conservation Act 1950*

P4 = priority 4 (in need of monitoring) on CALM's Priority Fauna List

Table 3: Reptiles and Amphibians of Barrow Island

Scientific Name	Common Name	Status
<i>CHELONIIDAE</i>		
<i>Caretta caretta</i>	Loggerhead Turtle	T
<i>Chelonia depressa</i>	Flatback Turtle	
<i>Chelonia mydas</i>	Green Turtle	
<i>Eretmochelys imbricata</i>	Hawksbill Turtle	
<i>GEKKONIDAE</i>		
<i>Diplodactylus jeanae</i>		
<i>Diplodactylus stenodactylus</i>	Crowned Gecko	
<i>Gehyra pilbara</i>	Pilbara Dtella	
<i>Gehyra variegata</i>	Tree Dtella	
<i>Heteronotia bynoei</i>	Bynoe's Gecko	
<i>PYGOPODIDAE</i>		
<i>Delma borea</i>		
<i>Delma nasuta</i>		
<i>Delma tinctoria</i>		
<i>Lialis burtonis</i>	Burton's Legless Lizard	
<i>Pygopus nigriceps nigriceps</i>		
<i>AGAMIDAE</i>		
<i>Ctenophorus caudicinctus</i>	Ring-tailed Dragon	
<i>Pogona minor</i>	Western Jew Lizard	
<i>Gemmatophora gilberti</i>	Gilbert's Water Dragon, Tata Lizard	
<i>SCINCIDAE</i>		
<i>Carlia tricantha</i>		
<i>Cryptoblepharus carnabyi</i>		
<i>Ctenotus duricola</i>		
<i>Ctenotus grandis titan</i>		
<i>Ctenotus hanloni</i>		
<i>Ctenotus pantherinus acripes</i>		?
<i>Ctenotus saxatilis</i>		
<i>Ctenotus serventyi</i>		
<i>Eramiascincus richardsonii</i>	Banded Skink	
<i>Lerista bipes</i>		
<i>Lerista elagans</i>		
<i>Lerista muelleri</i>		
<i>Menetia greyii</i>		
<i>Morethia lineoocellata</i>		
<i>Morethia ruficauda exquisita</i>	Firetail	
<i>Notoscincus ornatus</i>		
<i>Omolepida branchialis</i>		
<i>Proablepharus reginae</i>		
<i>Sphenomorphus isolepis</i>		
<i>VARANIDAE</i>		
<i>Varanus acanthurus</i>	Spiny-tailed Goanna	
<i>Varanus giganteus</i>	Perentie	
<i>TYPHLOPIDAE</i>		
<i>Rhamphotyphlops diversus</i>	Blind Snake	

ammodytes

BOIDAE

Morelia stimsoni stimsoni

Stimson's Python

ELAPIDAE

Demansia rufescens

Rufous Whipsnake

Furina ornata

Moon Snake

Pseudechis australis

Mulga Snake

Vermicella approximans

Northwestern Shovel-nosed Snake

HYDROPHIIDAE

Acalpytophis peronii

Horned Sea Snake

Aipysurus apraefrontalis

Short-nosed Sea Snake

Aipysurus duboisii

Dubois' Sea Snake

Aipysurus laevis

Golden Sea Snake

Astrotia stokesii

Stokes' Sea Snake

Emydocephalus annulatus

Turtle-headed Sea Snake

Hydrophis elegans

Bar-bellied Sea Snake

Hydrophis kingii

Spectacled Sea Snake

Hydrophis major

Olive-headed Sea Snake

Hydrophis ocellatus

Spotted Sea Snake

AMPHIBIANS

Cyclorana maini

Main's Frog

NOTE: T = threatened fauna under *Wildlife Conservation Act 1950*

SP = specially protected fauna under *Wildlife Conservation Act 1950*

P4 = priority 4 (in need of monitoring) on CALM's Priority Fauna List

APPENDIX 5 - CONTACT NUMBERS FOR WAPET AND CALM

	Address	Phone Number	Fax Number
WAPET	250 St Georges Tce Box S1580 GPO Perth WA 6001	08 9263 6000	08 9263 6699
	Barrow Island	08 9184 3723	08 9184 3799
CALM - Como	Environmental Protection Branch 50 Hayman Road Locked Bag 104 Bentley Delivery Centre 6983	08 9334 0365	08 9367 9913
CALMScience	PO Box 51 Wanneroo 6065	08 9405 5100	08 9306 1641
CALM - Karratha	SGIO Building Welcome Road PO Box 835 Karratha WA 6714	08 9143 1488	08 9144 1118

APPENDIX 7: RESEARCH PROJECTS SUPPORTED BY WAPET ON BARROW ISLAND

Year	Recipients	Details
1973	Mr LA Smith	Study of the terrestrial species of reptiles, their distribution, breeding condition, diet, body size and time of activity. Discuss relationships between Barrow Island and mainland fauna.
1974	Mr LS Hammond	Fauna of littoral environment, including soft mud, rocky shores on western and eastern sides, mangrove areas and sandy beaches.
1975	Dr HR Bakker	Adaptation of the Spectacled Hare-wallaby to arid conditions. Studied water and electrolyte metabolism.
1976	Mr EH Sedgewick	Annotated summary of birds so far recorded, indication of breeding status, localities sighted and population strength. Population survey of resident land birds.
1977	Prof. H Heatwole	The structure of an assemblage of 12 species of lizard from a typical <i>Triodia</i> habitat.
1978	Mr BJ Stephens	The role of metabolically active metals (eg. Cu, Zn) in Barrow Island mammals and establishment of baseline levels of toxic heavy metals in the area.
1979	Dr RD Wooler & Dr SJ Bradley	Examination of the insect diet of some of the main bird species, calls and behavioural responses of Spinifex Birds and genetic differences with mainland species.
1980	Dr RC Buckley	Botanical survey and flora checklist, resulting in the identification of 29 vegetation units. Detailed descriptions and mapping of main units. Assessment of factors responsible for distribution of species.
1981	Dr KJ McNamara & Mr GW Kendrick	Study of Miocene fossils in the Trealla Limestone. New species of fossils discovered.
1982	Dr CN Smithers	Production of an insect inventory on Barrow Island and nearby islands.
1983/84	Dr DR King & Dr B Green	Thermoregulation, turnover rates and diet of the Perentie, <i>Varanus giganteus</i> .
1987/89	Dr JC Short	Distribution, abundance and habitat preference of the Burrowing Bettong, <i>Bettongia lesueur</i> . Also includes work on Bandicoots, <i>Isoodon auratus</i> , and other rare macropods on Barrow Island, with similar studies on Bernier and Dorre Islands, Shark Bay.
1988	Dr IT Grierson & Dr MM Lewis	Development of a soils and vegetation Geographic Database for Barrow Island with the aid of remote sensing techniques.
1988/94	Prof D Bradshaw	Resource utilisation by mammals. Use of radioisotopes to trace wildlife requirements such as water, sodium and oxygen.
1991	Dr W Humphreys	Survey of caves on Barrow Island for invertebrate species. Discovered one new genus and 9 new species.
1993	Dr K Aplin	Vertebrate palaeontology. Found fossils 5000 to 7 million

		years old. Indications of environmental change they reflect.
1993	Perth Zoo & CALM	Survey of Barrow Island for Black-footed Rock Wallabies. Population stable at around 150 animals.
1994/96	Ms J King	Use of physiological parameters to monitor stress levels in rare mammal populations and adaptation to the arid environment. Genetic variation in wallabies and euros very low; euros anaemic; hormone levels measured in relation to water stress.
1986 onwards	Dr RIT Prince	Tagging and monitoring of nesting turtle populations.

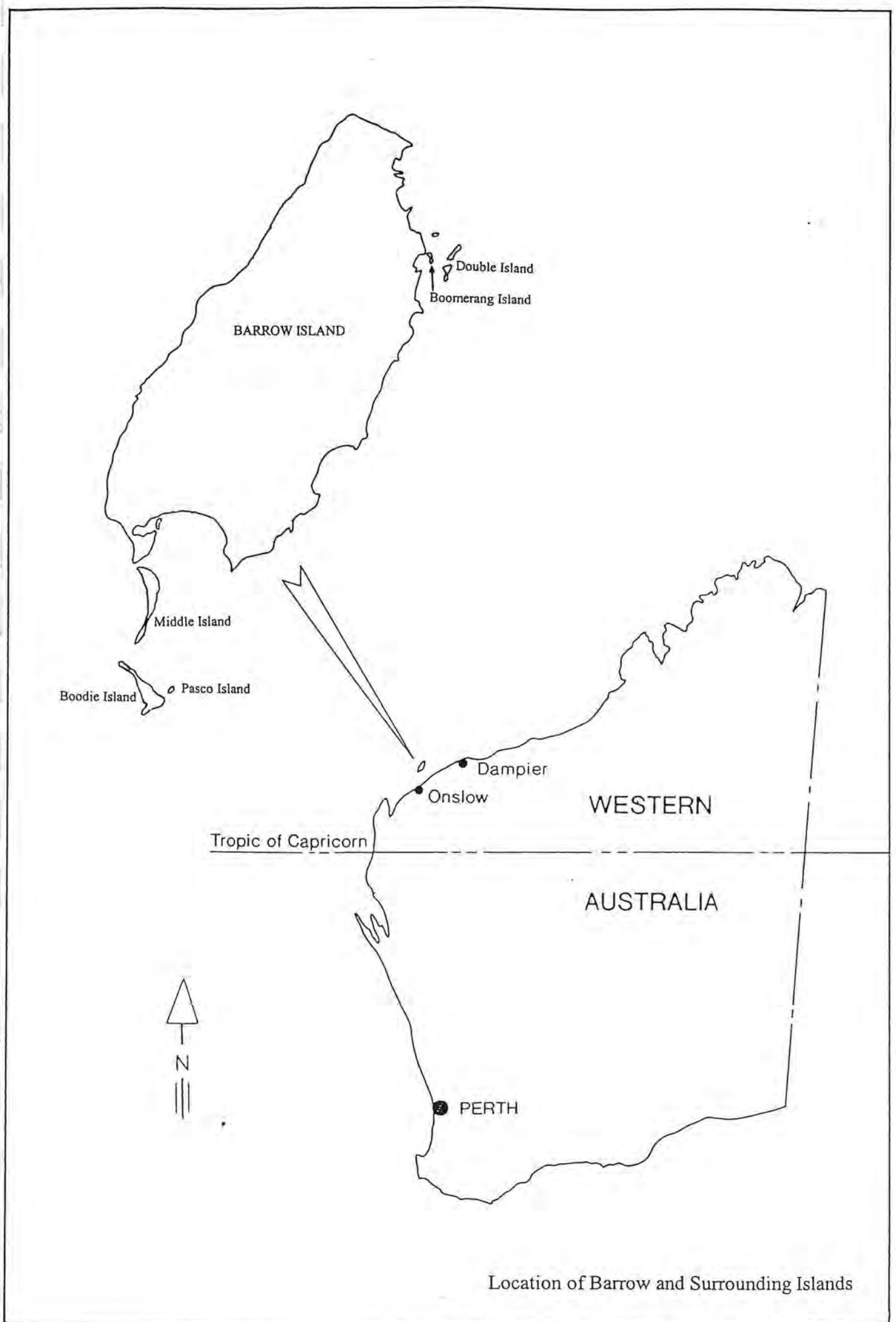
APPENDIX 10: APPLICABLE ACTS

Western Australian

Aboriginal Affairs Planning Authority Act 1972
Aboriginal Heritage Act 1972
Bush Fires Act 1954
Conservation and Land Management Act 1984
Environmental Protection Act 1986
Explosives and Dangerous Goods Act 1961
Fish Resources Management Act 1994
Health Act 1911
Heritage of Western Australia Act 1990
Land Administration Act 1997
Marine and Harbours Act 1981
Maritime Archaeology Act 1973
Mining Act 1978
Petroleum Act 1936
Petroleum Act 1967
Petroleum Pipelines Act 1969
Petroleum (Submerged Lands) Act 1982
Pollution of Waters by Noxious Substances Act 1987
Ports (Functions) Act 1994
Shipping and Pilotage Act 1967
Transport Co-ordination Act 1967
Western Australian Marine Act 1982
Western Australian Marine (Sea Dumping) Act 1981
Wildlife Conservation Act 1950

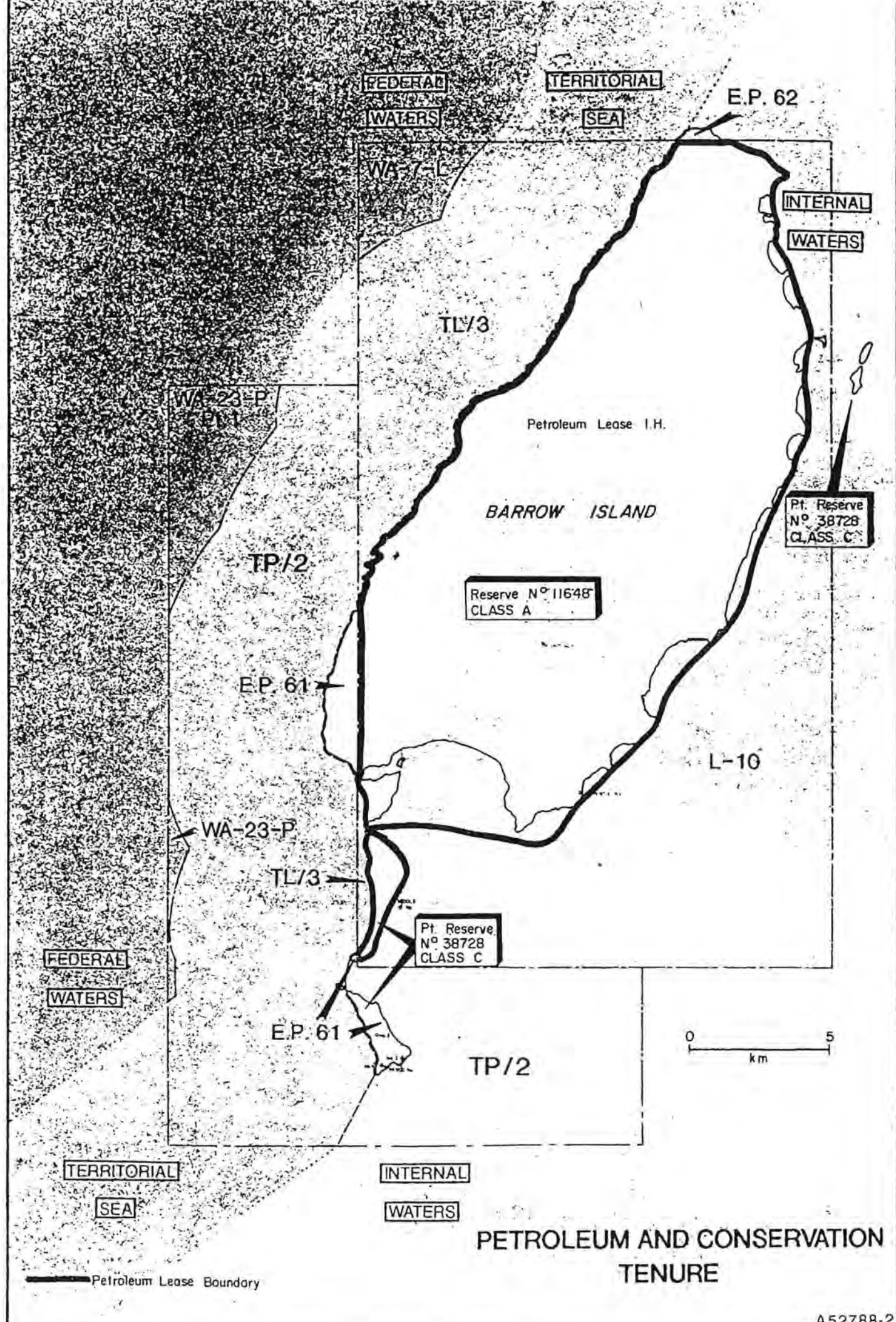
Commonwealth

Aboriginal and Torres Strait Islander Heritage Protection Act 1984
Australian Heritage Commission Act 1975
Defence Act 1903-1973
Endangered Species Protection Act 1992
Environmental Protection (Impact of Proposals) Act 1974
Environmental Protection (Sea Dumping) Act 1981
Historic Shipwrecks Act 1976
National Parks and Wildlife Conservation Act 1975
Native Title Act 1993
Petroleum (Submerged Lands) Act 1967
Protection of the Sea (Civil Liability) Act 1981
Protection of the Sea (Prevention of Pollution from Ships) Act 1983
Protection of the Sea (Powers of Intervention) Act 1981
Whale Protection Act 1980



Location of Barrow and Surrounding Islands

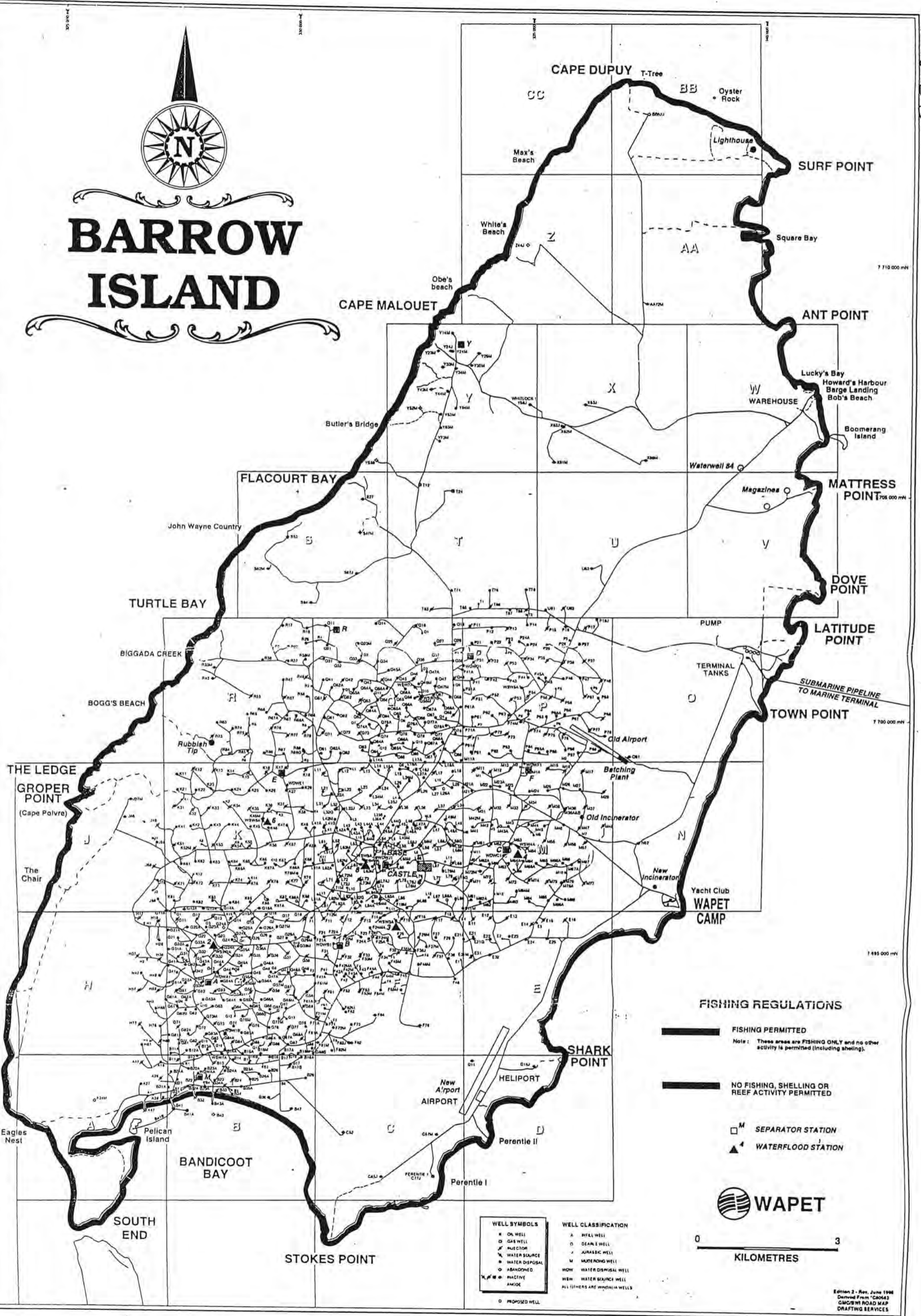
Figure 1







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FIGURE 2



BARROW ISLAND











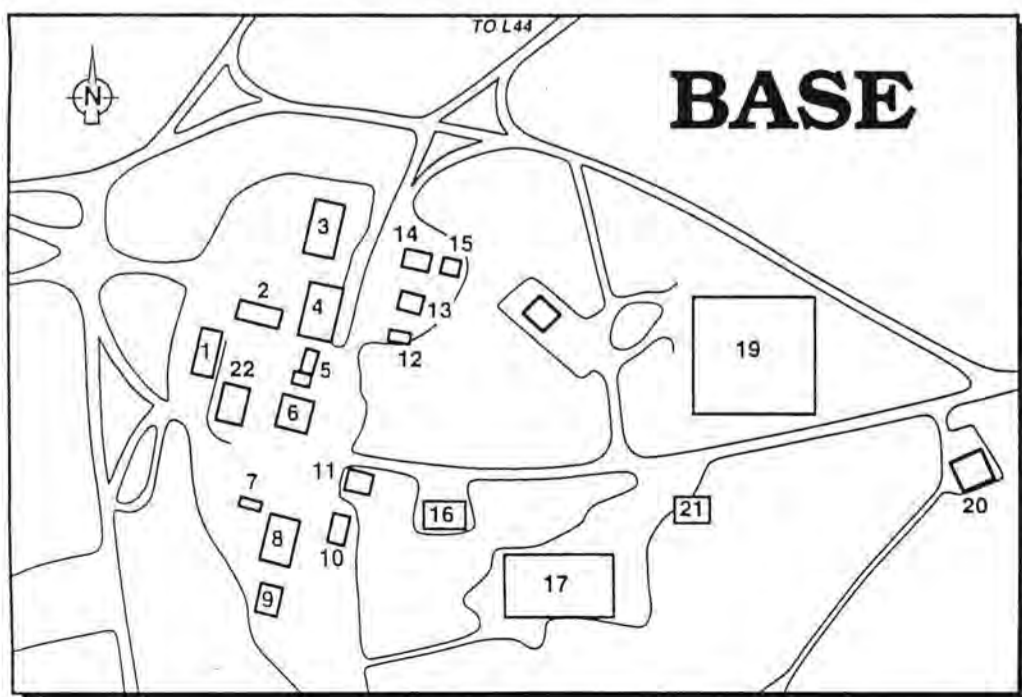
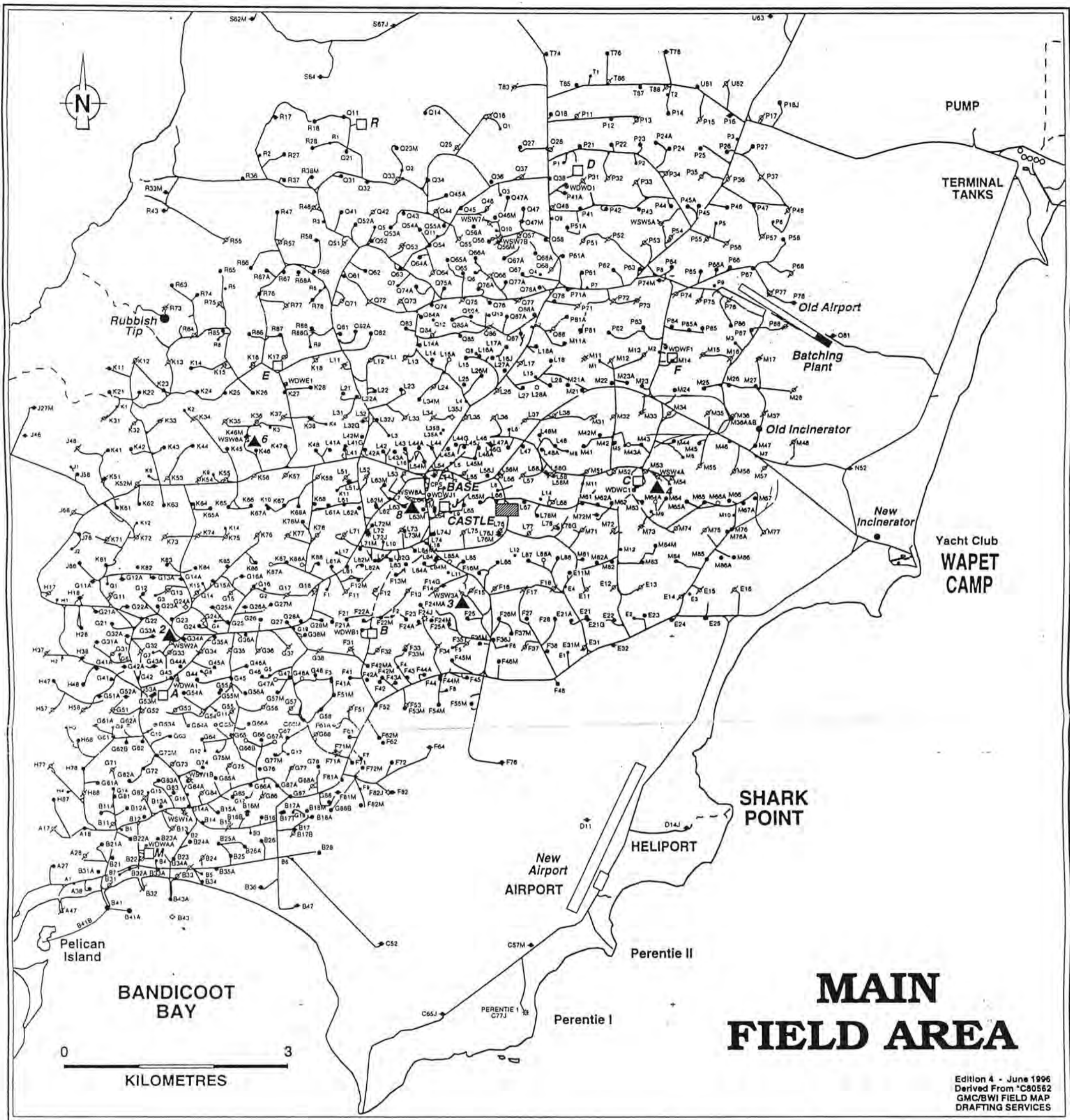
FISHING REGULATIONS

-  FISHING PERMITTED
Note: These areas are FISHING ONLY and no other activity is permitted (including shelling).
-  NO FISHING, SHELLING OR REEF ACTIVITY PERMITTED
-  SEPARATOR STATION
-  WATERFLOOD STATION



0 3
KILOMETRES

WELL SYMBOLS	WELL CLASSIFICATION
	A INFILL WELL
	D OIL WELL
	E OIL WELL
	F WATER SOURCE
	G WATER DISPOSAL
	H ABANDONED
	I RADIANT ANODE
	J PROPOSED WELL
	K MUDFLOW WELL
	L WATER DISPOSAL WELL
	M WATER SOURCE WELL
	N ALL OTHERS ARE WINDMILL WELLS



- 1 PUMP SHOP (& Transport Office)
 - a) Corrosion b) Production
 - c) Prod Eng'r d) Workover
 - e) Field Services
- 2 WELDING SHOP
- 3 DRILLING MUD WAREHOUSE
- 4 WAREHOUSE
- 5 TOOLSTORE
- 6 HEAVY DUTY WORKSHOP
- 7 PETROL & DIESEL BOWSERS
- 8 ELECTRICAL WORKSHOP
 - a) NDT Office b) Contract Supv.
 - c) Fid Eng'rs d) Planner
- 9 GEARHART WORKSHOP
- 10 WASHBAY
- 11 HALIBURTON SHED
- 12 LABORATORY
- 13 TRAINING CENTRE
- 14 FIRESHED
- 15 CHEMICAL STORE
- 16 BASE GENERATOR
- 17 L.T.S.
- 18 WORKOVER RIG WORKSHOP
- 19 CENTRAL POWER STATION
- 20 R.O. PLANT
- 21 LPG REFUELING
- 22 LIGHT DUTY WORKSHOP
- 23 HEAVY VEHICLE SERVICE BAY

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 GMC/BWI FIELD MAP
 DRAFTING SERVICES