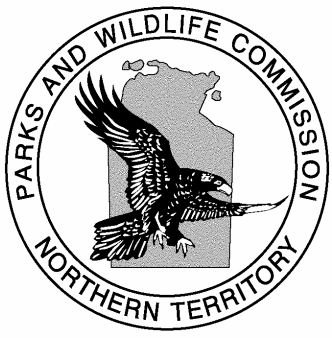
Charles Darwin National Park

Plan of Management



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Cover Graphics: Adrienne Williams

Foreword

Charles Darwin National Park, located minutes from Darwin city centre, provides an unique opportunity to conserve and enjoy, within an urban setting, some of the cultural, heritage and natural values, which characterise the Top End coastal fringes.

The Park comprises extensive littoral and estuarine vegetation communities, a large portion of which are undisturbed mangrove forests merging with expansive mudflats that are exposed at low tide and an open woodland on undulating hills offering superb views from an escarpment ridge. Several Aboriginal shell middens and a number of World War II bunkers of cultural and historical significance are located in the Park. The creation of Charles Darwin National Park is a major step toward the protection of these values, while at the same time providing an important natural recreation area close to the city centre.

This Plan of Management, prepared in accordance with sections 18 and 19 of the *Territory Parks and Wildlife Conservation Act,* sets the future development, aims, priorities and management strategies for the Park.

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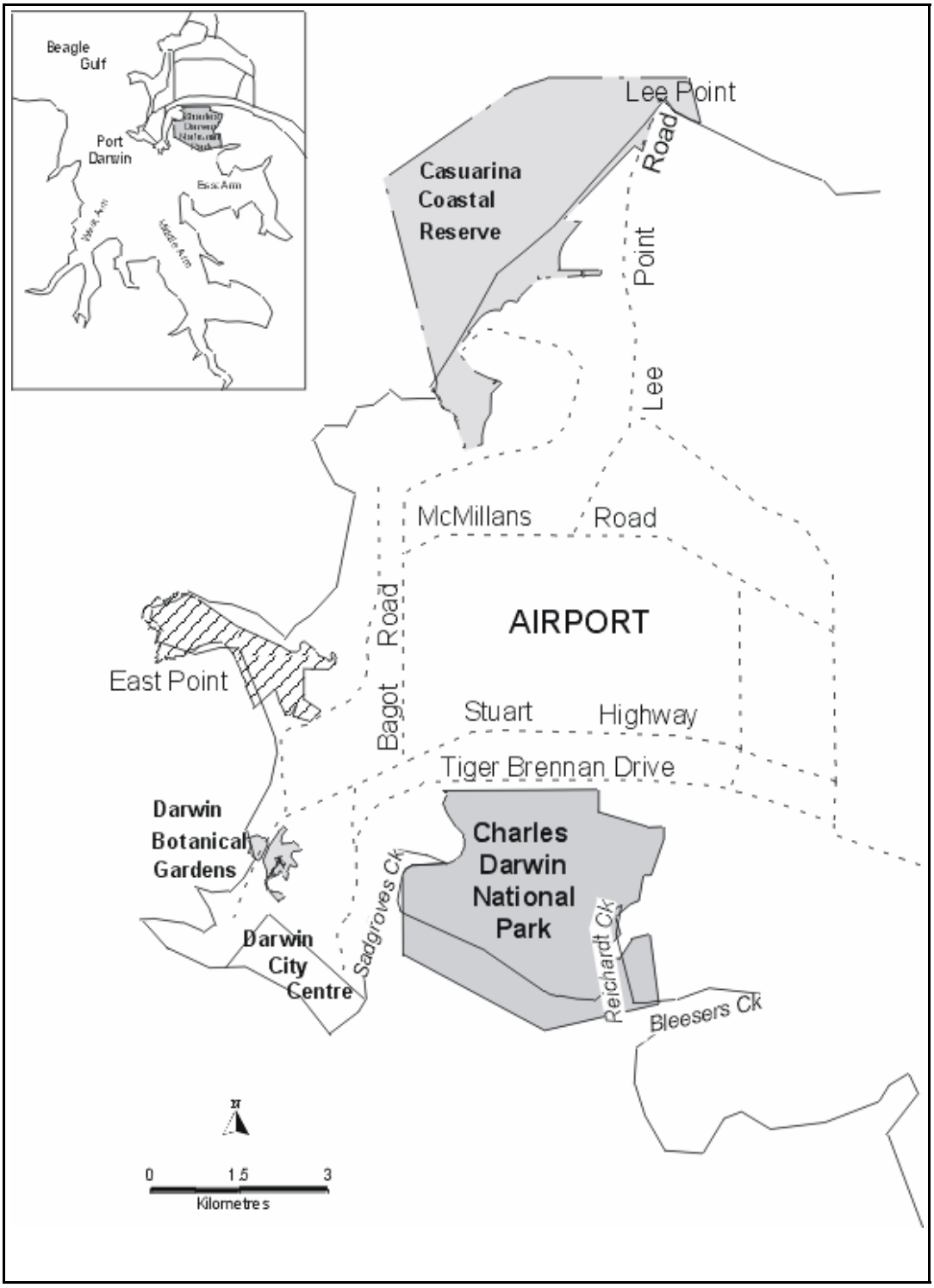
Figure 1: Charles Darwin National Park - Locality Map



1 INTRODUCTION

1.1 Background

Charles Darwin National Park is located a short distance from the Darwin City centre, on Frances Bay and includes the eastern bank of Sadgroves Creek, all of Reichardt Creek and an area north of Bleesers Creek (see figure 1, p.iv). The park contributes to the conservation of biodiversity in the Darwin region and provides an opportunity for recreation and nature-based tourism within close proximity to Darwin City.

The site, which encompasses a former military ordinance facility established during World War II, was earmarked for possible residential and commercial development. In April 1997, however, in response to public support for preserving remnants of Darwin bushland and conserving important mangroves, the Northern Territory Government proposed the establishment of Charles Darwin National Park. The Park's name was chosen to honor the great scientist and naturalist Charles Darwin, after whom the Port of Darwin and eventually the city of Darwin were named.

The area includes approximately 1040 hectares of coastal flats featuring diverse mangrove communities and approximately 310 hectares of woodland on an escarpment plateau and undulating hills. The site hosts a number of World War II explosive ordinance storage bunkers, contains several Aboriginal shell middens and offers superb views of the city and harbour from the escarpment.

1.2 Values of the Park

The aesthetic, natural, cultural and historical values of the Park are enhanced by its location close to the major population centres and resultant ease of access.

The Park's **aesthetic values** derive from its location and relief, which combine to afford superb views of Darwin City centre and Port Darwin across a broad expanse of mangroves and the waters of Frances Bay in the Darwin Harbour.

The **natural values** of the Park arise from its near pristine mangrove communities and sections of relatively undisturbed woodland/grassland communities, which host a wide diversity of flora and fauna and the intertidal mudflats that, are rich in bird life. Aquatic ecosystem protection and recreational and aesthetic value have been declared under the *Water Act* as the beneficial uses (environmental values) of the harbour for management in accordance with the *Water Act*. The birds using the park area include a number of bird species that are protected under international agreements. Darwin Harbour is listed as one of Australia's important wetlands[1]. The Darwin Harbour mangrove communities are among the most extensive mangrove communities in the Top End and the woodland is typical of much of the Top End. Increasing development pressures on Darwin, Palmerston and rural surrounds make this large area of protected woodland and coastal flats in the centre of Darwin a valuable public asset.

[1] Australian Nature Conservation Agency (1996), *A Directory of Important Wetlands in Australia*, Second Edition. ANCA, Canberra.

The Park has considerable **education and interpretation value** arising from the diversity of habitats it contains and its cultural values, including Aboriginal shell middens, its historical association with World War II events and its proximity to the major population centres of Darwin and Palmerston. The ease of access to these natural, cultural, and historical assets provide an opportunity for community education in a stimulating environment.

Due to its location and ease of access for Darwin residents and for visitors and its aesthetic, natural, cultural and historical assets, the Park has significant **recreation and tourism value**. With appropriate management, the Park has the potential to provide a range of recreational opportunities in a natural setting without the time and travel constraints associated with visiting similar environments elsewhere in the Top End.

The **Aboriginal cultural values** of the Park are derived from several shell middens located in and around the mangrove fringes of the Park. These indicate Aboriginal associations with the area dating back to the late Holocene (<3,000 years before present).

The more recent **historic values** of the Park stem from the use of the area by the Defence Force during World War II and the remaining buildings associating the area with wartime events. It is thought that prior to its use by the Defence Force, Chinese gardeners cultivated the mangrove fringes.

The **conservation values** of the Park arise from the desire to preserve the above values and assets from the current and potential threats to which they are exposed and the contribution it makes to the network of protected areas managed for this purpose by the Parks and Wildlife Commission.

1.3 Concept of the Park and its Purposes

Charles Darwin National Park was declared in recognition of the natural, aesthetic (scenic), historical and cultural values of the site. The Park complements the existing urban parks and reserves system in Darwin by virtue of containing natural communities, heritage sites and views which differ from other reserves in and around Darwin, and subsequently offering different educational, recreational, research and conservation opportunities.

In view of the increasing demand placed on surrounding land, the Park will contribute to the conservation of biodiversity in the Darwin region and provide an opportunity for a variety of recreational pursuits and educational opportunities in a natural setting which is easily accessible from the city centre and suburbs.

Accordingly the principal purposes of the Park are:

- to contribute to conservation of terrestrial and marine biodiversity in the Darwin region;
- to conserve the natural vegetation communities present;
- to optimise the contribution of the site to the maintenance of viable populations of important fauna by appropriate management of key habitats;
- to provide a natural area close to the city centre which can be used by the public for recreational activities that are consistent with the conservation of the aesthetic, natural and cultural values of the Park;
- to provide visitors with the opportunity to understand and appreciate the natural communities;
- to preserve the historical values of the site and provide visitors with the opportunity to learn of the events which occurred in Darwin during World War II;
- to preserve sites of Aboriginal cultural and archaeological significance and provide visitors with the opportunity to learn of historical and contemporary Aboriginal culture.

It is intended to manage and conserve the key values of the Park by:

- careful management of visitors and resources,
- sensitive development of the Park,
- liaison with relevant authorities and parties to help ensure that management of the surrounding land is sympathetic with the conservation objectives for the Park, and
- adoption of management strategies commensurate with regional conservation objectives.

1.4 Regional Management Implications

Charles Darwin National Park is one of five reserves located in the urban area of Darwin. The Corporate Plan for the Parks and Wildlife Commission has set a goal to manage the Darwin District Parks as part of a Greater Darwin Park. The Greater Darwin Park will aim to integrate the management of the protected areas in the Darwin Parks District.

The Parks and Wildlife Commission of the Northern Territory recognises the importance of these protected areas in maintaining the viability of individual species and their contribution to the biodiversity of the region. The aesthetic, natural and cultural values of each individual reserve will be greatly enhanced if they are managed as an integrated network of sites.

1.5 Intent of the Plan

This Management Plan states the intent of the Parks and Wildlife Commission with regard to the management of Charles Darwin National Park. It sets management objectives, addresses current issues and proposes appropriate measures to guide future management and development of the Park. The Plan will be in force for a minimum of five years and a maximum of ten years, unless revoked by a new Plan or amended as per section 20 of the *Territory Parks and Wildlife Conservation Act*. Under section 21 of the Act, the Parks and Wildlife Commission will manage the Park in accordance with this Plan.

2 ZONING SCHEME

2.1 Outline of the Zoning Scheme

The Zoning Scheme for the Park provides a basis for the regulation of activities and developments within defined areas to ensure that activities do not conflict and are compatible with the aim of conserving the natural and cultural values of the Park.

Zones for the Park have been identified and uses within these zones have been categorised in a manner that is intended to aid continuity and consistency in management. Public access and activities within any zone may be regulated and restricted if they are having a deleterious effect on the values of the area.

Under the Darwin Town Plan the park, including the mangroves and mudflats, is zoned CP (Community Purposes). Developments and activities proposed within the Park Zoning Scheme are consistent with this Town Planning Zone. There is a proposal to create an East Arm Control Plan, which will encompass the Park. Under this new Plan the park will fall into the Charles Darwin (CD) Zone, with the purpose being to accommodate the conservation, recreational and commercial activities associated with the Park.

The Park has been divided into four zones (Table 1, p.7 and Figure 2, p.8):

- Intensive Use Zone
- Dispersed Use Zone
- Minimum Use Zone
- Future Use Zone

The purpose of each zone, determined on the basis of its values, is outlined below.

2.2 Intensive Use Zone

The purpose of this zone is to concentrate visitor use and provide an area where appropriate visitor and management facilities are located.

This zone will provide for vehicle access and recreational and management infrastructure. Present developments include a picnic ground with shade shelters, an information shelter, ablution block, parking area and a walking track to the base of the escarpment. Future developments in this zone may also include a visitor centre, Ranger's office, interpretation facilities, completion of a loop walk, a drop off zone and parking for disabled persons.

Facilities will be designed and sited to utilise existing disturbed areas and have the least possible impact on the Park's aesthetic, natural and cultural values.

2.3 Dispersed Use Zone

The main purpose of this zone is to provide an area for a range of low key recreational activities in a natural setting.

In the woodland and grassland sections of this zone access by bicycle or foot along designated unsealed roads and tracks will be allowed. Firebreaks may also double as bicycle paths subject to assessment and monitoring of impacts such as weed introduction and erosion. Vehicle access is only for management purposes and by permit for special purposes such as scientific or educational activities. The mudflats and Reichardt Creek are included in the Dispersed Use Zone. Fishing and crabbing activities (subject to the *Fisheries Act* - see section 4.3.5), boat and foot access will be allowed in this zone.

Facilities in this zone will include low impact walking/cycling tracks, unobtrusive directional information and interpretation signs and appropriate Park furniture where necessary.

2.4 Minimum Use Zone

The purpose of this zone is to protect the area's key natural values including the mangroves and eucalypt woodlands while providing opportunities for visitor appreciation of the Park's values.

Visitor access will be by foot along designated walking tracks. Developments in this zone will be limited to walking paths, a mangrove walk, fire breaks, directional and interpretive/information signs and possibly a pontoon among the mangroves. The walking track in the mangroves will be designed so that interference with tidal currents and sedimentation processes is minimised.

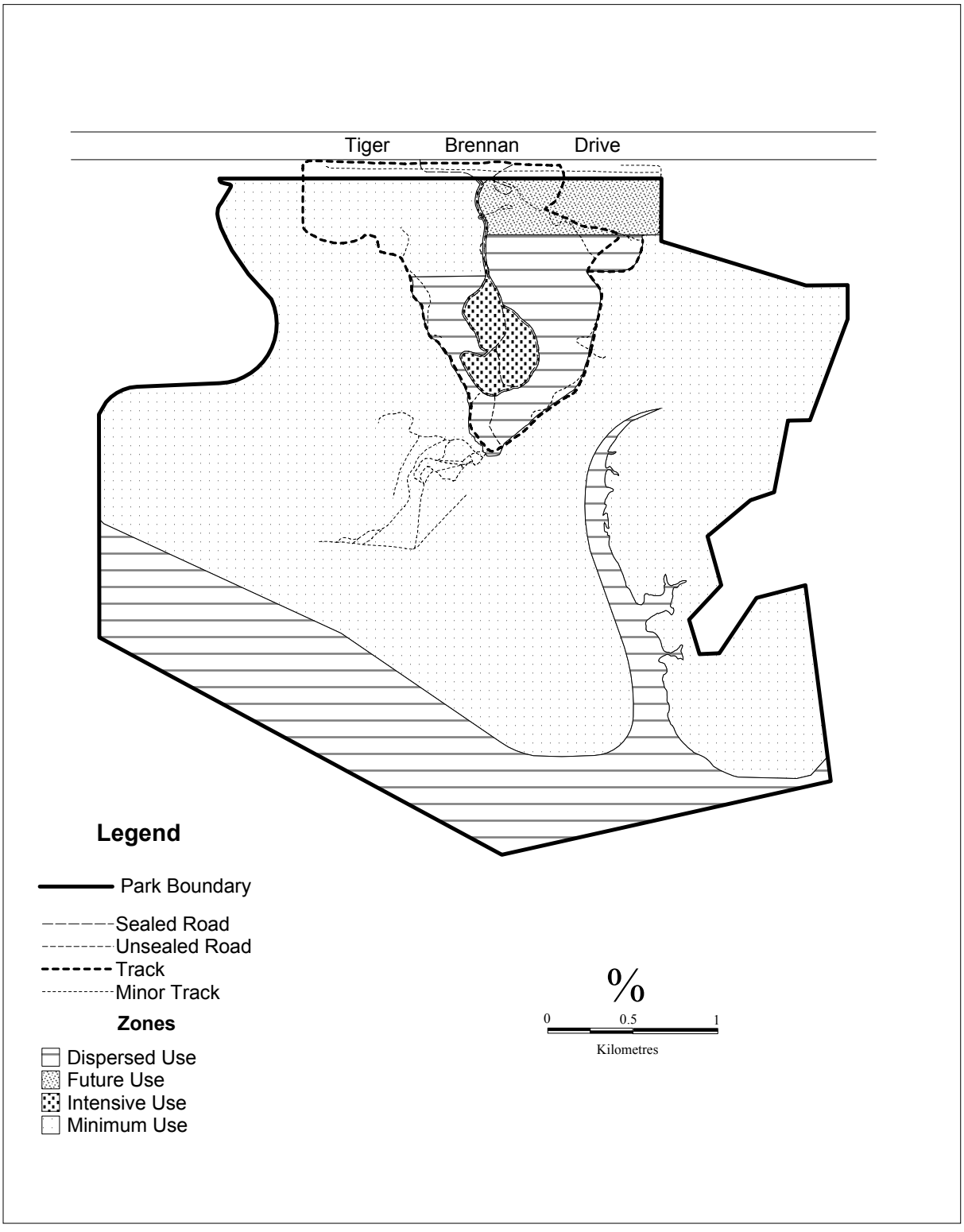
2.5 Future Use Zone

Parts of this zone are currently used by the NT Police and the Defence forces for training purposes. The area may in future be developed to include recreational and/or commercial activities. Some areas within this zone have been previously disturbed. Management of these areas will aim to reduce the risk of fire or weeds spreading from these disturbed areas to other parts of the Park. Visitor access to this zone will not be encouraged.

Table 1 - Summary of Zoning Scheme

Management Zone	Intensive Use	Dispersed Use	Minimum Use Zone	Future Use
Purpose	To provide appropriate visitor and management facilities and foster appreciation for and enjoyment of the Park.	To provide opportunities for a selected range of recreational activities in a natural setting while protecting conservation values.	To protect key natural values and interpret key conservation and natural values to the public.	To be established when patterns of Park use and future needs are determined.
Management Strategy	To concentrate development and visitor use in an area, which can be, managed to keep impacts within acceptable limits.	To retain in a predominantly natural state and provide limited facilities which allow for dispersed and low impact activities while allowing fire control and other management activities.	To provide facilities/ information which educate visitors on the values of the vegetation communities present and encourage appropriate behaviour. To protect the natural values.	To be maintained in its present state and managed to protect any natural and heritage values from fire damage. Control weeds. NT Police and the Defence Forces may use the area for training until future use is determined.
Access	Conventional vehicle and bicycle access on sealed roads. Elsewhere access by foot or bicycle as designated.	Visitor access by foot or bicycle along existing unsealed tracks and fire breaks. Vehicle access for management purposes only or by permit. Access to creeks and mudflats by boat.	Access by foot on designated walking tracks only, and by small vehicle for monitoring and management purposes.	Vehicle access along existing roads will be for management purposes or by permit. Existing roads and designated tracks may be used for cycling or walking but these activities will not be actively encouraged.
Facilities	Roads network, parking areas, picnic areas, visitor centre, office, interpretive facilities, toilets, barbeques, walking tracks, and a range of park furniture, possible food and beverage outlet.	Sealed and unsealed tracks, and low-key directional and interpretation/information signs. Low-key park furniture alongside existing tracks if deemed necessary.	Walking path and unobtrusive interpretation/information signs. Possibly a pontoon.	No Park facilities at present. Old RAAF and Correctional Services buildings and compounds.
Appropriate Uses	Picnicking, photography, walking, nature appreciation.	Walking photography, cycling, educational activities.	Nature appreciation, bush walking, bird watching, photography	To be determined.

Fig 2: Charles Darwin National Park - Zoning Scheme



3 MANAGEMENT FOR VISITOR USE

The Park provides a destination for visitors and local residents to enjoy low-key recreational activities in a natural setting, and to learn about the natural and cultural history and appreciate the values of the site.

Existing users of the Park include cyclists, walkers and birdwatchers who utilise the road network and several tracks through the woodland as well as recreational anglers and mudcrabbers who access the tidal creeks and mudflats by boat.

3.1 Objectives

- To offer a range of recreational opportunities, such as picnicking, day-use and nature appreciation, which are consistent with the principal purposes of the Park.

- To provide appropriate facilities and access to a range of Park settings allowing effective distribution of visitors, minimizing environmental impacts and potential conflicts between user groups.

- To develop an information and interpretation service which enhances visitors' enjoyment of the Park and promotes appreciation of the Park's natural and cultural values and visitor behaviour consistent with those values.

- To make provision for the safety of visitors and staff and the protection of Park assets.

3.2 Access

Access to Charles Darwin National Park is via Tiger Brennan Drive. The Park may also be reached by boat via the waterfront and creeks. Access to the Park's mudflats and creeks for recreational fishing and crabbing purposes is not subject to opening hours. At present there is no formalised water access for the Park.

A sealed road network within the Park provides access to car and bus parking facilities adjacent to the picnic ground and amenities on the escarpment ridge. Traffic will follow a one way route for reasons of public safety and to reduce visual impact, noise pollution and possible erosion of existing tracks. Several of the sealed roads and all of the unsealed tracks will be closed to public vehicle access. Closed roads, which are not undergoing rehabilitation, will be accessible by vehicle for management purposes and by permit for special purposes (e.g. scientific or educational field trips). These roads will be accessible for use by walkers and cyclists where the zoning scheme permits such activities.

Access within the different zones of the Park is covered in section 2. The main access road in the northern section of the Park may be realigned in the future to connect with arterial roads that enter the Park from the east and west.

Management Guidelines

3.2.1 Vehicular movement within the Park will be controlled by the use of management fencing and the implementation of a one way circular route.

3.2.2 Tracks, which are not required within the Park for visitor use or management purposes, will be closed and rehabilitated.

3.2.3 Walking and cycling in the Park will be permitted along designated roads and tracks only.

3.2.4 Boundary fences will be maintained to prevent unlawful entry to the Park.

3.2.5 The use of vehicles off designated access roads will be prohibited unless by special permit.

3.3 Visitor Facilities

The visitor facilities are designed to enhance and utilise existing panoramic views from the plateau edge to the Darwin City skyline. The zoning scheme outlined in section 2 indicated the range of visitor facilities within the different zones.

Visitor facilities in the Intensive Use Zone include the sealed roads network, a picnic area with barbeques, an interpretive shelter, wheelchair accessible ablution facilities and a walking track. The existing building at the bottom of the escarpment will be developed into an outdoor visitor centre in combination with the Park Ranger office. Other future developments in this zone could include a food and beverage outlet.

Opportunities exist for shared walking and cycling tracks within the Dispersed Use Zone of the Park. These tracks may incorporate interpretation themes and disperse visitors to isolated settings in the Park.

In the Minimum Use Zone a mangrove walk will be sited to include a cross section representative of the different types of mangrove communities. A unique opportunity exists for a boardwalk or suspended walkway of varying elevations, through the mangroves to one of the rainforest islands. A woodland walk in this zone would also provide visitors with an opportunity to enjoy solitude and some of the key values of the Park. Water transport access or a pontoon on one of the creeks may also be considered depending on the logistics of such developments.

All developments will be assessed for impacts on the Park's values and must be consistent with the principal purposes of the Park.

Management Guidelines

3.3.1 The provision of visitor facilities and recreational opportunities will be in accordance with the Zoning Scheme (see section 2).

3.2.2 Cycling will be allowed on designated roads, tracks and firebreaks only and in accordance with the Park zoning scheme.

3.3.3 Potential shared pathways will be identified.

3.3.4 All facilities will be sited and developed in accordance with Site Development Plans.

3.3.5 A mangrove walk and woodland walk will be developed in accordance with site development plans and the Park Zoning Scheme (see section 2).

3.3.6 The feasibility of a suspended walkway through the mangroves will be investigated.

3.4 Communication and Interpretation

To adequately manage visitors and help to facilitate safe and enjoyable visitor experiences within the Park, it is essential to provide appropriate, high quality, communication and interpretation programs.

Communication and interpretation programs should orientate visitors to the Park and its dangers through clear promotion and orientation programs. Providing quality information and interpretation programs about the Park's aesthetic, natural and cultural values can foster greater understanding of the Park's values and encourage visitors to take an active role in the preservation of those values. This can assist in the management and protection of the Park's values. The preparation of a Communication Plan for the Park will give direction to the development of appropriate communication and interpretation programs in the Park.

The occurrence of a high number of biting insects (mosquitos and midges) presents a health risk to visitors. The use of pre-visit and on-site visitor safety information will help to reduce this risk.

When developing visitor facilities and recreational opportunities within the Park, consideration needs to be given to opportunities for communication and interpretation of Park values.

Management Guidelines

3.4.1 Emphasis will be placed upon providing clear directional and orientation signs and information in the Park.

3.4.2 A Communication Plan will be prepared for the Park to guide the development of communication and interpretation programs in the Park. The Plan will take into account NT wide communication and interpretation objectives, and clearly identify:

- Stakeholders

- Audience
- Resources for interpretation
- Objectives
- Goals
- Themes
- Messages
- Appropriate media
- Sites
- Communication and interpretation programs
- Evaluation techniques

3.4.3 Emphasis will be placed upon providing pre-visit and on-site visitor safety information.

3.4.4 The opportunity for communication and interpretation of Park values will be considered in the development of visitor facilities and recreational opportunities.

3.5 Visitor Monitoring

Being a new Park there is currently no visitor monitoring conducted at Charles Darwin National Park. It is likely that it will become a Type 1 park as defined in the National Data Standards on Protected Areas Visitation. These are parks that collectively, account for 90 percent of total visits to PWCNT parks and reserves.

Establishment of a comprehensive visitor monitoring system for the Park is an essential component of environmental and visitor management. The short term objective for a visitor monitoring system at Charles Darwin National Park is to estimate the total number of visitors, the monthly use patterns and to determine the method of transport to the Park. In the longer term, monitoring of visitor use, expectations, behaviour and satisfaction will be conducted.

The opportunity exists for the Park to be included in the Northern Territory Tourist Commission Travel Monitor survey, which collects data about tourism activities from tourists in the Northern Territory.

The information collected will determine work programs, planning of facilities, future uses and assist in impact monitoring. Data on visitor behaviour and attitudes toward the Park will assist in providing required services, evaluating communication and interpretation programs and facilities and management of the Park.

Management Guidelines

3.5.1 A Visitor Monitoring System will be established for the Park. Visitor numbers will be estimated through the use of electronic vehicle and walking track-counting equipment as follows:

- An inductive loop traffic counter will be installed and calibrated on the main access road. Data collection will be continuous and equipment will be

calibrated to reflect the number of persons per vehicle, persons entering by other means, monthly and seasonal variations. The method of calibrations will be as outlined in the PWCNT draft Visitor Monitoring Manual.

3.5.2 Total person visits will be recorded in the PWCNT central database on a monthly basis.

3.5.3 Visitor activity data will be collected during the calibration survey events and by ranger observation.

3.5.4 As a potential Type 1 Park, qualitative monitoring will be conducted in Charles Darwin National Park as determined by the Parks Visitor Monitoring Steering Committee in accordance with the PWCNT Visitor Monitoring Strategy.

3.5.5 The Park will be included in the Northern Territory Tourist Commission's Travel Monitor.

3.6 Visitor Safety

Visitor safety is an essential factor in the management of the Park. Hazards in the Park may arise when cars, cyclists and pedestrians share roads and tracks, and at the escarpment edge after daylight. Other safety issues for visitors include outdoor hazards such as heat exhaustion, dehydration, sunburn, snake and insect bites. An old well situated on the bank of the creek in the north west section of the Park could be a hazard. The area was formerly used to store explosives but was not used for testing. Communications and interpretation are important management tools in ensuring visitor enjoyment and safety whilst visiting the Park.

Management Guidelines

3.6.1 An Emergency Response Plan will be prepared for the Park in conjunction with NT Police & Emergency Services, to formalise staff response to accidents and emergency situations which may arise in the Park.

3.6.2 The Communications and Interpretation Program in the Park will provide information and advice about the risks, symptoms and prevention of dehydration and sunburn, the location of available drinking water and protection against biting insects.

3.6.3 The Fire Action Plan (see section 4.3.7) will identify emergency response action relating to visitor safety in the event of wildfires in the Park.

3.6.4 Visitor safety will be considered during the design, selection, siting and maintenance of visitor facilities.

3.6.5 Speed restrictions will apply in the Park on all roads.

3.6.6 Shared pathways will be sign posted to alert users to potential dangers and to reduce conflicts.

3.6.7 Solar lighting will illuminate the picnic ground paths after dark.

3.6.8 An unexploded ordnance clearance, or similar certification of site safety for the area will be sought from the Department of Defence.

3.6.9 The well site will be fenced or covered.

3.7 Biting Insects

The Medical Entomology Branch of the Territory Health Services surveyed biting insects in the area between 1993 and 1994[2]. The study found extremely high numbers of *Culicoides ornatus* (Biting Midge) in the Park and its surrounds. These insects breed in the neap tide zones of the mangroves and are at their highest numbers on the two nights preceding and following the spring tide, with higher numbers associated with the full moon.

The numbers are highest during the months of August and September with populations rising steadily from April and decreasing from September. This reflects the pattern of increasing lowest tides of the month from April to August and decreasing lowest tides from September to April. The pattern of decreasing and increasing freshwater runoff into breeding sites is also reflected, i.e. numbers are higher in the dry season when breeding sites receive less freshwater input. The numbers of these insects at the top of the escarpment were found to be as high as or higher than in the mangroves. Biting midges do not carry human diseases but they can be nuisances as some people are sensitive to their bites and suffer localised infections as a result of being bitten. It is not practical to eradicate or control the numbers of midges except by destroying their mangrove habitats. Therefore, avoidance or personal protection is the only reasonable alternative to being bitten.

The species of mosquitoes found in the area are similar to those in other parts of Darwin. The most abundant species collected was the Saltmarsh mosquito, *Aedes vigilax* (vector of Ross River virus and other human arboviral diseases and canine heartworm).

Breeding sites for *Aedes vigilax* occur in areas where tidal water or rainwater pools for a period of over five days, e.g. creek lines and storm water drains at the mangrove margins areas, depressions in the upper tidal zone (above 7.4m ACD) which do not drain with the outgoing tide or where freshwater pools. Such depressions are naturally occurring but may also be created by vehicle tracks, gullying and construction work. The presence of natural predators helps to control the populations.

[2]Biting Insects Investigation - Darwin South Stage II.

Management Guidelines

3.7.1 Areas subject to waterlogging and ponding of tidal waters will be assessed, in consultation with the Medical Entomology Branch of the Territory Health Services, to identify potential mosquito breeding sites and appropriate measures for control.

3.7.2 Monitoring for *Aedes vigilax* mosquito larvae will be conducted according to schedules devised in consultation with the Medical Entomology Branch of the Territory Health Services. Larvae will be treated by approved insecticides that are target specific and non-destructive of habitat and non-target organisms (e.g. fish, Crustacea, aquatic insect predators of mosquito larvae).

3.7.3 To avoid creation of sites favourable for breeding *Aedes vigilax* and other species of biting insects, depressions created during construction works which may pool water will be levelled. Ruts in the boundary track that retain tidal water will be levelled and drainage lines will be maintained to avoid obstruction of water flow.

3.7.4 Communication and interpretation material will be developed in consultation with the Medical Entomology Branch of the Territory Health Services and will advise of the prevalence of biting insects, promote the use of repellents containing DEET and suitable clothing for personal protection.

3.8 Commercial Operations

Commercial operations within the Park can provide visitor services and amenities that can enhance the visitor experience. Commercial operations can also be an important tool for managing visitor activities and in assisting Park staff with maintenance requirements.

Opportunities exist within Charles Darwin National Park for concession operations such as:

- Guided tours, e.g. night tours, bird watching and nature appreciation tours, educational and cultural tours,
- A commercial food and beverage outlet.

Management Guidelines

3.8.1 All commercial operations within the Park will be required to operate under a concession lease or licence agreement in accordance with the Parks and Wildlife Commission's concession policy. Lease/licences will include term contracts that clearly set out the rights and obligations of each party.

3.8.2 All operations will be monitored to ensure they conform to required standards and to evaluate the application for lease/licence renewal.

3.8.3 Care will be taken to ensure that the type and number of operations will not compromise the Park's atmosphere and/or visitor experience.

3.8.4 All leases and licences will be subject to conditions designed to ensure the protection of the Park's aesthetic, natural and cultural values in accordance with the Parks and Wildlife Commission's concession policy.

3.8.5 Any commercial food and beverage operation must comply with relevant provisions of the *Public Health Act, Food Act* and Building Code of Australia.

4. MANAGEMENT OF THE PARK'S RESOURCES

4.1 Objectives

- To protect and conserve the diversity of the Park's natural environment including native flora and fauna communities and ecosystems, landforms, soils, geology and water resources.
- To protect the aesthetic values of the Park.
- To minimise deleterious impacts on the natural communities resulting from human activity and invasion by weeds, feral animals and wildfires.
- To protect the Park from the effects of erosion and where appropriate, rehabilitate disturbed landscapes.
- To preserve the historical buildings related to World War II and any other infrastructure of historical value.
- To protect any Aboriginal cultural values which may exist within the Park.
- To encourage and facilitate research into, and monitoring of, the natural and cultural resources of the Park.

4.2 Aesthetic Resources

The unique views of the city skyline and harbour are an important feature of the park. It is important to recognise and consider the visual impact of management activities and Park developments.

Management Guidelines

4.2.1 Developments in the Park will be sited to promote the views available.

4.2.2 Where possible the visual impact of management activities and developments in the Park will be minimised.

4.3 Natural Resources

4.3.1 Geology, Landforms and Soils

Three distinct Land Systems broadly define the Park[3]. These are Krans and Kay systems of the Koolpinyah Surface and the Littoral system. The gently undulating plateau and slopes of

[3]The Land Systems of the Darwin Region, Technical Report - Number 24, CCNT

the Park are part of the Koolpinyah surface that covers most of the Darwin region. The two main Koolpinyah surface systems present in the Park are the Kay and Krans land systems.

The level to very gently undulating upland terrain covered with open eucalypt forests is part of the Kay land system. This occurs mainly in the north east corner of the Park and as an inlier in the more well represented Krans system formed where the Koolpinyah surface has been dissected creating a low scarp line with associated slopes. These scarps and slopes form the edge of the Kay system and slope down to the lower alluvium/colluvium flats, which lie, between the higher country and the Littoral system. The slopes are stabilised by the cover of vegetation and would be susceptible to erosion if that cover was disturbed. Erosion of the steeper slopes has occurred in places where tracks have been formed.

A flat alluvial drainage floor spreads out from a small permanent stream at the base of the plateau in the northeastern section of the Park. This is formed of sands, silts and clays deposited in the Quaternary period (late Cainozoic, about 2 million years old) and more recently in the last 500 thousand years. These alluvium flats experience very poor drainage and regular wet season inundation can be expected. Gully erosion is beginning to form along the boundary track in this sector of the Park. Alluvial and colluvial sediments of the same period form a narrow fringe to the south of the escarpment, which widens to the west and east. A large quartz conglomerate outcrop occurs in the western section of this fringe.

The Littoral system, which covers over half the Park's area, consists of the bare tidal mud flats, mangrove forests and hyper saline flats. This system is formed of muds, clayey sands, silt and intertidal marine alluvium also deposited in the Quaternary period. A resistant quartz sandstone conglomerate vein, several metres in height and width, outcrops in the mudflats and borders a raised wedge of land that supports woodland species. A small raised 'Hinterland island' with gravelly soil supporting rainforest species occurs within the mangrove forest west of Reichardt Creek. Another larger island occurs amongst the mangroves on the Creek's eastern bank. These higher patches of ground are outcrops of the resistant Proterozoic beds.

These land systems can be further defined on the basis of slope, soil type, vegetation and drainage into land units. Appendix 4 contains a description of the land units of the Park.

Management Guidelines

4.3.1.1 Areas susceptible to soil erosion and acid sulfate soils will be identified to assist in assessing the capabilities of the Park for suitable visitor activities, developments and future uses.

4.3.1.2 Future developments will be designed, sited and constructed to avoid areas susceptible to erosion and prevent alterations to water drainage patterns, and undertaken in a manner which ensures minimal soil disturbance.

4.3.1.3 Consideration will be given to the likely impact of storm surges on constructions within the Park.

4.3.1.4 Appropriate measures will be undertaken to prevent or limit soil erosion on the Park including the regulation of visitor access and activities, and the maintenance of vegetation cover. Soils will not be excavated, removed or disturbed in the Park except where necessary for management purposes.

4.3.1.5 The extent of soil erosion will be assessed to identify areas in need of rehabilitation.

4.3.1.6 Regular monitoring will be performed to evaluate the effects of visitor and management activities on the soil.

4.3.1.7 Rehabilitation and erosion prevention measures will be undertaken in consultation with soil conservation staff.

4.3.1.8 Public vehicle access will be limited to designated sealed roads in the Intensive Use Zone. Access to other tracks and roads will be for emergency or management purposes or by permit.

4.3.1.9 Visitor use will be prohibited from areas susceptible to soil erosion.

4.3.1.10 Areas where visitor use and management activities have deleterious effects upon the soils will be closed and rehabilitated.

4.3.1.11 A reservation from occupation for the Park will be sought from the Department of Mines and Energy.

4.3.2 Water Resources

The Park is situated across two catchment zones, with approximately half the Park in each zone. The western half of the Park includes part of the Sadgroves Creek catchment and the eastern half is the lower Reichardt Creek catchment. Four storm water drains enter the Park from Tiger Brennan Drive and lead to a small permanent freshwater creek that enters a *Melaleuca* swamp at the upper tidal reaches of Reichardt Creek. Another storm water drain entering the neighbouring Power and Water Authority block (Por. 1764) also leads to the swamp. There are also several drainage lines and depressions in the Park that hold water during the wet season.

The drains that enter the Park originate or pass through the industrial estate on the northern side of Tiger Brennan Drive. The water in the upper section of these drains is visibly polluted with oil and sludges. There is an orange film of sedimentation on the creek bed and orange clouds of suspended particles in low flowing sections of the creek. This colouration results from the oxidation of the iron in the lateritic soils in the creek and is a natural phenomenon, though the process may be affected by water quality parameters such as pH. The drains, and the creek they enter, contain a large number of weeds (see section 4.3.4).

The quality of water in the creek is important because it is consumed by wildlife, supports aquatic wildlife and supplies freshwater to flush the brackish waters of the swamp and

mangrove fringes. The storm water drains are a source for weeds in the Park. The Natural Resources Division of the Department of Lands, Planning & Environment has undertaken studies of storm water runoff from different land use areas. Runoff from Winnellie's light industrial area was found to be high (compared with urban, rural and natural environments) in heavy metals, suspended sediments, nitrogen and phosphorus. A Storm Water Taskforce, comprising representation from the Darwin City Council and the Department of Lands, Planning and Environment is addressing the management of drainage from the Winnellie industrial area.

Natural Resources Division of the Department of Lands, Planning and Environment licences point source waste discharges into the harbour so as to protect aquatic ecosystems and recreational and aesthetic values. The Division also encourages integrated management to achieve desirable water quality in catchment runoff to the harbour. Activities in the harbour, which may impact on the water quality within the Park, include dredging activities and oil spills. A contingency plan has been developed to deal with the advent of oil spills in the harbour that includes the containment and cleanup of spills and the rescue and rehabilitation of oil affected wildlife.

Management Guidelines

4.3.2.1 Care will be taken to ensure that works and developments do not cause further water pollution or interfere with tidal flow patterns and the flow of creeks and other drainage lines.

4.3.2.2 Liaison will be initiated with the Storm Water Taskforce regarding the quality of water entering the Park via storm water drains.

4.3.2.3 The use of pollutant traps to help control the quality of water entering the Park will be investigated and installed where appropriate.

4.3.2.4 Research will be encouraged to assess the fate and ecological impacts of pollutants entering the Park. Such research will be in accordance with the Research and Monitoring program developed for the Park.

4.3.2.5 Drainage lines will be kept free of blockages to prevent pooling of water and creation of favourable mosquito breeding sites. Consideration will be given to providing concrete low flow inverts in drains where low flows exist.

4.3.2.6 Liaison with the Department of Lands, Planning and Environment and Darwin Port Authority will be initiated regarding dredging activities, harbour water quality testing and responses to oil spills in the harbour.

4.3.3 Flora

The vegetation communities present in the Park are a representation of the communities which were once abundant in Darwin and surrounds but due to the pressures of changed land use and increasing development have become fragmented and are in danger of disappearing

locally. The three major vegetation communities in the Park are, *Eucalypt* dominated woodland and open forest on the slopes and plateau, grassland and *Pandanus* in poorly drained areas, and mangroves in areas subject to tidal influence. A large number of Cycads, which are protected under Section 45 of the *Territory Parks and Wildlife Conservation Act*, are present in the woodland of the Park. Appendix 2 contains a list of flora identified in the Park.

Eucalyptus woodlands are the most diverse vegetation communities in the Top End and the *Eucalyptus* woodland of the Park is part of the largest in the local Darwin area. Large areas usually support greater plant diversity than smaller areas and are more resilient to edge effects such as die back, weed invasion and other disturbances.

Eucalyptus tetrodonta and E. miniata dominate the Eucalyptus woodlands and forests with grassland understoreys dominated by *Sorghum intrans* and *Heteropogon triticeus*. Other common woodland species include *E. bleeseri, E. clavigera, E. polycarpa, E. tectifica, Buchanania obvata, Cochlospermum fraseri, Cycas armstongii, Livistona humilis* and *Calytrix exstipulata*. The woodland to the western side of the main access road is in very good condition. It has no major invasions of grassy weeds and the stand structure suggests a common regeneration event, possibly following cyclone Tracy.

The area to the east of the main access road supports woodland and *Pandanus spiralis* low to very open low woodland with *Grevillea pteridifolia, Lophostemon lactifluus* and a mixed grass and sedge understory which have been disturbed in the past. Parts of this section and the section to the northeast, which contains ruins of buildings and compounds, are now heavily invaded with weeds (see section 4.5 for further discussion of weeds).

The small creek in the north east sector of the park supports a fringe of riparian vegetation and leads to a *Melaleuca leucadendra, Melaleuca cajuputi* and *Acacia auriculiformis* closed forest swamp. A closed grassland and sedgeland seasonal swamp occurs along a drainage line and flat in the western section of the Park close to the mangrove boundary track.

The mangrove forests that cover approximately two thirds of the total area of the Park support a large diversity of birdlife and provide a nursery habitat for many marine species. The forest has five distinct zones, these are the:

- seaward *Sonneratia alba* open forest (<12m);
- coastal, closed *Rhizophora stylosa* forest (<16m);
- tidal creek and transitional zone *Rhizophora stylosa, Bruguiera exaristata, Camptostemon schultzii* closed to open forest;
- pure stands of *Ceriops tagal* low closed forest on the tidal flats (2-6m), and
- the hinterland low closed forest (2-7m) zone where *Ceriops tagal, Avicennia marina, Lumnitzera racemosa* and *Excoecaria ovalis* occur as mixed or pure stands.

Several small and two large hyper saline bare muddy flats with a sparse covering of *Batis argillicola*, *Suaeda arbusculoides* and scattered stunted mangroves, two islands with gravelly soils supporting rainforest species and a wedge of high ground supporting woodland species occur within the *Ceriops tagal* forest on the tidal flats.

There are several large clear bulldozed tracks in the mangrove zone which appear on aerial photography as early as 1989, but may be older. These denuded tracts show little sign of natural revegetation and require rehabilitation.

Integrated management of the protected areas within urban Darwin and liaison with land managers of natural areas surrounding the Park will help to maintain the viability of the Park's plant and animal communities and enhance its contribution to regional biodiversity. It is therefore important to liaise with surrounding land managers and government departments to encourage land use that is sympathetic to the conservation objectives of the Park.

Management Guidelines

4.3.3.1 Park management will seek to protect the key values of the vegetation communities throughout the Park by:

- effective management of visitors and developments in accordance with the Zoning Scheme (see section 2),
- implementation of the Annual Fire Action Plan (see section 4.9) and Weed Management Program (see section 4.5), and
- liaison with regional land managers and government departments to encourage land management practices sympathetic to the Park's conservation objectives.

4.3.3.2 Disturbance to all of the vegetation communities will be minimised. Clearing of vegetation will be kept to the minimum necessary for management and development purposes.

4.3.3.3 Disturbed or denuded sites will be revegetated, by colonisation from surrounding natural areas wherever possible. Active management such as scarifying, seeding or planting disturbed areas may be employed where required. Priority areas for action will be the high erosion risk areas particularly old roads, tracks and boundary lines.

4.3.3.4 Research and monitoring will be undertaken in accordance with the Research and Monitoring Program (see section 5.4) to refine knowledge of the Park's plant communities and to monitor the effectiveness of management practices.

4.3.3.5 Management strategies will be formulated based on the findings of research and monitoring activities.

4.3.4 Weed Control

The Park contains many disturbed sites such as roads, tracks and fire breaks, refuse dumps and old buildings and compounds. These sites, and the permanent drainage lines in the Park have been colonised by various weeds. Twenty two introduced flora species have been recorded in the Park (see appendix 2).

The storm water drains that enter the Park provide an entry point to the Park for aquatic weeds or weeds transported by water. Weeds of particular note present in drainage lines of the Park are the class B noxious weeds *Mimosa pigra* (Mimosa), *Pennisetum polystachion* (Mission Grass), *Stachytarpheta urticifolia* (Dark Blue Snakeweed) and *Senna alata* (Candle Bush), as well as *Phyllanthus emblica* which is very large and crowds out native vegetation. Under the Noxious Weeds Act, the growth and spread of Class B species must be controlled.

A number of invasive environmental weeds are also present, including *Andropogon gayanus* (Gamba Grass), *Crotalaria goreensis* (Gambia Pea), *Ipomoea quamoclit* (Morning Glory Vine), *Celosia argentia, Clitoria ternatea, Crotalaria pallida var. obovata* (Streaked Rattlepod), *Macroptilium atropurpureum* (Siratro), *Passiflora foetida* (Passionfruit Vine), *Wedelia trilobata* (Singapore Daisy), *Stylosanthes humilis* (Stylo), *Leucaena leucocephala* (Coffee Bush) and *Centrosema pubescens* (Centro).

The major threats to the Park are *Andropogon gayanus* and *Pennisetum polystachion*. Both these grasses are capable of spreading through open undisturbed woodland whereas the other weeds present should remain largely confined to drainage lines and disturbed sites. Both these weeds provide high fuel loads for fires, *Andropogon gayanus* especially as it is a perennial which doesn't cure until late in the dry season and fuels intense fires.

Management Guidelines

4.3.4.1 A Weed Management Program for the Park will be prepared. This program will:

- determine the extent and distribution of weeds within the Park,
- examine current and potential impact of weeds,
- examine interaction between weeds and fire, and
- determine priorities and recommend methods for control and revegetation of effected areas.

4.3.4.2 Existing priorities for weed control in the Park are:

- to keep the western section of the Park weed free,
- to keep access tracks, roads, fence lines and key locations weed free,
- to carry out surveillance for new weeds entering the Park and prevent the spread of existing weeds, and
- to control weeds along the creek lines and storm water drains.

4.3.4.3 Regular surveillance will be conducted in order to locate new weed outbreaks concentrating on the most likely points of entry or occurrence (storm water drains**,** tracks, roads, car parks, fence lines, clearings and the picnic ground).

4.3.4.4 Any new colonisations of weeds, especially in the western sector of the Park, or spread of Class B weeds will be eradicated.

4.3.4.5 Periodic monitoring of existing weed infestations will occur in order to evaluate control programs.

4.3.4.6 Measures to be used in the control of introduced plants include manual or mechanical removal, burning, biological controls and the judicious use of herbicides.

4.3.4.7 All vegetation planted for management purposes, shade or ornamental purposes will be species native to the area.

4.3.5 Fauna

Apart from the birdlife and biting insects, the terrestrial fauna of the Park have not been extensively surveyed. Twenty-one reptiles, 17 mammals (including three introduced species) and nine amphibians have been recorded in the Park. Appendix 3 contains a list of the fauna recorded in the Park and their conservation status. Due to the variety and size of habitats present, it can be assumed that the Park is capable of supporting a much wider diversity of fauna than this list suggests.

A total of 116 species of birds from 42 families have been recorded in the Park (see appendix 3). Of these, 12 are listed on International Treaties such as the Bonn Convention, and the bilateral agreements with the Governments of Japan and China on migratory birds, known as JAMBA and CAMBA respectively. The Scolopacidae family (sandpipers and allies) has six representatives recorded all of which are listed on each of these Treaties. A further two species are listed by Garnett (1992) in the Action Plan for protection of bird species.

The mangrove communities support a number of bird species, some of which are endemic to the "Top End". The NT Coastal Resources Atlas refers to the population of *Eopsaltria pulverulenta* (Mangrove Robin) as possibly being the only population in the Darwin Metropolitan area, and describes the Frances Bay mudflats as a significant feeding ground for large numbers of waders that aggregate at low tide with the normally elusive *Eulabeornis castaneoventris* (Chestnut Rail) being easy to observe in this area. Two of the bird species present in the Park (the Chestnut Rail and *Esacus neglectus,* the Beach Stone-Curlew) have been identified as deserving special management attention.

Large numbers of *Miniopteris schreibersii* (Common Bent-wing Bat) have been sighted in the Park. These bats make their homes in the disused storage bunkers. A *Pteropus sp*. (Flying Fox) roost is also present in the mangroves at the mouth of Sadgroves creek.

Threats to animal populations and habitats in the Park include, isolation of populations within the Park's boundaries from those outside the boundaries, uncontrolled wildfire, weed infestation, clearing of habitats, removal of wildlife, over fishing/crabbing and other activities of visitors, alteration of the quantity and quality of water resources available in the Park, and pollution events in the Harbour.

All mammals, birds, reptiles and amphibians in the Park are protected under the *Territory Parks and Wildlife Conservation Act (NT)* and marine life is protected by Fisheries Management Plans, under the *Fisheries Act (NT),* which seek to manage fisheries so that they are not over exploited or endangered and the habitats of fish or aquatic life are not detrimentally affected.

There is a potential for oil spills in the harbour to impact upon wildlife in the Park, especially those species that use the mud flats and seaward fringes of the mangroves. A contingency plan has been developed to deal with events such as oil spills in the Harbour. Under this plan the Parks and Wildlife Commission has responsibility for the rescue and rehabilitation of oil affected wildlife and have trained staff who can respond in the event of an oil spill. There is potential for the introduction of exotic species from ballast water. However, it is not known whether there are such exotic species in the Harbour.

Management Guidelines

4.3.5.1 Park management will seek to protect the natural habitat of native animals by protecting the flora and water resources of the Park as outlined in sections 4.3.2 and 4.3.3.

4.3.5.2 Research and monitoring will be undertaken in accordance with the Research and Monitoring Program (see section 5.4) to refine knowledge of the Park's fauna and to monitor the effectiveness of management practices.

4.3.5.3 High priority will be given to studying the area required to maintain healthy populations of Chestnut Rails and Beach Stone-Curlews and develop methods to monitor their populations.

4.3.5.4 Management strategies will be formulated based on the findings of research and monitoring activities.

4.3.5.5 Other than traditional gathering and hunting of food, the possession of nets, animal traps, firearms and the taking of wildlife will be prohibited, unless approved for research purposes in accordance with the Parks and Wildlife Commission 'Scientific Licences Policy', or pursuant to Management Plans under the *Fisheries Act*.

4.3.5.6 One or more of the disused bunkers which are used by the Common Bent-wing Bat will be closed to public access and the ventilation shafts modified, if necessary, to allow access by the animals.

4.3.5.7 Liaison with the Department of Lands, Planning and Environment will be initiated regarding the presence of exotic species introduced from ballast water in the harbour.

4.3.5.8 The Park's Interpretative Plan will include information regarding the characteristics, distribution and habitats of native animals found in the Park.

4.3.6 Feral/Domestic Animal Control

Feral cats have been recorded on the Park. There is also anecdotal evidence of feral dogs, and feral pigs may also be present. Regular surveillance of the Park will help to identify species and numbers of feral animals present.

The Park will be a Schedule 1 Park under the Commission's 'Pets in Parks Policy' and no domestic animals will be permitted in the Park.

Management Guidelines

4.3.6.1 Communication and interpretation material will clearly indicate the regulations excluding domestic animals from the Park.

4.3.6.2 A feral animal control program will be developed which will:
- determine the extent and distribution of feral animals in the Park,
- examine the current and potential impacts of feral animals,
- recommend priorities and methods for control of feral animals, and
- provide for the removal of stray cats and dogs found in the Park.

4.3.7 Fire Management

Fire will be used as a management tool to provide a mosaic of vegetation communities, maintain biodiversity and to reduce the fuel loads and subsequently the intensity of wildfires in the Park. Prescribed burns may also be introduced to protect fire sensitive species.

An Annual Fire Action Plan will be prepared for the Park in conjunction with the NT Fire Service. This will set out measures to be used for the reduction of fire hazards, including the clearing or slashing of firebreaks, slashing grassed areas and carrying out prescriptive early wet and dry season control burning.

Management Guidelines

- *The Fire Action Plan will be updated annually after consultation with the NT Fire Service and will consider:*
  - *early wet and dry season prescriptive burns, to establish protection from later wildfires, in areas that have early curing rates or sufficient fuel loads,*
  - *habitat diversification in the woodland areas by maintaining a mosaic of burning regimes,*
  - *monitoring to determine progress with fire control measures and provision for revision of the Fire Action Plan where necessary, and*
  - *asset protection by mechanical clearance of vegetation around park signage, day-use areas, walking tracks, roads and fences.*

- *The lighting of fires in the Park, other than for management purposes, will be prohibited.*

- *Communication and interpretation material will remind visitors of the restrictions on the use of fire within the Park.*

- *Regular monitoring and maintenance of the Park's firebreaks will be undertaken by Park staff to facilitate fire control.*

4.4 Cultural Resources

4.4.1 Aboriginal Cultural Resources

The Park was possibly the location of an Aboriginal camp prior to the construction of the Explosives Complex. A.T. Woods' original field book of Goyder's survey of 1869 refers to the highlands of the Park as "Ilwaddy Flat" and indicates an Aboriginal camp "Ilwaddy Camp", two wells and a stream referred to as "Ilwaddy Stream" in the vicinity of the Park. It is difficult to determine the accurate location of the camp, wells and stream from the original drawing but the shape of 'India' (the highland of the Park) is clearly the "Flat." It is possible that the stream may in fact be Reichardt Creek, according to late 1930 or 1940's maps, or the small freshwater creek within the Park that leads to a Melaleuca swamp at the top of Reichardt Creek. The old well at the top of the creek may be one of the 'Ilwaddy' wells. Further research into this issue is necessary before any positive conclusions can be drawn.

Both the Larrakia and Dangalaba people have lodged claims on sections of the Park under the *Native Title Act*. All of the mangroves are claimed by both groups, the mudflats by the Dangalaba and sections of the alluvial flats by the Larrakia.

Ten shell middens have been identified in or adjacent to the mangroves within the Park (see appendix 5) indicating that the area was traditionally used as a gathering ground. These middens, situated in and adjacent to the mangroves, have been disturbed to some degree by the construction of the World War II complex. Although none of these sites are registered with the Aboriginal Areas Protection Authority, they are protected within the terms of Sections 29 and 39 of the *Heritage Conservation Act*.

Radiocarbon studies have identified the period of formation of the middens as the late Holocene (~3,000 years ago). The middens provide a significant representation of a portion of the archaeological record of a late Holocene Aboriginal economy. A profile of the predominant shell species present in the middens indicates a change in the coastal environment. *Anadara granosa*, the dominant shell taxon, and other molluscs are intertidal species that occur on sandy mudflats. Gastropod species common to mangrove forests occur to a lesser extent in the middens. Further research on these middens would provide information on prehistoric Aboriginal diet and subsistence strategies, past marine and estuarine environments and geomorphic processes[4]. One or more of the middens may be suitable for inclusion in the Parks Interpretive Plan.

Management Guidelines

[4]Burns, 1997

4.4.1.1 In managing and interpreting the Aboriginal archaeological values of the Park, consultation will be undertaken with relevant Aboriginal people, their representative organisations and personnel with relevant archaeological and heritage expertise.

4.4.1.2 Prescribed archaeological places and objects will be managed in accordance with the provisions of the *Heritage Conservation Act*. Any activities proposed that might impact upon archaeological places or objects will require approval from the Minister responsible for Heritage.

4.4.1.3 All new developments in the Park will be undertaken in accordance with the provisions of the *Sacred Sites Act*.

4.4.1.4 Further research by qualified personnel and appropriate organisations will be encouraged to locate, record, document and protect the archaeological values and assets of the Park.

4.4.2 Historical Resources

The area, developed as an Explosive Ordnance Storage Area during World War II, was known as the Frances Bay RAAF Explosives Complex for many years. The construction of the complex just prior to and during the war years, was part of an initiative to establish Darwin as a major allied defensive and counter offensive base in the war against Japan. This military buildup provided the impetus for growth that transformed Darwin into a major city. The complex is evidence of Australia's decision to pursue a defence policy independent from that of the British Empire.

Eleven of the bunkers that housed the explosives during the war are still standing [(1,2,3,5,6,7,8,9,10,11 and 12)see appendix 5]. Nine of these are set into the contours of the hills, the other two (11 and 12) are free standing, all are covered with vegetated earth. They are all 'Armco' barrel vault constructions internally strengthened with tramway rails, possibly from tracks used at mines throughout the Territory at the turn of the century. One of the bunkers (5) carries 12.7 mm diameter projectile entry and exit points which have been attributed to Japanese strafing by Mitsubishi A6MZ 'Zero' or Nakajima Ki-45 'Nick' which used 12.7 mm weapons in air attacks on Darwin.

In the 1800's Chinese gardeners established market gardens on the slopes bordering the mangroves throughout the area. It is possible that gardens were established in the Park but there is no obvious evidence of such activity.

The NT Heritage Advisory Council has considered the existing buildings and infrastructure in the Park for possible inclusion on the NT Heritage Register. If assessment of the sites indicates heritage value they will be recommended to the Minister for Heritage for inclusion on the Register under the *Heritage Conservation Act*.

Management Guidelines

4.4.2.1 The heritage values of the Park will be assessed by the Heritage Unit (Department of Lands, Planning & Environment) and Parks and Wildlife Commission with a view to nominating sites of significant heritage value for inclusion on the NT Heritage Register.

4.4.2.2 Any work carried out on existing buildings or constructions will be done in consultation with Heritage Authorities, or if successfully nominated for the NT Heritage Register, in accordance with the Burra Charter and the requirements of the *Heritage Conservation Act.*

4.4.2.3 The World War II history of the area will be included in the Communication and Interpretation Plan for the Park.

4.4.2.4 The Parks and Wildlife Commission will encourage further research to document the Park's historical use and historical cultural resources.

5. PARK ADMINISTRATION AND RESEARCH

5.1 Objectives

- To provide responsible management and appropriate and efficient administration of the Park.
- To ensure that management procedures and practices achieve the objectives of this Plan by adhering to the Management Prescriptions.
- To apply the *Territory Parks and Wildlife Conservation Act*, its By-laws and other relevant legislation to management of the Park.
- To establish appropriate research and monitoring programs for the Park's natural and cultural resources.
- To liaise with relevant authorities, neighbouring landholders and interested groups and individuals regarding management of the Park.
- To encourage public input and involvement in the management of the Park.
- To make adequate provision for the safety of visitors and staff, and the protection of reserve assets.

5.2 Staffing and Management Facilities

Whilst the Park will be managed by the Parks and Wildlife Commission, some of the routine maintenance duties may be contracted out to private contractors. Other avenues available for the Commission to gain assistance with park maintenance activities include the "Volunteers in Parks Program," "Australian Trust for Conservation Volunteers," "Green Corps" and development of a "Friends of Charles Darwin" group.

Management Guidelines

5.2.1 Work programs outlining the day to day responsibilities of the Park staff will be formulated.

5.2.2 Consideration will be given to using private contractors to open and close the Park, maintain the picnic ground, remove rubbish and clean the ablution block.

5.2.3 Park management will explore additional avenues for assistance with Park maintenance.

5.2.4 An administrative office may be incorporated into the design of the Visitor Centre and one of the explosives storage bunkers will be used to store maintenance and safety gear.

5.3 External Relations

Apart from the industrial estate to the north, the Park is bordered mostly by water under the control of the Darwin Port Authority and Department of Primary Industries and Fisheries or Crown Land under the authority of Government Departments, such as, Department of Lands, Planning and Environment, Work Health and Safety and PAWA. Activities on the surrounding land have the potential to impact upon the Park and its values.

Establishing and maintaining cooperative relations with neighbouring authorities and liaison with nearby industries is needed to ensure that pressures or infringements from outside the Park do not negate effective management of the Park and its values.

Issues of mutual concern include:

- land use planning in the area,
- Park security,
- visitor access and safety,
- vandalism, litter management and general amenity of the area,
- runoff, direct or via storm water drains, into the Park from neighbouring activities,
- management of fish and aquatic life,
- interpretation and promotion of the Park and the area, and
- natural resource management issues such as control of fire, weeds, domestic and introduced animals, soil degradation and ongoing viability of plant and animal populations.

Other reserves managed by the Parks and Wildlife Commission and natural areas in urban Darwin contribute to the maintenance of viable populations of plants and animals in the Park. Cooperative relationships and liaison with organisations and groups that manage natural areas and some modified lands outside the Park will help to maintain the aesthetic, natural and cultural values of the Park.

Management Guidelines

5.3.1 Relevant government authorities and interested local groups and individuals will be consulted regarding issues of mutual concern with the hope of resolving these issues through cooperation and joint planning.

5.3.2 Liaison will be undertaken with organisations and groups that manage natural areas and some modified lands outside the Park to help ensure the continuing viability of plant and animal populations in the Park.

5.3.3 Liaison will be undertaken with relevant government authorities regarding the quality of the water entering the storm water drains.

5.4 Research and Monitoring

Research and monitoring of the Park's flora, fauna, hydrology, geology, cultural and historical assets and recreational use will aim to record the natural and cultural values present

and examine how these resources are affected by visitor and management activities. The information gained will be utilised in the formulation and evaluation of management strategies, and may be imparted to the public through the Communication and Interpretation Plan for the Park. Earlier sections of the Plan identify a number of research and monitoring projects to be undertaken or encouraged during the life of the Plan.

Management Guidelines

5.4.1 A Research and Monitoring Program will be prepared and implemented as resources allow. The program will be based on priorities established for the Park by the Scientific Services Division having regard to the particular challenges involved in maintaining viable populations in a relatively small site.

5.4.2 Results of monitoring programs will be used to formulate and evaluate management strategies.

5.4.3 Research and monitoring will be undertaken by Parks and Wildlife Commission staff, or other suitably qualified persons or agencies, to provide baseline data and further the understanding of the Park's natural and cultural resources and values and the impacts upon those values.

5.4.4 All research and monitoring activities proposed by persons or agencies external to the Parks and Wildlife Commission will require the approval of the Director pursuant to section 111 of the *Territory Parks and Wildlife Conservation Act*. Research and monitoring activities must also be consistent with guidelines specified in the Parks and Wildlife Commission's 'Scientific Licences Policy' and 'Monitoring on Parks Policy'. A report on the work carried out and a summary of the results of such research and monitoring activities will be supplied to the Parks and Wildlife Commission.

5.4.5 All survey results will be recorded in a database maintained by the Parks and Wildlife Commission.

5.5 Law Enforcement

For proper management of the Park, and the safety of persons and property, it is essential that Park regulations are in place and properly enforced.

Management Guidelines

5.5.1 Conservation Officers will enforce the provisions of the *Territory Parks and Wildlife Conservation Act*, including its By-laws and regulations, and other legislation where applicable.

6. MANAGEMENT PROGRAMS

This Plan has specified a number of actions that will be undertaken in order to meet management objectives. Priorities for the implementation of these actions are summarized below.

Priorities have been assigned according to the action, relative importance and urgency for implementation:

Ongoing: Must be implemented on an ongoing basis in order to achieve the objectives of the Plan.

High: Imperative in order to achieve the Plan's stated objectives.

Medium: Very important to achieve the Plan's stated objectives but subject to the availability of resources.

Low: Desirable to achieve the Plan's stated objectives but only if the necessary resources are available and only after higher priorities have been satisfied.

ACTION	PAGE	PRIORITY
Management for Visitor Use		
Identify and rehabilitate tracks not required for visitor use	10	Medium
Identify shared pathways and erect signs	11, 14	High
Prepare Site Development Plans	11	Ongoing
Investigate feasibility of suspended mangrove walk	11	Low
Erect orientation signs	11	High
Prepare Communication and Interpretation Plan	12	Medium
Establish and implement Visitor Monitoring System	13	Medium
Conduct visitor satisfaction monitoring	13	Low
Prepare Emergency Response Plan	13	High
Install lighting in picnic ground	14	High
Obtain ordnance clearance	14	Medium
Secure well site	14	High
Identify mosquito breeding sites and adopt adequate control programs	15	Ongoing
Devise schedule for larvae monitoring	15	Ongoing
Management of the Park's Resources		

Assess and monitor soil erosion	19	Ongoing
Rehabilitate areas subject to soil erosion	19	High
Establish liaison with Storm Water Taskforce	20	High
Investigate Use of Pollutant traps	20	High
Maintain drainage lines	21	Ongoing
Initiate liaison with DLP&E regarding oil spills, dredging and introduction of exotic species from ballast water	20, 25	Ongoing
Revegetate disturbed/denuded sites	22	Medium
Research and monitoring of Flora	22	Ongoing
Prepare Weed Management Program to monitor and control weeds	23	High
Weed control and surveillance	23	Ongoing
Develop and implement research strategies for		
- Chestnut Rail	25	High
- Beach Stone-Curlew	25	Medium
Research and monitoring of Fauna	25	Ongoing
Prepare and implement feral animal control program	26	Ongoing
Prepare and implement Annual Fire Action Plan	14, 26	High
Establish liaison with relevant bodies regarding management of Aboriginal cultural resources	27	High
Encourage and facilitate research/monitoring of		
- Aboriginal culture	28	Medium
- Historical use	29	Medium
Assess heritage values of the Park	29	Ongoing

Park Administration and Research

Establish work programs	30	High
Liaise with government authorities, organisations and other interested groups that manage natural areas outside the Park	31	Ongoing
Establish Research Monitoring programs for flora, fauna, soils and visitors	32	High
Record survey results in database	32	Ongoing

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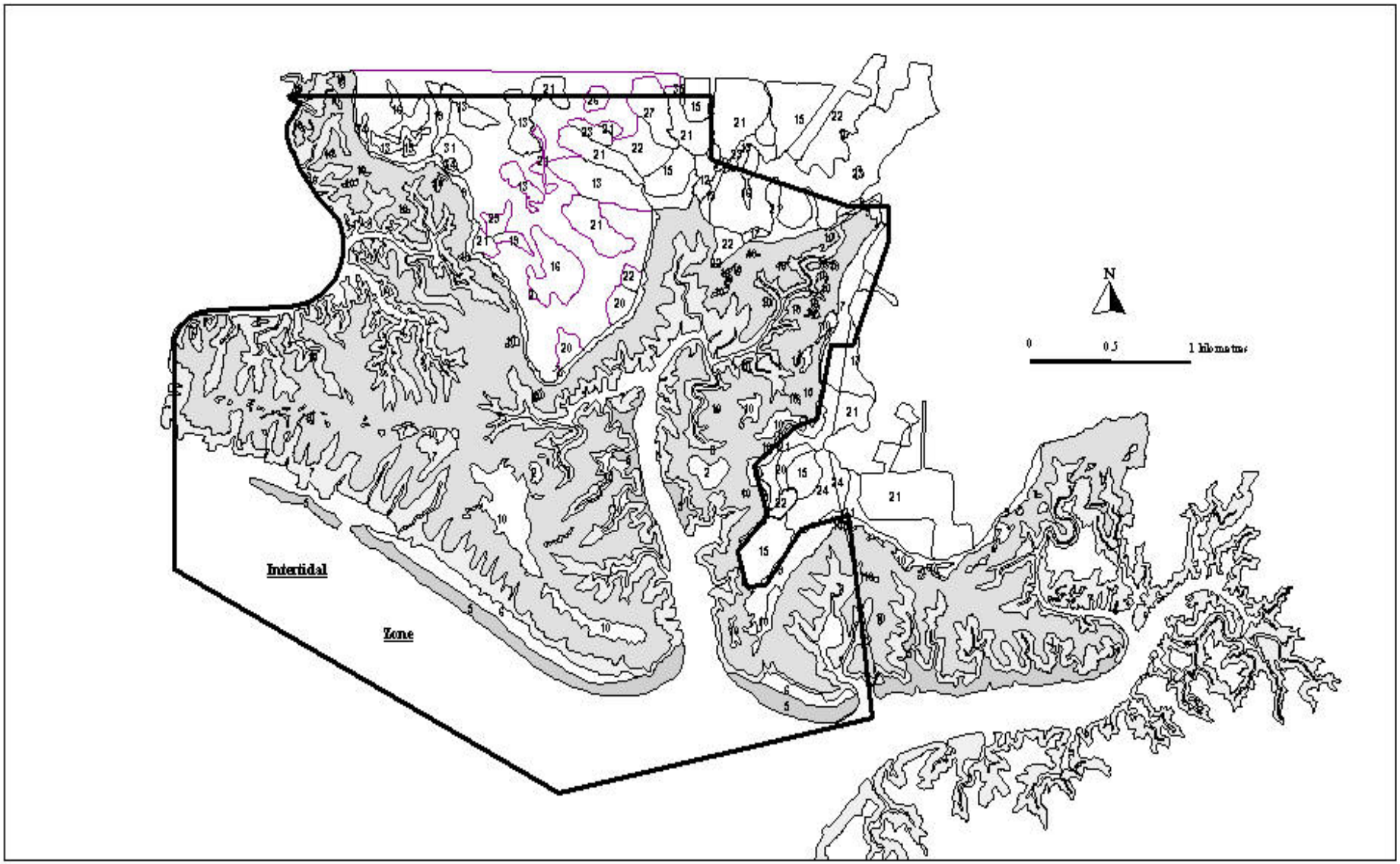
Appendix 1: Charles Darwin National Park - Vegetation Map



Appendix 1: Table 1

No.	Vegetation Unit Description
2	Mixed species coastal monsoon forest associated with seasonally dry habitats.
5	*Sonneratia alba* open forest to woodland to 12m tall. The seaward mangrove zone.
6	Coastal *Rhizophora stylosa* closed forest to 16m tall, commonly in pure stands forming shoreline zone.
7	*Rhizophora stylosa*, *Brugeira exaristata*, *Camptostemon schultzii* closed forest to open forest. This community grows along tidal creeks and includes adjacent transitional zones.
8	*Ceriops tagal* low closed forest 2-6m tall. Commonly forms pure stands on tidal flats.
9	*Ceriops tagal*, *Avicennia marina*, *Lumnitzera racemosa*, *Excoecaria ovalis*, low closed forest generally 2-7m tall. Hinterland mangrove zone.
10	Salt flats. Hypersaline flats or bare sandy mud, with occasional shrubs such as *Batis argillicola* and *Suaeda arbusculoides*, and scattered stunted mangroves.
12	*Melaleuca leucadendra*, *Melaleuca cajuputi*, *Acacia auriculiformis* closed forest swamp.
13	*Eucalyptus tetradonta*, *E. miniata* open forest with *Sorghum intrans* and *Heteropogon triticeus* grassland understorey.
15	*Eucalyptus tetradonta*, *E. miniata* woodland to low woodland, with mixed species mid stratum and grassland understorey.
16	*E. miniata*, *E. tetradonta*, *E. bleeseri* woodland to open woodland with sparse mid layer and dense grassland understorey.
17	*E. tectifica* low open woodland, with *E. clavigera*, *Xanthostemon paradoxus*, and grassland understorey.
19	*Lophostemon lactifluus* mixed species open forest with *Acacia auriculiformis* and *Melaleuca leucadendra*. A transition community.
20	*Lophostemon lactifluus*, Pandanus spiralis open forest, with Sorghum intrans and Pennisetum polystachion grassland understorey, and mixed shrubs and herbs.
21	*Pandanus spiralis* low open woodland to very low open woodland, with *Lophostemon lactifluus* and *Grevillea pteridifolia*. Ground layer dominated by mixed species grasses and sedges.
22	*E. clavigera*, *E. polycarpa*, *E. tectifica* mixed species low open woodland to very low open woodland. Understorey mixed species grasses and sedges.
23	Regeneration *Buchanania obovata*, *Cochlospermum fraseri*, *Calytrix exstipulata* mixed species very low open woodland/shrubland. Includes areas of grassland and disturbed areas.
24	*Sorghum intrans*, *Eriachneburkittii*, *Heteropogon contortus* mixed species grassland, with regeneration very low open woodland. Includes cleared or disturbed areas.
26	*Plectrachne pungens* hummock grassland with *Eriachne contorta* and *Petalostigma quadriloculare*, and scattered very low open woodland.
27	*Pennisetum ploystachion*, *Eriachne burkittii*, *Fuirena ciliaris*, *Pseudopogonatherum contortum* closed grassland with scattered low trees.
29	*Themeda triandra* closed grassland with scattered very low open woodland.
31	*Ischaemum australi* closed grassland seasonal swamp with *Bothriochloa bladhii*, *Xerochloa imberbis* and sedges including *Fimbistylus littoralis* and *Eleocharis spiralis*.
34	*Melaleuca leucandendra* stunted very low open woodland.
35	*Senna alata* tall closed shrubland 3-4m tall with *Senna obtusifolia*, *Crotolaria goreensis* and occasionally *Mimosa pigra*.

Appendix 2: Flora List for Charles Darwin National Park

Endemic to NT	e
Introduced species	*
Noxious Weed Class B	B

Family	Species	Common Name	Status	
Acanthaceae	*Brunoniella australis*			
	Hypoestes floribunda			
Amaranthaceae	*Celosia argentea*		*	
	Gomphrena canescens			
	Ptilotus distans			
Anacardiaceae	*Buchanania obvata*	Green Plum/Wild Mango		
Apiaceae	*Trachymene didiscoides*			
Apocynaceae	*Alstonia actinophylla*	Milkwood		
	Alyxia spicata			
	Catharanthus roseus			
	Ichnocarpus frutescens			
	Parsonsia velutina			
	Tabernaemontana orientalis			
	Wrightia pubescens			
	Wrightia saligna			
Arecaceae	*Carpentaria acuminata*			
	Livistona humilis	Sand Palm/Fan Palm		e
Aristolochiaceae	*Aristolochia holtzei*			
Asclepiadaceae	*Cynanchum carnosum*			
	Gymnanthera oblonga			
	Gymnema geminatum			
	Marsdenia viridiflora			
	Sarcostemma viminale			
	Secamone elliptica			
	Tylophora erecta			
	Tylophora flexuosa			
Asteraceae	*Allopterigeron filifolius*			
	Bidens bipinnata	Cobbler's Peg		
	Blumea saxatilis			
	Epaltes australis			
	Minuria macrorhiza			
	Pleurocarpaea denticulata			
	Synedrella nodiflora			*
	Wedelia trilobata	Singapore Daisy		*
Bignoniaceae	*Dolichandrone filiformis*			
Bixaceae	*Cochlospermum fraseri*	Kapok Bush		e
Bombacaceae	*Camptostemon schultzii*	Kapok Mangrove		
Boraginaceae	*Heliotropium ventricosum*			
Burseraceae	*Canarium australianum*			
Capparaceae	*Capparis sepiaria*			
	Capparis umbonata	Wild Orange		
Caryophyllaceae	*Polycarpaea sp*			

	Polycarpaea violacea		
Caesalpiniaceae	*Chamaecrista absus*		
	Chamaecrista mimosoides		
	Chamaecrista nicititans		
	Erythrophleum chlorostachys	Ironwood	
	Senna alata	Candle Bush	*B
Celastraceae	*Denhamia obscura*		
Chenopodiaceae	*Halosarcia indica*		
	Suaeda arbusculoides		
Combretaceae	*Lumnitzera racemosa*	Black Mangrove	
	Terminalia ferdinandiana	Billygoat Plum	
	Terminalia microcarpa		
Commelinaceae	*Cartonema spicatum*		
	Commelina ensifolia		
	Murdannia graminea		
Convolvulaceae	*Bonamia brevifolia*		
	Evolvulus nummularis		*
	Ipomoea abrupta	Yam	
	Ipomoea coptica		
	Ipomoea graminea		
	Ipomoea polymorpha		
	Ipomoea quamoclit	Morning Glory	*
	Merremia aegyptia		*
	Polymeria ambigua		
	Xenstegia tridentata		
Cyadaceae	*Cycas armstrongii*	Cycad	e
Cyperaceae	*Bulbostylus barbata*		
	Cyperus polystachyos		
	Cyperus iria		
	Cyperus javanicus		
	Fimbristylis A23005 Darwin		
	Fimbristylis D126624 Charles Darwin		
	Fimbristylis A23005 Darwin		
	Fimbristylis acicularis		
	Fimbristylis acuminata		
	Fimbristylis bisumbellata		
	Fimbristylis cymosa		
	Fimbristylis D126624 Charles Darwin		
	Fimbristylis densa		
	Fimbristylis ferruginea		
	Fimbristylis macrantha		
	Fimbristylis modesta		
	Fimbristylis pachyptera		
	Fimbristylis pallida		
	Fimbristylis pauciflora		
	Fimbristylis recta		
	Fimbristylis schoenoides		
	Fimbristylis schultzii		
	Fimbristylis simplex		

	Fimbristylis tetragona		
	Fimbristylis xyridis		
	Fuirena ciliaris		
	Lipocarpha microcephala		
	Rhynchospora exserta		
	Scleria brownii		
	Scleria novae-hollandiae		
	Scleria pygmaea		
	Scleria rugosa		
	Tricostularia undulata		
Dilleniaceae	*Hibbertia tasmanica*		
	Pachynema junceum		
Dioscoreaceae	*Dioscorea transversa*	Long Yam	
	Dioscorea bulbifera		
Droseraceae	*Drosera burmannii*		
	Drosera petiolaris	Sundew	
Ebenaceae	*Diospyros compacta*		
	Diospyros cordifolia	Ebony	
Elaeocarpaceae	*Elaeocarpus arnhemicus*		
Euphorbiaceae	*Antidesma ghaesembilla*		
	Croton argyratus		
	Croton arnhemicus		
	Glochidion xerocarpum		
	Breynia cernua		
	Bridelia tomentosa		
	Drypedes deplanchei		
	Euphorbia schultzii		
	Euphorbia vachellii		
	Excoecaria ovalis	Blind your eye Mangrove	
	Flueggea virosa melanthesoides		
	Jatropha gossypifolia	Bellyache	*B
	Petalostigma pubescens	Quinine Bush	
	Petalostigma quadrilocare	Quinine Bush	
	Phyllanthus emblica		*
	Phyllanthus flagellaris		
	Phyllanthus minutiflorus		
	Phyllanthus virgatus		
	Poranthera microphylla		
	Sauropus glaucus		
	Sauropus paucifolius		
Fabaceae	*Abrus precatorius*	Crabs Eye Vine	
	Alysicarpus glumaceus		
	Alysicarpus vaginalis		*
	Cajanus scarabaeoides var. penunculatus		
	Calopogonium mucunoides	Calopo	*
	Centrosema pubescens	Centro	*
	Clitoria australis		
	Clitoria ternatea	Blue Pea/Butterfly Pea	*
	Crotolaria brevis		

	Crotalaria goreensis	Gambia Pea	*
	Crotalaria medicaginea		
	Crotolaria montana		
	Crotalaria pallida var. obovata	Streaked Rattlepod	*
	Crotolaria retusa		
	Dendrolobium A7716 Prostatum		e
	Desmodium clavitrichum		
	Desmodium A7567		
	Desmodium A7582		
	Desmodium brownii		
	Desmodium trichostachyum		
	Dunbaria singuliflora		
	Eriosema chinense		
	Flemingia parviflora		
	Galactia megalophylla		
	Galactia tenuiflora		
	Indigofera hirsuta		
	Indigofera linifolia		
	Macroptilium atropurpureum	Siratro	*
	Rhynchosia australis		
	Rhynchosia minima		
	Stylosanthes hamata		*
	Stylosanthes humilis	Stylo	*
	Tephrosia lamproloboides		
	Uraria lagopodioides		
	Vigna lanceolata var. filifolius		
	Vigna lanceolata var. filiformis		
	Vigna radiata		
	Vigna vexillata var. angustifolia		
	Vigna vexillata var. vexillata		
	Zornia prostrata		
Flacourtiaceae	*Flacourtia territorialis*		
Flagellariaceae	*Flagellaria indica*		
Goodeniaceae	*Goodenia armstrongiana*		
	Goodenia holtzeana		
	Goodenia pumilio		
Haemodoraceae	*Haemodorum coccineum*		
	Haemodorum parviflorum		
Lamiaceae	*Hyptis suaveolens*		*B
	Plectranthus scutellarioides		
Lauraceae	*Cassytha filiformis*	Dodder Laurel	
	Litsea glutinosa		
Lentibulariaceae	*Utricularia caerulea*		
	Utricularia chrysantha		
	Utricularia leptorhyncha		
Lecythidaceae	*Barringtonia acutangula*	Freshwater Mangrove	
	Planchonia careya	Cocky Apple	
Liliaceae	*Chlorophytum laxum*		
	Curculigo ensifolia		

	Protasparagus racemosus	Asparagus Fern	
	Sowerbaea alliacea		
	Thysanotus banksii		
Lindsaeaceae	*Lindsaea ensifolia*		
Loganiaceae	*Mitrasacme connata*		
	Mitrasacme gentianea		
	Mitrasacme latiflora		
	Mitrasacme nummularia		
	Mitrasacme retroloba		
	Mitrasacme subvolubilis		
	Strychnos lucida	Strychnine Bush	
Lycopodiaceae	*Lycopodiella cernua*		
Malvaceae	*Hibiscus meraukensis*		
	Hibiscus sabderiffa	Rosella	*
	Malachra fasciata		
	Sida acuta	Spinyhead Sida	*B
	Sida rhombifolia	Common Sida	*B
	Thespesia populneoides		
	Urena lobata	Urena Burr	
Melastomataceae	*Melastoma affine*		
	Melastoma polyanthum	Native Lasiandra	
	Memecylon pauciflorum		
Meliaceae	*Xylocarpus mekongensis*	Cedar Mangrove	
Mimosaceae	*Acacia auriculiformis*	Black Wattle	
	Acacia difficilis		
	Acacia dimidiata	Swamp Wattle	
	Acacia holosericea		
	Acacia lamprocarpa		
	Acacia latescens		e
	Acacia mimula		
	Acacia plectocarpa plectocarpa		
	Acacia torulosa		
	Leucanena leucocephala	Coffee Bush	*
	Mimosa pigra	Mimosa	* B
	Neptunia gracilis		
Menispermaceae	*Pachygone ovata*		
	Tinospora smilacina		
Molluginaceae	*Mollugo pentaphylla*		
Moraceae	*Ficus opposita*	Sandpaper Fig	
	Ficus opposita var. indecora		
	Ficus platypoda	Rock Fig	
Myrsinaceae	*Aegiceras corniculatum*	River Mangrove	
Myrtaceae	*Calytrix exstipulata*	Turkey Bush	
	Corymbia bella	Ghost Gum	
	Corymbia bleeseri	Smooth-stemmed Bloodwood	
	Corymbia polycarpa	Blue Plooca	
	Corymbia porrecta	Grey Bloodwood	
	Eucalyptus alba	Salmon Gum	
	Eucalyptus clavigera	Cabbage Gum	

	Euclayptus miniata	Woolybutt	
	Eucalyptus tectifica	Grey Box	
	Eucalyptus tetrodonta	Stringy Bark	
	Lophostemon lactifluus	Swamp Murtle	
	Melaleuca cajuputi	Paperbark	
	Melalueca leucadendra	Weeping Paperbark	
	Melaleuca nervosa	Paperbark	
	Melaleuca viridiflora		
	Syzygium eucalyptiodes bleeseri	White Bush Apple	
	Syzygium suborbiculare	Red Bush Apple	
	Verticordia cunninghamii		
	Verticordia verticillata		
	Xanthostemon paradoxus		
Onagraceae	*Ludwigia octovalvis*		
	Ludwigia perennis		
Orchidaceae	*Geodorum neocaledonicum*		
	Liparis habenarina		
Pandanaceae	*Pandanus spiralis*	Screw Palm	
Passifloraceae	*Passiflora foetida*	Passionfruit Vine	*
Plumbaginaceae	*Aegialitis annulata*	Club Mangrove	
Poaceae	*Adropogan gayanus*	Gamba Grass	*
	Alloteropsis semialata		
	Aristida holathera		
	Bambusa arnhemica	Bamboo	
	Bothriochloa bladhii		
	Bothriochloa pertusa		*
	Brachiaria holosericea		
	Cenchrus elymoides		
	Chloris inflata		*
	Chrysopogon fallax		
	Cymbopogon bombycinus		
	Digitaria gibbosa		
	Ectrosia leporina		
	Eragrostis cumingii		
	Eriachne sp.		
	Eriachne avenacea		
	Eriachne burkittii		
	Eriachne ciliata		
	Eriachne triseta		
	Eulalia annua		
	Germainia grandiflora		
	Germainia truncatiglumis		
	Heterachne gulliveri		
	Heteropogon contortus		
	Heteropogon triticeus		
	Imperata cylindrica		
	Ischaemum australe		
	Ischaemum australe var. australe		
	Melinus repens		

	Mnesithea formosa			
	Mnesithea rottboellioides			
	Panicum maximum			
	Panicum mindanaense		*	
	Pennisetum pedicellatum		*	
	Pennisetum polystachion	Mission Grass	*	B
	Plectrachne pungens	Curly Spinifex		
	Pseudopogonatherum contortum			
	Rottboellia cochinchinensis		*	
	Sehima nervosum			
	Setaria apiculata			
	Sorghum exstans			
	Sorghum intrans	Spear Grass		
	Themeda arguens		*	
	Themeda triandra			
	Whiteochloa capillipes			
Polygalaceae	*Polygala orbicularis*			
	Salomonia ciliata			
Portulacaceae	*Portulaca bicolor*		e	
Proteaceae	*Banksia dentata*			
	Grevillia decurrens		e	
	Grevillea dryandri			
	Grevillea pteridifolia	Fern-leaved Grevillea		
	Persoonia falcata	Milky Plum		
	Stenocarpus cunninghamii			
Restionaceae	*Leptocarpus spathaceus*			
Rhamnaceae	*Alphitonia excelsa*	Red Ash		
	Ziziphus oenopolia			
Rhizophoraceae	*Bruguiera exaristata*	Ribbed Mangrove		
	Bruguiera parviflora	Slender Mangrove		
	Carallia brachiata			
	Ceriops australis	Spur Fruit Mangrove		
	Ceriops tagal	Yellow Mangrove		
	Rhizophora stylosa	Stilt Mangrove		
Rubiaceae	*Borreria sp.*			
	Canthium D55756			
	Gardenia megasperma			
	Gardenia schwarzii			
	Kailarsenia suffruticosa		e	
	Knoxia stricta			
	Mitracarpus hirtus		*	
	Nauclea orientalis	Leichhardt Tree		
	Oldenlandia mitrasacmoides			
	Oldenlandia mitrasacmoides subsp. mitrasamoides			
	Timonius timon			
Rutaceae	*Glycosmis trifoliata*			
	Melicope elleryana			
Santalaceae	*Exocarpos latifoliius*	Native Cherry		
	Santalum album			

Sapindaceae	*Allophylus cobbe*		
	Cupaniopsis anacardionides		
	Dodonaea lanceolata		
	Dodonaea platyptera		
Sapotaceae	*Mimusops elengi*		
	Planchonella pohlmaniana		
Schizaeaceae	*Lygodium microphyllum*	Climbing Maiden Hair Fern	
Scrophulariaceae	*Buchnera gracilus*		
	Buchnera linearis		
	Limnophila fragrans		
	Lindernia lobelioides		
	Lindernia scapigera		
	Lindernia vitacea		
	Mimulus debilis		
	Scoparia dulcis		*
	Stemodia lythrifolia		
	Striga curviflora		
Sinopteridaceae	*Cheilanthes brownii*		
	Cheilanthes contigua		
	Cheilanthes nitida		
Smilacaceae	*Smilax australis*		
Solanaceae	*Physalis minima*		
Sonneratiaceae	*Sonnerata alba*	Pornupan Mangrove	
Stackhousiaceae	*Stackhousia intermedia*		
Sterculiaceae	*Brachychiton diversifolius*	Kurrajong	
	Brachychiton megaphyllus		
	Helicteres A78389 Darwin		
	Helicteres dentata		
	Helicteres hirsuta		
	Sterculia quadrifida	Peanut Tree	
	Waltheria indica		
Stylidiaceae	*Stylidium leptorrhizum*		e
Taccaceae	*Tacca leontopetaloides*		
Thelypteridaceae	*Cyclosorus interruptus*		
Thymelaeaceae	*Thecanthes punicea*		
Tiliaceae	*Corochorus aestuans*		
	Grewia breviflora		
	Grewia oxyphylla		
Typhaceae	*Typha domingensis*		
Ulmaceae	*Celtis philippensis*		
	Trema tomentosa viridis		
Verbenaceae	*Avicennia marina*	Grey Mangrove	
	Clerodendrum floribundum		
	Clerodendrum inerme		
	Clerobundrum tatei		
	Lantana camara	Common Lantana	*B
	Premna acuminata		
	Premna odorata		
	Stachytarpheta jamaicensis	Snake Weed	*B

	Stachytarpheta urticifolia	Dark Blue Snake Weed	*B
	Vitex acuminata		
	Vitex trifolia		
Vitaceae	*Ampelocissus acetosa*	Wild Grape	
	Ampelocissus frutescens		
	Cayratia maritima		
	Cayratia trifolia		
	Cissus reniformis		
Xanthorrhoeaceae	*Lomandra tropica*		
Xyridaceae	*Xyris complanata*		

Appendix 3: Fauna List for Charles Darwin National Park

* introduced species	B Bonn
J Jamba	K little known (Garnett 1992)
C Camba	V vulnerable (Garnett 1992)

Family	Species	Common Name	Status
Birds			
Accipitridae	*Accipiter fasciatus*	Brown Goshawk	
	Aviceda subcristata	Pacific Baza	
	Haliaeetus leucogaster	White-bellied Sea-eagle	C
	Haliastur indus	Brahminy Kite	
	Haliastur sphenurus	Whistling Kite	
	Milvus migrans	Black Kite	
	Pandion haliaetus	Osprey	
Alcedinidae	*Alcedo azurea*	Azure Kingfisher	
	Todiramphus pyrrhopygia	Red-backed Kingfisher	
Anatidae	*Tadorna radjah*	Radjah Shelduck	
Anhingidae	*Anhinga melanogaster*	Darter	
Apodidae	*Apus pacificus*	Fork-tailed Swift	J, C
Ardeidae	*Ardea alba*	Great Egret	J, C
	Ardea intermedia	Intermediate Egret	
	Ardea sumatrana	Great-billed Heron	
	Butorides striatus	Striated Heron	
	Egretta garzetta	Little Egret	
	Egretta novaehollandiae	White-faced Heron	
	Egretta sacra	Eastern Reef Egret	C
Artamidae	*Artamus cinereus*	Black-faced Woodswallow	
	Artamus leucorynchus	White-breasted Woodswallow	
	Cracticus quoyi	Black Butcherbird	
	Cracticus nigrogularis	Pied Butcher bird	
Burhinidae	*Burhinus grallarius*	Bush Stone-curlew	
	Esacus neglectus	Beach Stone-curlew	V
Cacatuidae	*Cacatua galerita*	Sulphur-crested Cockatoo	
	Cacatua roseicapilla	Galah	
	Cacatua sanguinea	Little Corella	
	Calyptorhynchus banksii	Red-tailed Black-cockatoo	
Campephagidae	*Coracina novaehollandiae*	Black-faced Cuckoo-shrike	
	Coracina papuensis	White-bellied Cuckoo-shrike	
	Coracina tenuirostris	Cicadabird	
	Lalage leucomela	Varied Triller	
	Lalage sueurii	White-winged Triller	
Caprimulgidae	*Caprimulgus macrurus*	Large-tailed Nightjar	
Centropodidae	*Centropus phasianinus*	Pheasant Coucal	
Charadriidae	*Charadrius leschenaultii*	Greater Sand Plover	J, C, B
	Vanellus miles	Masked Lapwing	
Ciconiidae	*Ephippiorhynchus asiaticus*	Black-necked Stork	
Columbidae	*Columba livia*	Rock Dove (Feral Pigeon)	*
	Ducula bicolor	Pied Imperial Pigeon	
	Geopelia humeralis	Bar-shouldered Dove	
	Geopelia striata	Peaceful Dove	
Coraciidae	*Eurystomus orientalis*	Dollarbird	
Cuculidae	*Cacomantis variolosus*	Brush Cuckoo	
	Chrysococcyx minutillus	Little Bronze-Cuckoo	
	Eudynamys scolopacea	Common Koel	
Dicaeidae	*Dicaeum hirundinaceum*	Mistletoebird	
Dicruridae	*Dicrurus bracteatus*	Spangled Drongo	
	Grallina cyanoleuca	Magpie-lark	
	Myiagra alecto	Shining Flycatcher	
	Myiagra rubecula	Leaden Flycatcher	

	Myiagra, ruficollis	Broad-billed Flycatcher	
	Rhipidura leucophrys	Willie Wagtail	
	Rhipidura phasiana	Mangrove Grey Fantail	
	Rhipidura rufifrons	Rufous Fantail	
	Rhipidura rufiventris	Northern Fantail	
Falconidae	*Falco berigora*	Brown Falcon	
Halcyonidae	*Dacelo leachii*	Blue-winged Kookaburra	
	Todiramphus chloris	Collared Kingfisher	
	Todiramphus macleayii	Forest Kingfisher	
	Todiramphus sanctus	Sacred Kingfisher	
Hirundnidae	*Hirundo nigricans*	Tree Martin	
Laridae	*Larus novaehollandiae*	Silver Gull	
	Sterna nilotica	Gull-billed Tern	
Maluridae	*Malurus melanocephalus*	Red-backed Fairy-wren	
Megapodiidae	*Megapodius reinwardt*	Orange-footed Scrubfowl	
Meliphagidae	*Conopophila albogularis*	Rufous-banded Honeyeater	
	Entomyzon cyanotis	Blue-faced Honeyeater	
	Lichenostomus unicolor	White-gaped Honeyeater	
	Lichmera indistincta	Brown Honeyeater	
	Melithreptus albogularis	White-throated Honeyeater	
	Myzomela erythrocephala	Red-headed Honeyeater	
	Myzomela obscura	Dusky Honeyeater	
	Philemon argenticeps	Silver-crowned Friarbird	
	Philemon buceroides	Helmeted Friarbird	
	Philemon citreogularis	Little Friarbird	
Meropidae	*Merops ornatus*	Rainbow Bee-eater	J
Oriolidae	*Oriolus flavocinctus*	Yellow Oriole	
	Oriolus sagittatus	Olive-backed Oriole	
	Sphecotheres viridis	Figbird	
Pachycephalidae	*Colluricincla megarhyncha*	Little Shrike-thrush	
	Pachycephala melanura	Mangrove Golden Whistler	
	Pachycephala simplex	Grey Whistler	
Pardalotidae	*Gerygone chloronotus*	Green-backed Gerygone	
	Gerygone levigaster	Mangrove Gerygone	
	Gerygone magnirostris	Large-billed Gerygone	
	Pardalotus striatus	Striated Pardalote	
	Smicrornis brevirostris	Weebill	
Passeridae	*Lonchura castaneothorax*	Chestnut-breasted Mannikin	
	Lonchura flaviprymna	Yellow-rumped Mannikin	K
	Neochmia phaeton	Crimson Finch	
	Poephila acuticauda	Long-tailed Finch	
	Taeniopygia bichenovii	Double-barred Finch	
Pelecanidae	*Pelecanus conspicillatus*	Australian Pelican	
Petroicidae	*Eopsaltria pulverulenta*	Mangrove Robin	
	Microeca flavigaster	Lemon-bellied Flycatcher	
Phasianidea	*Coturnix australis*	Brown Quail	
Podargidae	*Podargus strigoides*	Tawny Frogmouth	
Psittacidae	*Aprosmictus erythropterus*	Red-winged Parrot	
	Platycercus venustus	Northern Rosella	
	Psitteuteles versicolor	Varied Lorikeet	
	Trichoglossus haematodus	Rainbow Lorikeet	
Ptilonorhynchidae	*Chlamydera nuchalis*	Great Bowerbird	
Rallidae	*Eulabeornis castaneoventris*	Chestnut Rail	
Scolopacidae	*Actitis hypoleucos*	Common Sandpiper	J, C, B
	Calidris acuminata	Sharp-tailed Sandpiper	J, C, B
	Heteroscelus brevipes	Grey-tailed Tattler	J, C, B
	Limosa lapponica	Bar-tailed Godwit	J, C, B
	Numenius madagascariensis	Eastern Curlew	J, C, B
	Numenius phaeopus	Whimbrel	J, C, B
Strigidae	*Ninox novaeseelandiae*	Southern Boobook	
Sylviidae	*Cisticola exilis*	Golden-headed Cisticola	
Threskiornithidae	*Threskiornis molucca*	Australian White Ibis	
	Threskiornis spinicollis	Straw-necked Ibis	
Zosteropidae	*Zosterops luteus*	Yellow White-eye	

Reptiles

Agamidae	*Chlamydosaurus kingii*	Frilled Lizard	
	Diporiphora bilineata	Two-Lined Dragon	
	Lophognathus temporalis	Northern Water Dragon	
Colubridae	*Dendrelaphis punctulata*	Common Tree Snake	
Elapidae	*Pseudechis australis*	King Brown or Mulga Snake	
Gekkonidae	*Gehyra australis*	Northern Dtella/House Gecko	
	Hemidactylus frenatus	Asian House Gecko	
	Heteronotia binoei	Bynoes Gecko	
	Oedura rhombifer	Zig-zag Gecko	
Pygopodidae	*Delma borea*		
	Lialis burtonis	Burton's Legless Lizard	
Scincidae	*Carlia gracilis*	Slender Rainbow Skink	
	Carlia munda	Striped Rainbow Skink	
	Cryptoblepharus plagiocephalus	Aboreal Snake-eyed Skink	
	Ctenotus borealis	Northern Ctenotus	
	Ctenotus essingtonii	Port Essington Ctenotus	
	Ctenotus hilli	Hill's Ctenotus	
	Morethia storri	Storr's Snake-eyed Skink	
Varanidae	*Varanus panoptes*		
	Varanus scalaris	Spotted Tree Monitor	

Amphibians

Hylidae	*Cyclorana australis*	Giant Frog	
	Litoria caerulea	Green Tree-frog	
	Litoria microbelos		
	Litoria nasuta	Rocket Frog	
	Litoria rubella	Red Tree-frog	
	Litoria tornieri		
Myobatrachidae	*Crinia bilingua*	Bilingual Froglet	
	Limnodynastes convexiusculus	Marbled Frog	

Mammals

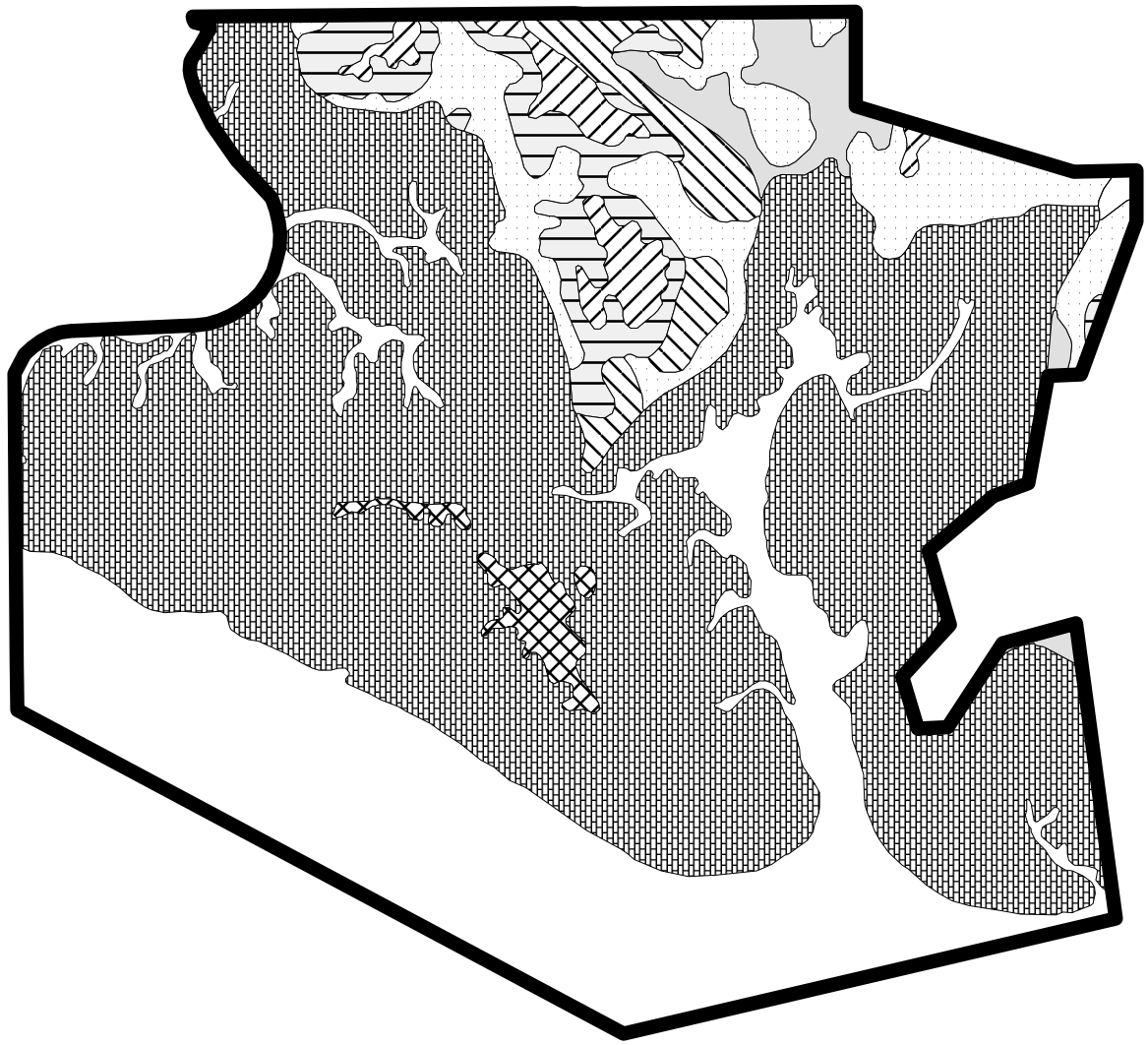
Canidae	*Canis familiaris*	Dingo	
Dasyuridae	*Dasyurus hallucatus*	Northern Quoll	
	Sminthopsis virginiae	Red-cheeked Dunnart	
Felidae	*Felis catus*	Cat (feral)	*
Macropodidae	*Macropus agilis*	Agile Wallaby	
Muridae	*Hydromys chrysogaster*	Water-rat	
	Melomys burtoni	Grassland Melomys	
	Mesembriomys gouldii	Black-footed Tree-rat	
	Mus musculus	House Mouse	*
	Rattus rattus	Black Rat	*
Peramelidae	*Isoodon macrourus*	Northern Brown Bandicoot	
Phalangeridae	*Trichosurus vulpecula*	Common Brushtail Possum	
Pteropodidae	*Pteropus alecto*	Black Flying-fox	
	Pteropus scapulatus	Little Red Flying-fox	
Vespertilionidae	*Chalinolobus nigrogriseus*	Hoary Wattled Bat	
	Miniopterus schreibersii	Common Bent-wing Bat	
	Myotis moluccarum	Large Footed Myotis	

Insects

Ceratopogonidae	*Culicoides actoni*	Biting midge
	Culicoides austropalpalis	Biting midge
	Culicoides bundyensis	Biting midge
	Culicoides cordiger	Biting midge
	Culicoides flumineus	Biting midge
	Culicoides histrio	Biting midge
	Culicoides marksi	Biting midge
	Culicoides narrabeenensis	Biting midge
	Culicoides ornatus	Biting midge
	Culicoides pallidothorax	Biting midge
	Culicoides papuensis	Biting midge
	Culicoides pungens	Biting midge
	Culicoides undescribed sp. Vic. 42	Biting midge
	Culicoides undescribed sp. (ornatus gp) No.6	Biting midge

	Culicoides undescribed sp. (shermani gp) No.8	Biting midge
Culicidae	*Aedeomyia(Ady) catasticta*	Mosquito
	Aedes ( ) sp 160	Mosquito
	Aedes (Adm) alboscutellatus	Mosquito
	Aedes (Cha) elchoensis	Mosquito
	Aedes (Fin) kochi	Mosquito
	Aedes (Fin) notoscriptus	Mosquito
	Aedes (Fin) pecuniosus	Mosquito
	Aedes (Mac) sp 76	Mosquito
	Aedes (Mac) tremulus	Mosquito
	Aedes (Muc) alternans	Mosquito
	Aedes (Neo) lineatopennis	Mosquito
	Aedes (nr. Levua) daliensis	Mosquito
	Aedes (Och) normanensis	Mosquito
	Aedes (Och) phaecasiatus	Mosquito
	Aedes (Och) vigilax	Salt Marsh Mosquito
	Aedes (Ver) funereus	Mosquito
	Aedes (Ver) reesi	Mosquito
	Anopheles (Ano) bancroftii	Black Australian Anopheline
	Anopheles (Cel) annulipes	Common Australian Anopheline
	Anopheles (Cel) farauti	Australian Malaria Mosquito
	Anopheles (Cel) hilli	Salt Water Anopheles Mosquito
	Anopheles (Cel) meraukensis	Mosquito
	Anopheles (Cel) novaguinensis	Mosquito
	Coquillettidia (Coq) xanthogaster	Golden Mosquito
	Culex (Cui) pullus	Mosquito
	Culex (Cux) annulirostris	Common Banded Mosquito
	Culex (Cux) bitaeniorhynchus	Mosquito
	Culex (Cux) quinquefasciatus	Brown House Mosquito
	Culex (Cux) sitiens	Salt Water Culex Mosquito
	Culex (Cux) (Vishnui group)	Mosquito
	Culex (Lop) sp. 167	Mosquito
	Mansonia (Mnd) uniformis	Water Hyacinth Mosquito

Appendix 4: Charles Darwin National Park - Land Unit Map



Plateau surface, gently undulating - < 5%; Shallow gravelly earths and lithosols, moderately extensive outcrops of laterite; Well drained.

Gently undulating slopes below plateau surface, slopes < 3%; Moderately deep red and yellow gravelly earths; Well drained.

Scarps and steep slopes from 8 to 25%; Shallow lithosols - extensive rock outcrop and surface stone; Well drained.

Low footslopes - commonly < 3% - creek margin/seepage zones; Yellow earths and minor red silaceous and earthy sands; Imperfectly drained.

Drainage floors and stream margins - slopes < 1%; Silaceous and earthy sands, minor yellow podzolics; Poorly drained - subject to flooding.

Salt flats, slope = 0%, firm with salt crusting; Saline muds and clays, uniform silty loam to salty clay; Tidal inundation - very poorly drained.

Estuarine fringe, slope = 0%; Saline muds and clays, uniform silty loam to salty clay; Tidal inundation - very poorly drained.

Gentle sideslopes to low hills, slopes 2 to 5%; Extensive surface gravels, shallow gravelly massive earths and minor lithosols; Rapid drainage.

Appendix V: Charles Darwin National Park - Cultural Sites