Knuckey Lagoons Conservation Reserve

Management Plan

Northern Territory Government

Parks and Wildlife Commission of the Northern Territory
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Knuckey Lagoons Conservation Reserve Management Plan

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FOREWORD

The Knuckey Lagoons Conservation Reserve is a small wetland located in a semi urban area on the outskirts of Darwin, the capital of the Northern Territory. This Conservation Reserve is a significant wildlife habitat and provides an important opportunity for the public to view flora and fauna in their natural state.

This Management Plan recognises the importance of these wetlands as part of the larger 'Top End' wetlands system and its importance to the local community.

While management of the Reserve is the responsibility of the Parks and Wildlife Commission, local residents have formed a community group*, Knuckey Lagoons Wildlife Sanctuary Incorporated* and executed a formal agreement with the Parks and Wildlife Commission to assist with the planning and management of the Reserve.

This agreement is a result of the commitment shown by a local community group to protect the values of an important part of the Darwin region's natural and cultural heritage.

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1. INTRODUCTION TO THE PLAN

1.1 BACKGROUND

Knuckey Lagoons Conservation Reserve is located approximately 12 kilometres south east of the Darwin City Centre (FIGURE 1). The Surveyor General, Goyder named the area in 1869 after the surveyor, Richard Randall Knuckey.

The Reserve is an important wetland habitat within a semi-urban setting, which provides a refuge for wildlife. The maintenance and protection of native wildlife and their habitats within Knuckey Lagoons Conservation Reserve contributes to the conservation of biodiversity in the Darwin region. The Reserve also provides opportunities for low key recreation and interpretation of the natural environment within close proximity to Darwin and Palmerston.

The Knuckey Lagoons Conservation Reserve contains four natural depressions of varying size that fill with water and combine to create one large body of water covering an area of approximately 54 hectares during the wet season. The Reserve's Lagoons contain water long after the wet season has passed, providing an important habitat for native wildlife particularly Magpie Geese (*Anseranas semipalmata*), the Little Curlew (*Numenius minutus*), Egrets (*Ardea ibis, Ardea alba, Egretta intermedia, Egretta garzetta*), and the Long-necked Turtle (*Chelodina rugosa*), as they wait out the dry season.

The 125 hectare Conservation Reserve is bordered by the Stuart Highway to the south and by private properties along Lagoon Road to the west, Secrett Road to the north and Thorak Road to the east. The main points of access to the Reserve are via Fiddlers Lane, Randall Road, Thorak Road and from the Stuart Highway (FIGURE 1).

The area includes Section 2933 covering 110.5 hectares, which was declared a protected area under Section 22 of the *Territory Parks and Wildlife Conservation Act* in 1985. The area also includes NT Portion 2852, which is not a declared protected area but is vested in the Conservation Land Corporation as a Crown Lease in Perpetuity (FIGURE 1).

1.2 VALUES OF THE RESERVE

The Reserve's **natural values** are related primarily to its importance as a wetland habitat for a variety of birds and other wildlife. Several of the birds that use the area are listed on the bilateral agreements with the Governments of Japan and China for the protection of migratory birds and their habitats (APPENDIX 2). Knuckey Lagoons and McMinns Lagoon have been listed in the Directory of Important Wetlands in Australia as a supplementary site for the NT as part of the Darwin Peninsula Swamps. Whilst not considered nationally

important in its own right, as part of a supplementary site the Reserve supports and contributes to the values of other nationally important wetlands across the Top End

The **aesthetic values** of the Reserve derive from the views provided of water and waterlilies during the wet season and the congregation of bird life around the lagoons when other water bodies subside during the dry season.

Due to its location and ease of access for local residents and visitors, the Reserve has the potential to provide low impact **recreation** and **tourism** opportunities centred on its aesthetic, natural and cultural values.

Also of importance are **cultural values**, including past and contemporary use of the Reserve by Aboriginal people. The **historical values** of the Reserve relate to its use as a recreational area and use by the defence forces during WWII. Chinese gardeners also used the area during the early development of Darwin.

The **educational** and **interpretative values** of the Reserve relate to its habitats and wildlife, its use by Aboriginal people and its historic values.

The Reserve **scientific values** relate to the opportunity to study a wetland habitat and its importance to wildlife, particularly waterfowl, migratory birds and freshwater turtles within a semi–urban environment. The contribution of the Reserve's wildlife and their habitats to the conservation of biological diversity within the Darwin Region also gives the Reserve scientific value.

1.3 CONCEPT OF THE RESERVE AND ITS PURPOSES

Knuckey Lagoons Conservation Reserve has been set aside to protect an area of land subject to seasonal inundation that provides a refuge for wildlife, particularly birds.

In addition to preserving the natural and cultural values of the area, the Reserve also provides opportunities for presenting a natural wetland environment.

Accordingly, the principal purposes of the Reserve are:

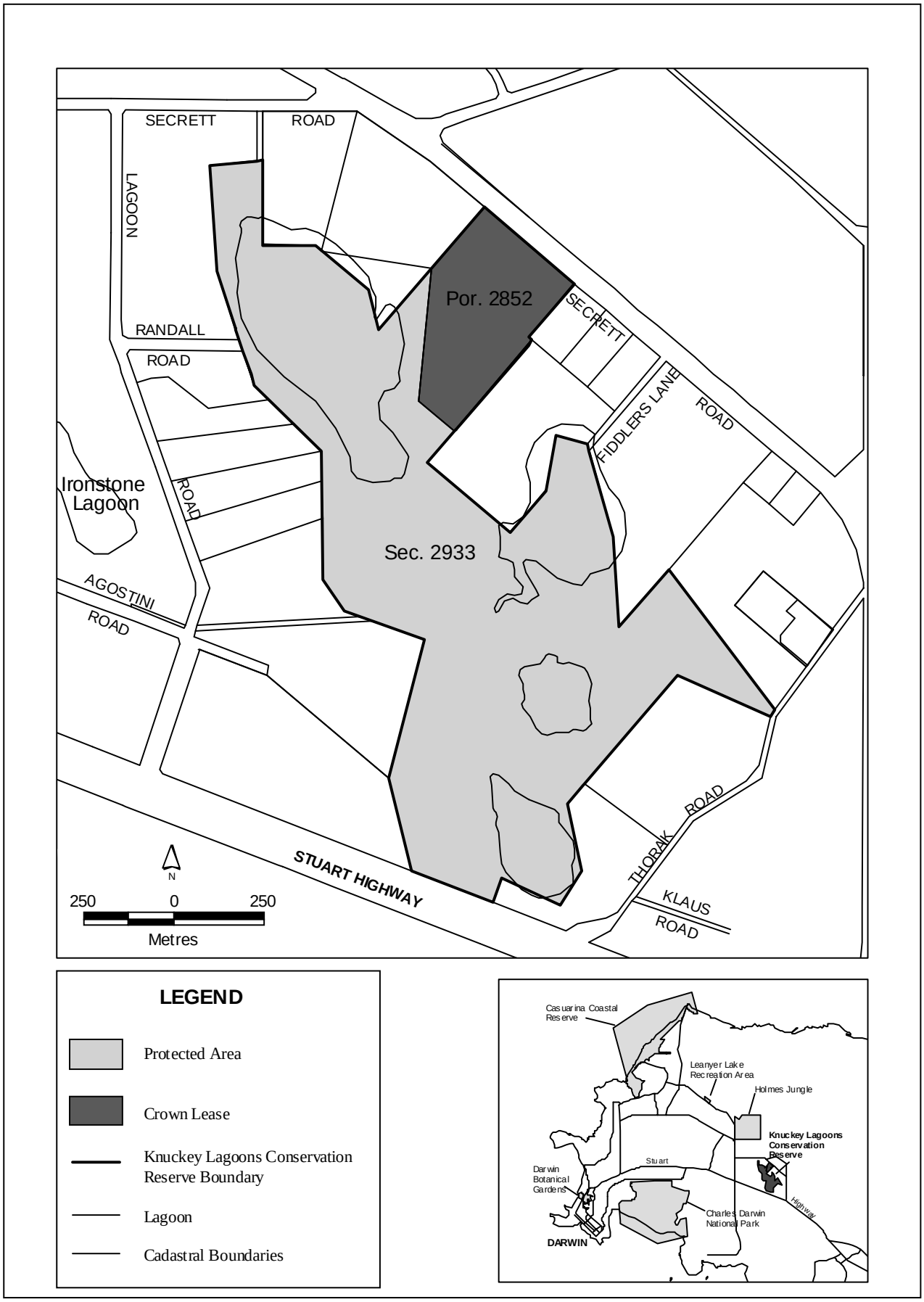
◊ To contribute to the conservation of biodiversity in the Darwin Region, in particular to conserve wetlands habitat for migratory birds, waterfowl and turtles.

◊ To protect the native flora and fauna, water resources and aesthetic values of the Reserve.

◊ To provide opportunities for recreational and interpretive activities consistent with the primary objective of conservation of the Reserve's values.

◊ To protect and interpret cultural values associated with Aboriginal use and historical values associated with WWII.

FIGURE 1 – LOCALITY KNUCKEY LAGOONS CONSERVATION RESERVE



1.4 REGIONAL CONTEXT

Knuckey Lagoons is one of six reserves located in the urban and semi rural areas near Darwin City and Palmerston (FIGURE 1). The Corporate Plan of the Parks and Wildlife Commission and the Northern Territory Parks Masterplan has set a goal to manage and develop the Darwin District Parks as part of a Greater Darwin Park. The Greater Darwin Park will aim to consolidate and integrate the management of protected areas in the Darwin Parks District.

The Parks and Wildlife Commission of the Northern Territory recognises the importance of these reserves in maintaining the viability of individual species and communities. The maintenance of wildlife and their habitats within these urban and semi-urban reserves also contributes to the conservation of biodiversity within the Darwin region.

It is recognised that other natural areas in Darwin also provide habitat for wildlife and contribute to maintaining wildlife values in Knuckey Lagoons Conservation Reserve. Liaison and cooperation with surrounding landholders and managers of other natural areas to encourage land use and land management practices that are sympathetic to the conservation values of this Reserve will be an important step in maintaining and enhancing its values.

1.5 MANAGEMENT OF KNUCKEY LAGOONS

Management of Knuckey Lagoons Conservation Reserve is the responsibility of the Parks and Wildlife Commission under the provisions of the *Territory Parks and Wildlife Conservation Act*.

Local residents have formed an incorporated association*, Knuckey Lagoons Wildlife Sanctuary Incorporated*, (the Association) to assist with the coordinated planning and management of the Reserve. The Commission, in recognition of the commitment of the Association to preserving the values of the Reserve, has executed a formal agreement with them to coordinate management.

The agreement allows for the establishment of a Knuckey Lagoons Management Committee. The Committee is comprised of five members, including the Chief District Ranger - Darwin District Parks (or delegate) and the Principal Planner – Darwin Region (or delegate) of the PWCNT and three members nominated by the Association.

The Committee's functions under the agreement are:

⇒ To prepare a draft Management Plan for Knuckey Lagoons for consideration by the Commission.

⇒ To oversee the implementation of the approved Management Plan.

⇒ To review and make recommendations to the Commission on the implementation and effectiveness of the approved Management Plan.

⇒ To report to the Commission on a regular basis with respect to its deliberations and actions.

The Parks and Wildlife Commission's responsibilities under the agreement include:

⇒ Ultimate responsibility for the care control and management of Knuckey Lagoons Conservation Reserve.

⇒ The provision of resources to enable the Committee to carry out its functions;

⇒ Approving the Management Plan in consultation with the Committee.

⇒ Day to day implementation of the management plan.

⇒ To develop and maintain the reserve in accordance with the approved Management Plan.

1.5 INTENT OF THE PLAN

This Management Plan states the intent of the Parks and Wildlife Commission with regard to the management of Knuckey Lagoons Conservation Reserve. It sets management objectives, addresses current issues and proposes appropriate measures to guide future management and development of the Reserve.

The Plan will be in force for a minimum of five years and a maximum of ten years.

2. ZONING SCHEME

2.1 OUTLINE OF THE ZONING SCHEME

The Zoning Scheme for the Reserve is the basis for the regulation of activities and developments within defined areas to ensure that activities are compatible with the aim of conserving the natural and cultural values of the Reserve.

The Reserve is zoned Open Space-Conservation under the Litchfield Shire Zoning established under the *Northern Territory Planning Act*. Developments and activities proposed within the Reserve Zoning Scheme are consistent with the Town Planning Zone.

The Reserve has been divided into two zones (TABLE 1, FIGURE 2):

- ◊ Special Purpose Zone, and
- ◊ Dispersed Use Zone

The purpose of each of the two zones, determined on their values, is outlined below. Public access within any zone may be regulated and restricted where necessary.

2.2 SPECIAL PURPOSE ZONE

The purpose of this zone is to protect the conservation values of the wetland lagoons and their habitats, in particular the bird habitat in the northern section of the Reserve. Management of this zone will aim to maintain the natural flora and fauna, water quality and quantity and restrict access by feral animals and eradicate weeds. No visitor facilities will be developed within this zone and visitor access will be by permit.

2.3 DISPERSED USE ZONE

The main purpose of this zone is to conserve the natural and cultural values of the area whilst allowing for the provision of low key recreational activities in a natural setting. Visitor facilities may include a combination rest, shelter and bird viewing area containing interpretation, and dual walking and bicycle paths with elevated boardwalks.

FIGURE 2 – ZONING SCHEME KNUCKEY LAGOONS CONSERVATION RESERVE

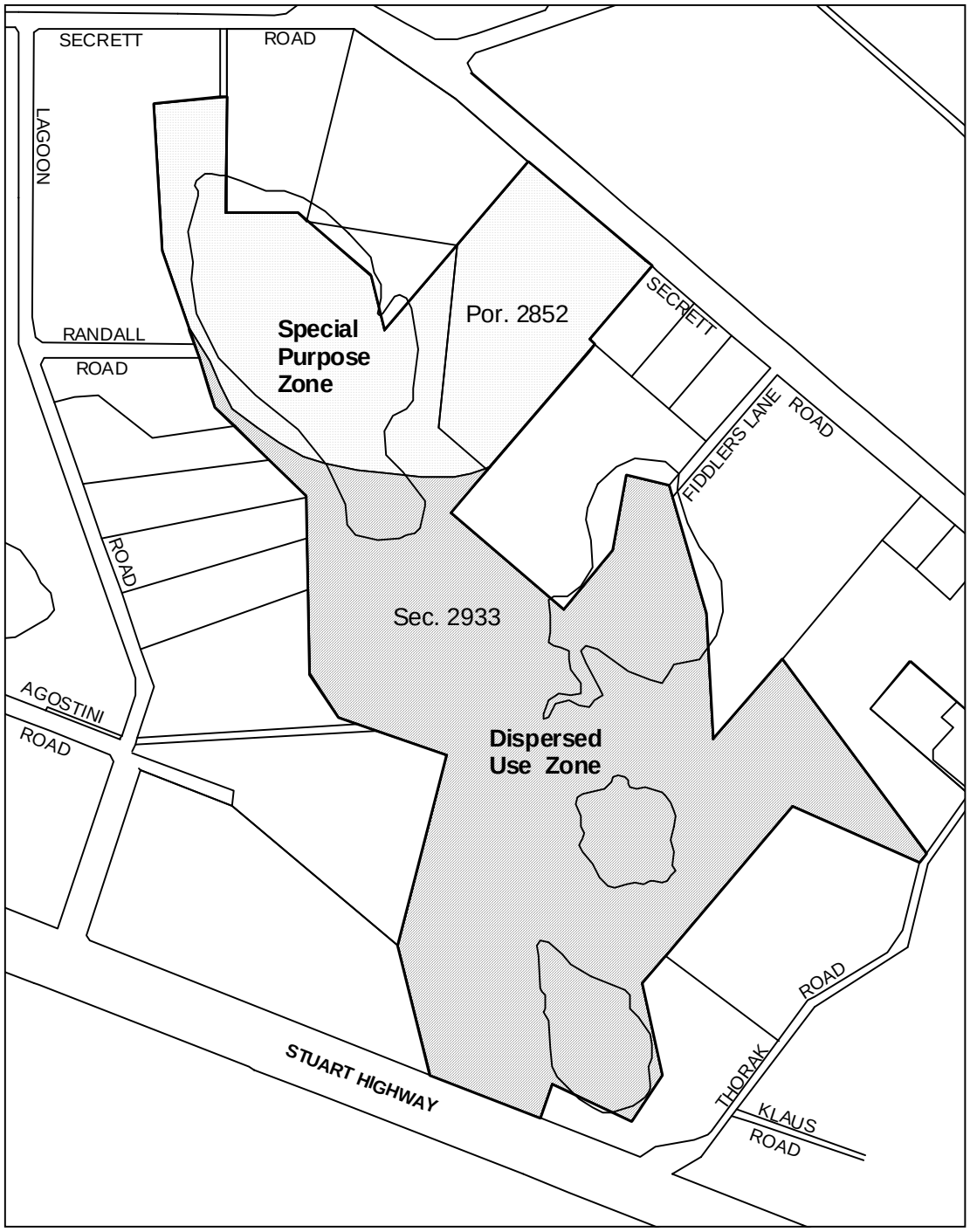


TABLE 1 – SUMMARY OF ZONING SCHEME

	Special Protection Zone	Dispersed Use Zone
Purpose	To protect significant bird habitat.	To provide opportunities for a range of recreational activities in a natural setting while protecting the Reserve's values.
Management Strategy	To provide special protection of the wetland and bird habitats from adverse impacts. Special management attention to maintain the natural flora and fauna, water quality and quantity, restrict access by feral animals, eradicate weeds and minimise mosquito breeding in the area. Maintain liaison with government departments and surrounding property owners to encourage management practices and land uses compatible with the Reserve's conservation objectives.	To protect the natural and cultural values and to provide facilities and information that educates visitors about the values of the Reserve.
Access	Access for management purposes, authorised scientific study and for traditional Aboriginal resource use in accordance with the *Territory Parks and Wildlife Conservation Act*. No domestic pets or unauthorised vehicles.	Visitor access by foot and bicycle along designated paths only. Access for management vehicles. No domestic pets or unauthorised vehicles.
Facilities	Signs to advise users of zone restrictions. Barrier fences may be constructed if necessary to control access. No other developments.	Walking/bicycle path, interpretive shelter/s, Bird viewing platform with appropriate access, signs, boardwalk, carpark, toilet may be constructed.
Appropriate Uses	Scientific research, biological conservation, management programs and traditional Aboriginal resource use in accordance with the *Territory Parks and Wildlife Conservation Act*.	Wildlife observation, photography, walking, cycling, educational activities and picnicking.

3. MANAGEMENT OF THE RESERVE'S RESOURCES

3.1 OBJECTIVES

1. To conserve the Reserve's biodiversity through management and protection of native flora and fauna communities and ecosystems, landforms, soils and water resources.

2. To minimise impacts on the natural environment resulting from human activity and invasion by weeds, feral animals and wildfires.

3. To protect the Aboriginal cultural and contemporary historical values that may exist within the Reserve.

4. To identify and implement research and monitoring requirements for the Reserve's natural and cultural resources.

5. To protect the aesthetic values of the Reserve.

3.2 GEOLOGY, LANDFORMS AND SOILS

In the Reserve early proterozoic (~1870 million years ago) undifferentiated silt-stones and mud-stones of the South Alligator Group are overlain with the weathered, sand silts and clays of the Quatenary period (~2 million years ago).

The Bureau of Mineral Resources has identified a faultline running between Ironstone Lagoon and the Knuckey Lagoons Conservation Reserve. The early proterozoic Burrell Creek Formation (Finnis River Group) are located to the west of the fault line and the South Alligator Group to the east.

The Reserve is divided into two basic land unit types. The outer perimeter of the Reserve predominantly consists of upland depressions and floodways with negligible slopes and with siliceous and earthy sands. These often overlay indurated ironstone or a layer of deeper clay. Vegetation within this land unit is mostly grassland with scattered trees. The remaining sections of the Reserve are swamp depressions, which are inundated during the wet. Soils in this area are friable, mottled yellow duplex soils, containing an organic loam over clay.

The lagoons are formed from depressions in the plateau surface. Soil and organic matter have accumulated in the depressions to form a thick organic layer that is thought to inhibit the seepage of water into the ground water. Thus the lagoons are poorly drained and water remains long after wet season flooding.

There is little evidence to suggest large amounts of sediment are entering the lagoons at this time. The area around the lagoons is well grassed and of a low gradient, this slows the flow of water, which allows most of the sediment to be filtered out before entering the lagoons. However, it is possible that future developments within the Reserve and on surrounding lands could increase the amount of sediment entering the lagoons.

The Natural Resources Division of the Department of Lands Planning and Environment is currently compiling Erosion and Sediment Control Guidelines. These guidelines will assist landholders to minimise erosion and control sediment movement on their properties and help to reduce impacts on surrounding lands.

Knuckey Lagoons Conservation Reserve is within Mining Reserve 390 that covers the Darwin town locality. This is equivalent to a Reservation from Occupation and ensures no mining will occur in the area.

MANAGEMENT GUIDELINES

- Appropriate measures will be undertaken to prevent or limit soil erosion in the Reserve, including the regulation of visitor access and activities in accordance with the Reserve's zoning scheme.
- Soils will not be excavated, removed or disturbed in the Reserve except where necessary for management purposes.
- Any future developments within the Reserve will be designed, sited and constructed to restrict soil erosion and avoid areas susceptible to soil erosion.
- Existing erosion along old tracks, firebreaks and drainage lines will be rehabilitated and erosion prevention measures installed.
- Liaison will be undertaken with relevant government authorities regarding storm water drains in particular appropriate erosion and sediment control measures for the drains. If necessary the installation of appropriate sediment traps in storm water drains will be considered.
- Authorised vehicles only will be permitted in the Reserve.

3.3 WATER RESOURCES

Knuckey Lagoons Conservation Reserve is situated at the head of two catchments forming part of the Milners Creek surface catchment and the Holmes Jungle Nature Park groundwater catchment. Each wet season the groundwater table is recharged by wet season rains.

Knuckey Lagoons Conservation Reserve contains perennial, temporary and intermittent lagoons which are connected to the groundwater table. Consequently the lagoons reflect the fluctuations in the level of the water table.

When the groundwater table falls below the surface water level in the dry season the lagoons begin to drain. Clayey soils and thick organic matter lining the lagoons inhibit drainage and by the late dry season the lagoons often present a perched lake effect, where the surface water is five to ten metres above the level of the groundwater table.

Water usually remains in at least one or two of the lagoons all year. When other surface waters in the area dry up waterbirds congregate here waiting for the wet season rains before moving on. Wildlife in the Reserve can be severely impacted by deterioration in water quality and quantity.

The Lagoons water quality and aquatic vegetation were investigated in 1997 and reported to be in a "healthy" state (Lloyd D 1999). The waters of the Lagoons are very clear, permitting light for photosynthesis by underwater plants, with low concentration of nutrients and microscopic algae. Tests of the Lagoons sediments for heavy metals and pesticides found they were very low and not indicative of any pollution. About 20 water plants have been found in the Lagoon, all were native.

However, ongoing monitoring of water quality is needed to detect changes and develop appropriate management strategies. Assistance from volunteers, community groups and other government departments may be sought to carry out water quality monitoring. Such monitoring will be in accordance with the research and monitoring program developed for the Reserve.

Stormwater drains enter the Reserve from the vicinity of Agostini Rd, Ironstone Lagoon and Secrett Rd. In the wet season these stormwater drains channel floodwaters into the lagoons and drain water from the surrounding properties. Stormwater drains and the runoff from surrounding properties and light industrial areas are potential sources of contamination from runoff of fertilizers, pesticides and other contaminants, as well as erosion and subsequent siltation. Stormwaters and runoff from surrounding properties may also carry weeds into the Reserve.

A number of detrimental actions could effect water quality and quantity, sediment levels and vegetation in the lagoons. These include

- ◊ Increased run-off of sediments,
- ◊ Increased run-off of fertiliser and other contaminants from neighbouring properties,
- ◊ Animals swimming in the lagoons, and
- ◊ Introduction of exotic aquatic weeds, such as salvinia and cabomba, from domestic fish tanks and local plant nurseries.

Maintenance of low levels of nutrients in the lagoons' water is particularly important to maintain water clarity. If nutrient levels and the amount of microscopic algae were to increase, and reduce water clarity, this could significantly affect the numbers and types of plants in the lagoon.

MANAGEMENT GUIDELINES

- A water quality monitoring program will be developed to help identify impacts on water quality and quantity from visitor activities, developments, nearby land-use, weeds, animals, storm water drains and runoff from surrounding properties.
- Control and eradication of aquatic weeds will be a priority of the Weed Management Program (refer to section 3.5).
- Future developments (refer to section 4.3) will be designed and sited to restrict water pollution or alterations to water drainage patterns and groundwater flows.
- Reserve management will seek to protect the water resources in the Reserve by;
    - ⇒ Management of visitors and developments in accordance with the Reserve's zoning scheme
    - ⇒ Implementation of domestic and feral animal control measures and weed and fire management programs
    - ⇒ Control of the impacts of erosion and siltation in the Reserve, and
    - ⇒ Liaison with relevant government departments and adjoining landowners to encourage management practices on surrounding land that are compatible with the Reserve's conservation objectives.

- Liaison will be maintained with neighbouring landowners and relevant management authorities regarding protection of the catchment of Milners Creek and the Knuckey Lagoons groundwater source.
- Liaison will be undertaken with relevant government authorities regarding storm water drains in particular appropriate erosion and sediment control measures for the drains. If necessary the installation of appropriate sediment traps in storm water drains will be considered.

3.4 NATIVE VEGETATION

The Reserves native vegetation consists predominantly of closed grasslands of *Bothriochloa bladhii*, *Pseudoraphis spinescens* and *Eleocharis sundaica* with low to low open woodlands surrounding the lagoons and swamp areas dominated by *Pandanus spirilas* with *Lophostemon lactifluus* and *Grevillea pteridifolia* and mixed species of grasses and sedges. Small patches of *Eucalyptus tetradonta*, *Eucalyptus miniata* woodland to low open woodland with a mid-stratum of mixed species and a grassland understorey are found in the southern area of the Reserve. Eighteen aquatic plant species have been recorded in the Reserve's lagoons most of which are endemic to the Northern Territory. APPENDIX 1 includes a list of Flora recorded for the Reserve.

Much of the woodland vegetation that remains is remnant of vegetation once widespread in the Darwin and Palmerston area. A substantial proportion of the woodland surrounding the lagoons has been removed. Maintaining ecological connections with other protected areas and natural bushland will be important for maintaining the vegetation communities in the Reserve.

MANAGEMENT GUIDELINES

- Clearing and other disturbances of the vegetation communities will be kept to the minimum necessary for management purposes in accordance with the Zoning Scheme, the Reserves Fire Action Plan (section 3.8) and the Weed Management Program (section 3.5).
- 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 with local indigenous species may be employed where required.
- Reserve management will seek to protect the vegetation in the Reserve by;
    - ⇒ Management of visitors and developments in accordance with the Reserve zoning scheme
    - ⇒ Implementation of feral and domestic animal control, and weed and fire management programs
    - ⇒ Erosion control and water quality and quantity maintenance, and
    - ⇒ Liaison with adjoining landowners to encourage land management practices on surrounding land that is compatible with the Reserve's conservation objectives.

3.5 WEED CONTROL

The Reserve is surrounded by rural and semi-urban development and the potential for the Reserve to be impacted by weeds from neighbouring properties is high. Surface run-off from neighbouring properties and stormwater drains provide points of entry for aquatic weeds or weeds transported by water including salvinia and cabomba. Stormwater drains enter the Reserve from the vicinity of Agostini Rd, Ironstone Lagoon and Secrett Rd.

Weeds can have a significant impact on conservation values by displacing native plants, altering fauna habitats and restricting the aesthetic and recreational values of the Reserve.

The Reserve already contains a wide variety of weeds and exotic pastures. These include Gamba Grass (*Andropogon gayanus*), Para Grass (*Brachiaria mutica*), Calopo (*Calopogonium mucunoides*), Centro (*Centrosema pubescens*), Gambia Pea (*Crotalaria goreensis*), Couch Grass (*Cynodon dactylon*), Mission Grass (*Pennisetum polystachion*), Spiny Head Sida (*Sida acuta*), Wild passionfruit (*Passiflora foetida*) and Hyptis (*Hyptis suaveolens*).

Mission Grass, Hyptis and Spinyhead Sida are classified as “Noxious B” under the *Noxious Weeds Act* and hence their growth and spread must be controlled.

MANAGEMENT GUIDELINES

- The Parks and Wildlife Commission will prepare an annual Weed Action Plan for the Reserve. The plan will:
- Determine the extent, distribution and impact of weeds within the Reserve with particular emphasis on noxious and aquatic weeds,
- Determine priorities and recommend methods for control and where possible eradication and affected areas.
- Provide for the monitoring and assessment of the weed action plan.
- Monitoring will be conducted in order to locate new weed outbreaks concentrating on the most likely points of entry or occurrence (stormwater drains, roads/tracks, carparks, and adjoining residential fence lines) and having particular emphasis on identifying previously unknown aquatic and woodland weeds.
- Measures to be used in the control of introduced plants include manual or mechanical removal, burning, biological controls and the judicious use of herbicides.
- All vegetation planted for management purposes, shade or ornamental purposes will be species native to the area.

3.6 FAUNA

All mammals, birds, reptiles and amphibians in the Reserve are protected under the *Territory Parks and Wildlife Conservation Act (NT).* As a declared protected area the use of firearms and traps is prohibited. Aquatic life is protected under the *Fisheries Act (NT)*. Under section 122 of the *Territory Parks and Wildlife Conservation Act* traditional hunting and collecting by Aboriginal people may be carried out on the Reserve (refer to section 3.9).

Apart from bird species, thorough baseline fauna information has not been collected from the lagoons.

Sixty-seven species of birds have been recorded in the Reserve. The birdlife consists mainly of waterbirds and wader species attracted to the wetland during the extended dry season. The Birds usually congregate at the end of the Dry season when other sources of water in the area have dried up. The lagoons are a particularly important habitat for Magpie geese (*Anseranas semilpalmata*) and other waterfowl, which often use the Reserve as a refuge during the hunting season.

A number of bird species which visit the Reserve are listed on international treaties such as the Bonn Convention and the Bilateral Agreements on migratory birds with the Governments of Japan and China, known as JAMBA and CAMBA (APPENDIX 2). These convention and agreements aim to protect migratory birds and their habitats across the globe.

A comprehensive survey of the Reserve's fauna has not yet been undertaken however NTU students have carried out opportunistic fauna surveys in the Reserve and Kennett undertook a study of long necked turtle (*Chelodina rugosa*) populations in the Reserve's lagoons in 1994. Kennett's study aimed to improve current knowledge of the long-necked turtle including their adaptations to life in the wet-dry tropics. Kennett also recorded the presence of three fish species, three reptiles and several aquatic invertebrates.

Each wet season new fish stocks in the Reserve are naturally replenished. It is important to ensure that the construction of fencing in the Reserve does not inhibit the movement of native wildlife in particular the long necked turtles.

The grassland communities in the Reserve provide nesting sites for Finches. Excessive slashing of grasses below the dry season water line may reduce the value of the Reserve as a nesting site for finches. Further study is required to determine the importance of the Reserve as a nesting site for finches and the impacts of grass slashing.

Several species of Mosquitoes breed in the Reserve, however the lagoons are not breeding sites for large numbers of disease transmitting mosquitoes. Should there be increases in the percentage cover of semi aquatic reeds and organic matter the number of mosquitoes breeding in the reserve could increase and pose a risk to the public's health. Control measures including engineering measures to improve the biological control of mosquitoes would then be required. The Medical Entomology Branch of the Territory Health Services monitors mosquito numbers on an opportunistic basis in the Knuckey Lagoons area but does not have a formal mosquito monitoring role in rural areas of Darwin.

Section 2933 (see FIGURE1) is a declared Protected Area under the *Territory Parks and Wildlife Conservation Act* and the use of nets traps and firearms will be prohibited. In accordance with the *Territory Parks and Wildlife Conservation Act* signs will be placed in the Reserve, notifying visitors of these restrictions.

MANAGEMENT GUIDELINES

- The Reserve will be managed for the long-term protection of the natural distribution, abundance and diversity of native animals and their habitats within the Reserve by:
    - ⇒ Management of visitors and developments in accordance with the Zoning Scheme
    - ⇒ Implementation of feral and domestic animal control, fire and weed management programs
    - ⇒ Erosion control and water quality and quantity maintenance, and

⇒ Liaison with adjoining landowners to encourage land management practices that do not impact adversely on the Reserve.

- Parks and Wildlife Commission will carry out a biological study of the Reserve, in consultation with the Reserve Management Committee, during the life of this plan. The study will aim to refine knowledge of the Reserve's wildlife and habitats as well as the impacts upon them.
- Grass slashing operations will be monitored to determine any impacts on flora and fauna distribution within the Reserve and slashing programs will be adjusted where necessary.
- Hunting, fishing, trapping or other taking of wildlife is prohibited, unless approved for research purposes or unless undertaken by Aboriginals as part of traditional hunting and gathering practices in accordance with the *Territory Parks and Wildlife Conservation Act* and its By-laws and Regulations.
- The use of nets, traps and firearms will be prohibited within the Protected Area. In accordance with the *Territory Parks and Wildlife Conservation Act* signs will be placed in the Reserve, notifying visitors of these restrictions within the Protected Area.
- Management will liaise with the relevant Aboriginal clans which are able to harvest resources from the Reserve to develop sustainable use levels and discuss with the community any management changes required.
- Should the number of mosquitoes breeding in the Reserve pose a public health risk appropriate mosquito control measures will be undertaken in cooperation with the Medical Entomology Branch of the Territory Health Services.

3.7 FERAL ANIMALS, ANIMAL PESTS AND DOMESTIC ANIMAL CONTROL

Feral and domestic animals that have been recorded in the Reserve include; domestic dogs, cats and horses from the surrounding residential area. Pigs and buffaloes have not been recorded in the Reserve for many years. Pest species such as feral pigeons, Asian honey bees, big-headed ants and cane toads could potentially establish themselves in the Reserve. Feral animals and animal pests modify ecosystems by disturbing native habitats, replacing or killing native species and spreading diseases.

Under the Parks and Wildlife Commission 'Pets in Parks' policy, domestic animals are not permitted within the Reserve.

MANAGEMENT GUIDELINES

- Regulations excluding domestic animals from the Reserve will be clearly stated on signs and in interpretation material.

- Monitoring will be carried out to identify occurrences of feral animals, animal pests and domestic animals in the reserve, and provision made for appropriate control measures and/or their removal from the Reserve.
- Perimeter fencing will be constructed to exclude feral and domestic animals from the Reserve. Fencing will not prevent access to the Reserve by native wildlife including long-necked turtles.

3.8 FIRE MANAGEMENT

Uncontrolled wildfires are detrimental to wildlife and their habitats and a risk to people's safety and assets. It is neither practical nor desirable to completely exclude fire from the Reserve however, the incidence and impact of intense wildfires can be greatly reduced by controlled fuel reduction burning.

The priority for fire management in the Reserve is to protect wildlife and their habitats from the effects of fires and to protect assets and neighbouring properties from the effects of fires starting within the Reserve. This can be achieved by:

- ◊ reducing fuel loads,
- ◊ maintaining firebreaks in the Reserve, and
- ◊ implementing controlled burning in accordance with the Reserve's annual Fire Action Plan.

The use of firebreaks will help to contain wildfires within the Reserve and exclude wildfires from outside the Reserve.

MANAGEMENT GUIDELINES

- An annual Fire Action Plan will be prepared for the Reserve and will be implemented after consultation with the NT fire Service and adjoining landholders. It will include but not be restricted to:
  - ⇒ the establishment and maintenance of firebreaks
  - ⇒ controlled early wet and dry season burns, to establish protection from wildfires,
  - ⇒ the protection of assets from fires by clearance of vegetation along perimeter boundaries, around signage, along walking tracks, roads, fence lines and around Reserve facilities. Chemical clearance of vegetation using low persistence herbicides may occur.
  - ⇒ prescription burns to protect fire sensitive wildlife species or vegetation communities, and
  - ⇒ provision for the monitoring and adjustment of the Fire Action Plan where necessary.

- The lighting of fires in the Reserve, other than for management purposes or by permit, will be prohibited.

- Signs and interpretation material will advise visitors of fire restrictions within the Reserve.

3.9 ABORIGINAL USE AND CULTURAL RESOURCES

Larrakia Aboriginal people claim traditional responsibility for the Knuckey Lagoons area. In 1980 an area of land adjacent to the Reserve was granted to the Aboriginal Development Foundation to provide hostel type accommodation for Aboriginal people.

Knuckey Lagoons are known to Aboriginal people as 'Muddie', meaning barramundi and the area is referred to as Barramundi Dreaming (Valadian, 1974). Presently, no sacred sites have been recorded or registered with the Aboriginal Areas Protection Authority for Knuckey Lagoons Conservation Reserve.

Any Aboriginal artefacts within the Reserve are protected as 'Prescribed Archaeological Objects' under the *Heritage Conservation Act*. Sacred Sites are protected under *Northern Territory Sacred Sites Act* whether or not they are recorded.

Under Section 122 of the *Territory Parks and Wildlife Conservation Act* the right to hunt, fish and collect for traditional purposes has been secured for Aboriginal people who have traditionally hunted in the Reserve.

Along with other impacts unsustainable harvesting practices can lead to a reduction of numbers or the localised disappearance of wildlife species from a habitat. This is not a desirable outcome for either Aboriginal people or the Parks and Wildlife Commission.

MANAGEMENT GUIDELINES

- Aboriginal cultural resources will be managed in accordance with the *Northern Territory Sacred Sites Act* and the *Heritage Conservation Act*.
- The PWCNT will consult with relevant Aboriginal people and authorities regarding the significance, conservation and management of Aboriginal cultural resources in the Reserve.
- Aboriginal hunting and gathering is permitted in the Reserve in accordance with the *Territory Parks and Wildlife Conservation Act*.
- Relevant Aboriginal people and their representative organisations will be consulted regarding the appropriate use and treatment of material on Aboriginal cultural and spiritual beliefs in the Reserve's interpretive program.
- Liaison with the relevant Aboriginal community regarding harvesting of the Reserve's flora and fauna will allow monitoring of harvested species and development of appropriate sustainable harvesting practices.

3.10 HISTORICAL RESOURCES

Knuckey Lagoons was named after the surveyor, Richard Randall Knuckey in the 1800's. Prior to and during WWII, the Reserve was used for several purposes: a site for recreation and nature-based activities, wartime use as a Radar Station, and for hunting and collecting by Aboriginal people.

The National Trust NT has identified relics of Radar Station No. 132 used to detect incoming enemy warplanes during WWII. The Station was the most sophisticated used in Darwin during the WWII and was disguised as part of a racetrack.

Further historical research is required to provide additional detail on WWII use of the Reserve and Aboriginal and non-Aboriginal habitation in the Reserve area. There is a significant amount of local knowledge about the Reserve, which could be included in the Reserve's Communication and Interpretation Plan (refer to section 4.4).

MANAGEMENT GUIDELINES

- Management of sites of historical interest within the Reserve, such as the WWII Radar Station, will be performed in consultation with the Heritage Conservation Branch of the Department of Lands, Planning and Environment and the National Trust NT and in accordance with the *Heritage Conservation Act*.
- Liaison with relevant heritage organisations, authorities and interest groups regarding the significance, conservation and management of the Reserve's historical and other cultural resources will be carried out by Parks and Wildlife Commission.
- The history of the area and its use may be included in the Communication and Interpretation Plan for the Reserve.

4. MANAGEMENT FOR VISITOR USE

4.1 OBJECTIVES

- To offer opportunities for wildlife appreciation and recreational activities consistent with the conservation of the Reserve's natural and cultural values.
- To provide appropriate access routes to the Reserve's features.
- To develop communication and interpretation services that enable visitors to use, enjoy and appreciate the Reserve and its values.
- To monitor use by visitors, and where necessary, regulate that use to minimise any adverse impacts.
- To make provision for the safety of visitors.

4.2 ACCESS

Public vehicular access to the boundary of the Reserve is via Fiddlers Lane, Randall Rd, and off both Thorak Rd and the Stuart Highway. There is no public vehicular access provided into the Reserve, however it may be necessary to provide vehicular access with limited car parking facilities in the future (Refer 4.3 Visitor Facilities and Developments).

Visitor access into the Reserve will be by foot or bicycle along designated paths only from Fiddlers Lane, Randall Road, Thorak Road and Stuart Highway in accordance with the Reserve's zoning scheme and the principle purposes of the Reserve (see page 2). Some walking tracks may double as access for authorized management vehicles.

If vehicular access is provided it may be necessary to gazette opening and closing times for vehicle access to deter illegal camping.

MANAGEMENT GUIDELINES

- Public access within the Reserve will be by foot or bicycle along designated access tracks within the Dispersed Use Zone. There will be provision for vehicle access for management purposes in all zones.
- Permits issued by the Parks and Wildlife Commission will be required for organised group recreational activities.
- Any tracks not required within the Reserve for visitor access or for management purposes will be closed and rehabilitated. Management access will be sign-posted where necessary.
- Fences will be erected and maintained to define the boundaries of the Reserve and to restrict access by unauthorised vehicles.

- Barrier fencing may be erected within the Special Protection Zone to restrict public access if necessary.
- Opening and closing times may be gazetted when and if vehicular access into the Reserve is provided

4.3 VISITOR FACILITIES AND DEVELOPMENTS

Visitor facilities are not currently provided in the Reserve. The Zoning Scheme outlined in section 2.1 provides for the future development of visitor facilities within the Dispersed Use Zone if required.

Facilities may include limited vehicle access, boardwalks and unsealed paths, a viewing platform, shade area, communication and interpretation displays, minimal car parking, and park furniture. Such developments will be concentrated in the southwestern section of the Reserve. If visitor numbers increase significantly it may be necessary to install a composting toilet. Camping will not be permitted within the Reserve and lighting of fires will be by permit or for management purposes only.

Illegal dumping of rubbish is a problem in some areas of the Reserve. Littering may also become a problem in the Reserve as visitor numbers increase.

MANAGEMENT GUIDELINES

- The provision of visitor facilities and recreational opportunities will be in accordance with the principal purposes of the Reserve (see Page 2), the *Environmental Assessment Act, Heritage Conservation Act, Sacred Sites Act, Soil Conservation and Land Utilisation Act, Water Act* and the guidelines outlined in this plan.
- The Parks and Wildlife Commission will prepare site development plans for the Reserve in consultation with the Management Committee and the Reserve Planning Team. The plan will detail all proposed visitor facilities within the Reserve and include:
    - ⇒ the location and layout of walking/bicycle paths,
    - ⇒ provision of shade shelters and/or bird viewing platforms, and
    - ⇒ appropriate vehicular access and parking provisions.

- Facilities will be sited and developed in accordance with site development plans and will be designed to minimise impacts on the Reserve values. Wherever possible, natural barriers will be used to screen facilities from general view.

- The dumping of Rubbish is not permitted in the Reserve. If necessary rubbish bins will be provided within the Reserve to minimise litter.

4.4 COMMUNICATION, INTERPRETATION AND INFORMATION

Information and interpretive services are important as they enhance visitor appreciation of the Reserve's values, provide for visitor orientation, comfort and safety, and create awareness of management objectives.

Communication and interpretation services have not been developed for the Reserve. To adequately manage visitors and help facilitate safe and enjoyable visitor experiences within the Reserve, appropriate, high quality, communication and interpretation programs will need to be developed.

MANAGEMENT GUIDELINES

- A Communication and Interpretation Plan for the Reserve will be prepared. Emphasis will be placed upon providing clear safety, directional and orientation signs and information in the Reserve.
- The Reserve's Communications and Interpretation Plan will include interpretive services that highlight the importance of this urban wetland to wildlife and the local community and the need for wetland protection.

4.5 VISITOR MONITORING

Visitor monitoring is not yet carried out in the Reserve. The establishment of a visitor monitoring system for the Reserve is needed to help develop appropriate environmental and visitor management strategies.

The short term objective for the visitor monitoring strategy will be to estimate the total number of visitors and the monthly use patterns. In the longer term, visitor use, mode of transport, visitor expectations, behaviour and satisfaction may be assessed.

Walking track counters may be installed on the main access routes to monitor visitor use.

MANAGEMENT GUIDELINES

- A Visitor Monitoring System will be established for the Reserve.
- Visitor data collected will be recorded in the PWCNT central database.

4.6 VISITOR SAFETY

Visitor safety is considered a high priority in the Reserve. Information signs and pre-visit fact sheets will outline risks and the need to adopt appropriate safety precautions when visiting the Reserve.

Dehydration, sunburn and bites from insects present the most likely safety risk to visitors in the Reserve and can detrimentally effect the visitor's experience. The provision of information about dehydration, sunburn, and insect bites and how to guard against their effects will increase visitor enjoyment and reduce safety risks. Visitors will not be permitted to enter the water in the Reserve without a permit issued by the Parks and Wildlife Commission.

Section 2933 (see FIGURE1) is a declared Protected Area under the *Territory Parks and Wildlife Conservation Act* and the use of firearms will be prohibited. In accordance with the *Territory Parks and Wildlife Conservation Act* signs will be placed in the Reserve notifying visitors of the restrictions.

MANAGEMENT GUIDELINES

- Parks and Wildlife Commission emergency response procedures will be adopted for the Reserve.
- The Parks and Wildlife Commission will liaise with Aboriginal people with a traditional right to hunt in the Reserve to ensure that hunting and harvesting techniques do not present a safety risk to visitors.
- The Reserve's Communication and Interpretation programs will inform visitors about safety hazards and how to minimise safety risks, including information about biting insects and leeches.
- When necessary signs will be erected informing visitors of safety risks or the closure of areas of the Reserve for management purposes.

5. RESERVE ADMINISTRATION AND RESEARCH

5.1 OBJECTIVES

- To provide responsible management and administration of the Reserve in accordance with the objectives of this Plan.
- To apply the Territory Parks and Wildlife Conservation Act, its By-laws and other relevant legislation.
- To establish research and monitoring programs for the Reserve's natural and cultural resources.
- To develop, encourage and facilitate effective involvement of the Community and other relevant authorities in the management of the Reserve.

5.2 MANAGEMENT FACILITIES AND STAFFING

The Reserve is part of the Darwin Districts Parks project. Parks and Wildlife Commission staff based at the project's headquarters at Berrimah manage the Reserve. The Knuckey Lagoons Management Committee is responsible for overseeing the implementation of management programs outlined in this Management Plan.

Private contractors may perform some routine maintenance programs in the Reserve and Park management activities may also be complemented by volunteer work undertaken by the Knuckey's Lagoons Wildlife Sanctuary Incorporated. Other avenues available for the Commission to gain assistance with Reserve management, maintenance and development activities include "the volunteers in parks program", "Waterwatch", "Landcare" groups, the "Australian Trust for Conservation Volunteers" and "the Green Corps".

Future plans, to improve access to the Reserve and provide appropriate visitor facilities, have the potential to increase visitor numbers and subsequently the need for increased resources and facilities. It is important to ensure that the Parks and Wildlife Commission provide adequate resources to appropriately manage the Reserve in accordance with the provisions of this plan.

MANAGEMENT GUIDELINES

- Visitor numbers and their impacts will be monitored to identify the need for changes to the level and frequency of management services and resources.
- Subject to suitable administrative arrangements community involvement in the selected management programs within the Reserve will be encouraged.

- Consideration will be given to using private contractors to maintain Reserve facilities, when developed.

5.3 RESEARCH AND MONITORING

Earlier sections of this Plan identified a number of research and monitoring projects to be undertaken or encouraged during the life of this plan and include research and monitoring of flora, fauna, water resources, erosion, Aboriginal harvesting, cultural and historical assets and visitor use. Such research and monitoring will aim to record the resources present and examine how these are effected by visitor and management activities and focus on monitoring the ecological health of the lagoons. 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 programs for the Reserve.

There are many avenues open to the Commission to have such research and monitoring carried out including the use of volunteers, undergraduate students and other government funded initiatives such as Water Watch and Landcare.

MANAGEMENT GUIDELINES

- A research and monitoring Program for the Reserve will be prepared in consultation with the Bioregional Assessment Unit of the Parks and Wildlife Commission and in accordance with the provisions of this Plan.
- Scientific, research and educational organisations will be encouraged to undertake research, monitoring and survey work on flora fauna and water resources of the Reserve in association with Ranger staff.
- Subject to suitable administrative arrangements involvement of the community in monitoring programs will be encouraged. Surrounding landholders may be invited to participate in selected management programs.
- 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.* All external research and monitoring activities must be consistent with the guidelines specified in the 'Parks and Wildlife Commission's Scientific Licenses Policy.
- All scientific information collected will be recorded in databases maintained by the Parks and Wildlife Commission of the NT.

5.4 EXTERNAL RELATIONS

A light industrial area, rural residential land, vacant crown land, plant nurseries, natural bushland, stormwater drains and a major arterial road border Knuckey Lagoons Conservation Reserve. Activities on these surrounding lands have the potential to impact upon the Reserve and its values

Given the close proximity to the residential area and the fact that several properties back onto the Reserve it is important to involve the community in the management of the Reserve through liaison and wherever possible direct involvement. This involvement will encourage a sense of ownership and responsibility within the local community for the management of the Reserve and its values. Such community involvement should include Aboriginal people and their interests (refer to section 3.9).

Members of the local community have long expressed a desire to be involved in the Management of the Reserve and have formed a local incorporated group called Knuckey Lagoons Wildlife Sanctuary Incorporated. This group has signed an agreement with the Parks and Wildlife Commission to become part of a Management Committee, which oversees the management of the Reserve, principally through the development and implementation of this Management Plan.

Other volunteer groups, organisations and individuals may also provide important resources for managing the Reserve particularly in carrying out management and monitoring functions. Volunteers will continue to be sought and will be of considerable benefit in implementing many aspects of this management plan including water quality monitoring and revegetation programs (refer to section 5.2 and 5.4).

Many government agencies have responsibilities for the management of the land surrounding the Reserve. It is very important that all Government agencies whose role affects the Reserve recognise the values of the area, the main issues of concern, and the part they can play in protecting these values.

In the case of Knuckey Lagoons Conservation Reserve it is of particular importance to maintain liaison with the Litchfield Shire Council, the Power and Water Authority, the Department of Transport and Works and the Department of Lands Planning and Environment. Ongoing liaison with the NT Fire Service regarding fire protection of areas adjacent to the Reserve is also required.

Issues of mutual concern include but are not limited to:

⇒ Land use planning in the area,
⇒ Reserve developments,
⇒ Vandalism, litter management and the need to protect the integrity and conservation values of the lagoons and their surrounds,
⇒ Visitor access and safety,
⇒ Development of the road network in the vicinity of the Reserve,

⇒ Water quality and quantity and stormwater drainage,
⇒ Sewerage and waste disposal,
⇒ Water supplies, and
⇒ Unauthorised hunting of waterfowl.

MANAGEMENT GUIDELINES

- P&WCNT will continue to liaise with relevant Government departments and the Litchfield Shire Council in managing the Reserve.
- Where appropriate consultation and liaison with neighbouring landowners, students and interested local groups and individuals will be undertaken regarding management of the Reserve.
- The local community and volunteers will be encouraged to participate in management of the Reserve in conjunction with ranger staff.

5.5 LAW ENFORCEMENT

For management of the Reserve, and the safety of persons and property, it is essential that relevant legislation, by-laws and regulations be enforced.

MANAGEMENT GUIDELINES

- 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 summarised below.

Priorities have been assigned according to the action, relative importance and urgency for implementation. It must be taken into account that these actions may change in their priority depending on funds, community needs and the Reserve management priorities.

High	Imperative 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, but will be undertaken only if the necessary resources are available or other conditions stated in the guidelines are fulfilled.
Ongoing	Must be achieved on an ongoing basis in order to achieve the objectives of the Plan.

TABLE 2 ACTION PRIORITY LIST

ACTION	PAGE	PRIORITY	RESPONSIBILITY
Management of the Reserve's Resources			
Rehabilitate areas subject to soil erosion	9-10	High	P&WCNT
Monitor areas subject to soil erosion	9-10	Ongoing	P&WCNT
Monitor water quality and quantity	10,11, 12	Ongoing	P&WCNT, Vol. Groups
Monitor vegetation communities	12	Ongoing	P&WCNT, Vol. Groups
Rehabilitate disturbed or denuded sites	12	Medium	P&WCNT, Vol. Groups
Prepare Weed Management Program to monitor and control weeds	13	High	P&WCNT, Vol. Groups
Carry out biological survey of Reserve	14-15	Medium	P&WCNT, Vol. Groups
Liaison with Aboriginal Community regarding harvesting.	14-15	Ongoing	P&WCNT, Ab. Groups
Monitor mosquito breeding sites and adopt appropriate Control Programs	14-15	Medium	P&WCNT, Medical Entomology
Prepare and implement Feral Animal Control Program	15-16	High	P&WCNT
Construct and maintain perimeter fence	15-16	High	P&WCNT, Vol. Groups
Prepare and implement Annual Fire Action Plan	16	High	P&WCNT, Vol. Groups
Consult with Aboriginal people regarding management and interpretation of Aboriginal cultural resources.	17-18	Ongoing	P&WCNT, Ab. Groups
Liaison with Heritage organisation regarding management and interpretation of historic values in the Reserve.	18	Medium	P&WCNT, Heritage Branch DLP&E

ACTION	PAGE	PRIORITY	RESPONSIBILITY
Management for Visitor Use			
Identify and rehabilitate tracks not required for visitor use or management purposes	19	Medium	P&WCNT
Prepare site development Plan for visitor facilities	20	High	P&WCNT, KLCRMC
Prepare Communication and Interpretation Plan	21	High	P&WCNT, KLCRMC
Establish and implement Visitor Monitoring System	21	Medium	P&WCNT, Vol Groups
Prepare emergency response plan for the Reserve	22	High	P&WCNT
Reserve Administration and Research			
Establish volunteer programs for Reserve	23	Medium	P&WCNT, KLCRMC
Establish research and monitoring program for the Reserve	24	Medium	P&WCNT, KLCRMC
Maintain liaison with relevant government departments and community groups in particular KLWSI on issues regarding management of the Reserve	25-26	Ongoing	P&WCNT, KLCRMC
Consult with adjoining landholders and the community on matters of mutual concern.	25-26	High	P&WCNT, KLCRMC

*Vol. Groups – Volunteer Groups

*KLCRMC– Knuckey Lagoons Conservation Reserve Management Committee

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APPENDICES

APPENDIX 1 - FLORA LIST FOR KNUCKEY LAGOONS CONSERVATION RESERVE

Rare R

Endemic to NT E

Introduced *

Noxious Weed B B

Family	Species	Common Name	Conservation Status
ARECACEAE	Livistonia humilis	Sand palm	E
BIXACEAE	Cochlospermum fraserii	Kapok bush	E
CAESALPINIACEAE	Erythrophleum chlorostachys	Ironwood	E
COMBRETACEAE	Terminalia ferdinanda	Billy goat plum	E
LECYTHIDACEAE	Planchonia careya	Cocky apple	E
MORACEAE	Ficus opposita	Sandpaper fig	E
MYRTACEAE	Eucalyptus miniata	Woollybutt	E
MYRTACEAE	Eucalyptus polycarpa	Long fruited bloodwood	E
MYRTACEAE	Eucalyptus bleeseri	Smooth stemmed bloodwood	E
MYRTACEAE	Asteromyrtus symphocarpa	Vicks tree	E
MYRTACEAE	Calytrix exstipulata	Turkey bush	E
MYRTACEAE	Eucalyptus tetrodonta	Darwin stringybark	E
PANDANACEAE	Pandanus spiralis	Pandanus	E
POACEAE	Sorghum exstans	Spear grass	E

Family	Species	Common Name	Conservation Status
PROTEACEAE	Banksia dentata	Banksia	E
PROTEACEAE	Grevillea pteridifolia	Fern-leaved grevillea	E
SCROPHULARIACEAE	Limnophila fragrans		E
WEEDS			
FABACEAE	Calopogonium muconoides	Calopo	*
FABACEAE	Centrosema pubescens	Centro	*
FABACEAE	Crotalaria goreensis	Gambia pea	*
LAMIACEAE	Hyptis suaveolens	Hyptis	*B
MALVACEAE	Sida acuta	Spinyhead Sida	*B
PASSIFLORACEAE	Passiflora foetida	Wild Passion Fruit	*
POACEAE	Andropogon gayanus	Gamba Grass	*
POACEAE	Brachiaria mutica	Para grass	*
POACEAE	Cynodon dactylon	Couch	*
POACEAE	Pennisetum pedicillatum	Annual Mission grass	*
POACEAE	Pennisetum polystachion	Mission grass	*B
AQUATIC FLORA			
ALISMATACEAE	Caldesia oligococca		E
CYPERACEAE	Cyperus serotinus		E
CYPERACEAE	Eleocharis		E

Family	Species	Common Name	Conservation Status
	sphacelata		
CYPERACEAE	Eleocharis sundaica		E
CYPERACEAE	Fimbristylis denudata		E
CYPERACEAE	Fimbristylis littoralis		
CYPERACEAE	Fimbristylis pauciflora		E
HYDROCHARITACEAE	Blyxa aubertic varaubertic		E
ISOETACEAE	Isoetes coromandeliana		E
ERIOCAULACEAE	Eriocaulon setaceum		E
ONAGRACEAE	Ludwigia adscendens		E
ONAGRACEAE	Ludwigia hyssopifolia		E
	Najas malesiana		E
	Najas tenuifolia		E
NYMPHAEACEAE	Nymphaea hastifolia		E
	Nymphaea violacea	Water lily	E
MENYANTHACEAE	Nymphoides aurantiaca		E
	Nymphoides indica		E
	Nymphoides minima		E
POACEAE	Oryza meridionalis		E
POACEAE	Panicum paludosum		E
	Persicaria attenuata		E

Family	Species	Common Name	Conservation Status
	Pseudoraphis spinescens	Spiky mud grass	E
	Rhyncospora submarginata		E
	Sorghum sp.	Spear grass	E
LENTIBULARIACEAE	Utricularia aurea		E
	Utricularia muelleri		E
RUBIACEAE	Oldenlandia tenuifolia		E
STERCULIACEAE	Melochia corchorifolia		E

Source: PWCNT Herbarium; Kennett, 1994.

APPENDIX 2 - FAUNA LIST FOR KNUCKEY LAGOONS CONSERVATION RESERVE

Vulnerable	V	JAMBA	J
Endangered	E	CAMBA	C
Rare	R	Bonn	B

Family	Species	Common Name	Conservation Status
BIRDS			
PARDALOTIDAE	Smicrornis brevirostris	Weebill	
ALAUDIDAE	Mirafra javanica	Singing bushlark	
HALYCONIDAE	Haleyon macleayii	Forest kingfisher	
HALYCONIDAE	Halycon sancta	Sacred kingfisher	
ANATIDAE	Anas querquedula	Gargeny	J,C
ANATIDAE	Nettapus pulchellus	Green pygmy goose	
ANATIDAE	Anas gibberifrons	Grey teal	
ANATIDAE	Aythya australis	Hard head	
ANATIDAE	Anas superciliosa	Pacific black duck	
ANATIDAE	Dendrocygna eytoni	Plumed Whistling-duck	
ANATIDAE	Tadorna radjah	Radjah shelduck	
ANHINGIDAE	Anhinga rufa	Darter	
ANSERANATIDAE	Anseranas semilpalmata	Magpie goose	
APODIDAE	Apus pacificus	Fork-tailed swift	J,C,
ARDEIDAE	Ardea ibis	Cattle egret	
ARDEIDAE	Ardea alba	Great egret	J,C
ARDEIDAE	Egretta intermedia	Intermediate egret (Plumed)	
ARDEIDAE	Egretta garzetta	Little egret	

Family	Species	Common Name	Conservation Status
ARDEIDAE	Ardea pacifica	Pacific heron	
ARDEIDAE	Ardea picata	Pied heron	
CACATUIDAE	Cacatua pastinator	Short-billed corella	
CACATUIDAE	Calyptorhynchus banksii	Red-tailed black cockatoo	
CAMPEPHAGIDAE	Lalage sueurii	White-winged triller	
CHARADRIIDAE	Charadrius melanops	Black-fronted Plover	
CHARADRIIDAE	Pluvialis dominica	Pacific golden plover	J,C
CHARADRIIDAE	Vanellus miles	Masked lapwing	
CHARADRIIDAE	Erythrogonys cinctus	Red kneed dotterel	
CICONIIDAE	Ephippiorhynchus asiaticus	Black-necked Stork	
GLAREOLIDAE	Stiltia isabella	Australian pratincole	
GLAREOLIDAE	Glareola pratincola	Oriental pratincole	
GRUIDAE	Grus rubicunda	Brolga	
HIRUNDINIDAE	Cecropis ariel	Fairy martin	
HIRUNDINIDAE	Cecropsis nigricans	Tree martin	
JACANIDAE	Irediparra gallinacea	Comb crested jacana	
LARIDAE	Sterna hirundo	Common tern	J,C
LARIDAE	Gelochelidon nilotica	Gull billed tern	
LARIDAE	Chlidonias hybrida	Whiskered tern	
MOTACILLIDAE	Motacilla alba	White wagtail	

Family	Species	Common Name	Conservation Status
PELECANIDAE	Pelecanus conspicillatus	Australian Pelican	
PHALACROCORACIDAE	Phalocrocorax sulcirostris	Little black cormorant	
PHALACROCORACIDAE	Phalacrocorax melanoleucos	Little pied cormorant	
THESKIORNITHIDAE	Plegadis falcinellus	Glossy ibis	C
THESKIORNITHIDAE	Platalea regia	Royal spoonbill	
THESKIORNITHIDAE	Threskiornis aethiopica	Sacred ibis	
THESKIORNITHIDAE	Threskiornis spinicollis	Straw-necked ibis	
PASSERIDAE	Lonchura castaneothorax	Chestnut-breasted mannikin	
PASSERIDAE	Lonchura flaviprymna	Yellow-rumped mannikin	
POPICIPEDIDAE	Tachybaptus novaehollandiae	Australasian Grebe	
RALLIDAE	Fulica atra	Eurasian Coot	
RALLIDAE	Porphyrio porphyrio	Purple swamphen	
RALLIDAE	Poliolimnas cinereus	White-browed crake	
RECURVIROSTRIDAE	Himantous himantopus	Black-winged Stilt	
SCOLOPACIDAE	Tringa hypoleucos	Common sandpiper	J,C
SCOLOPACIDAE	Calidris ferruginea	Curlew sandpiper	J,C,B
SCOLOPACIDAE	Tringa nebularia	Green shank	J,C
SCOLOPACIDAE	Gallinago hardwickii	Japanese snipe	J,C,B
SCOLOPACIDAE	Numenius minutus	Little curlew	J,C,B
SCOLOPACIDAE	Tringa stagnatilis	Marsh sandpiper	J,C,B

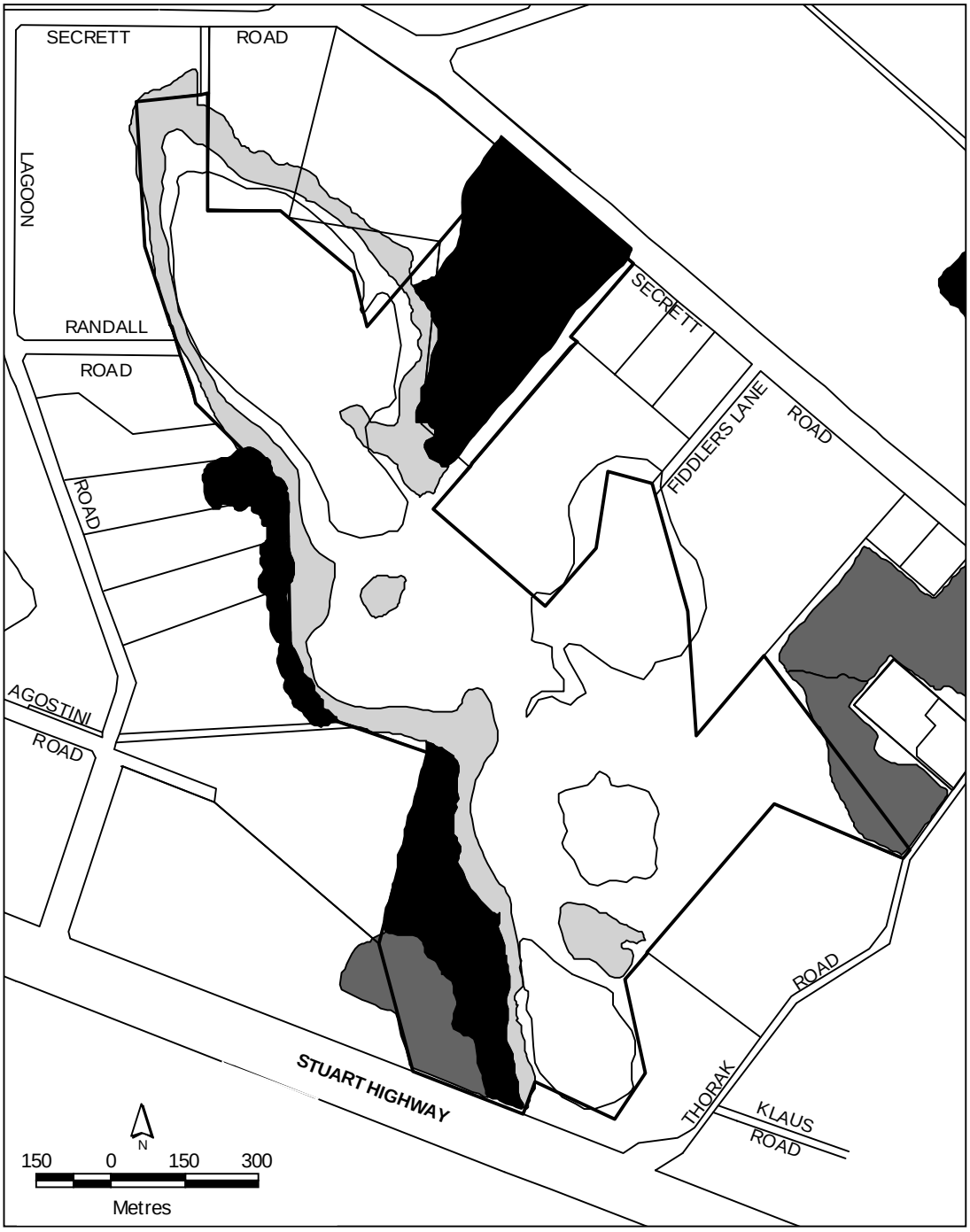
Family	Species	Common Name	Conservation Status
SCOLOPACIDAE	Gallinago stenura	Pintail snipe	J,C
SCOLOPACIDAE	Tringa glareola	Wood sandpiper	J,C,B
SYLVIIDAE	Cisticola exilis	Golden-headed cisticola	
SYLVIIDAE	Megalurus timoriensis	Tawny grassbird	
SYLVIIDAE	Cisticola juncidis	Zitting cisticola	
MAMMALS			
DASYURIDAE	Sminthopsis virginiae	Red-cheeked dunnart	
MACROPODIDAE	Macropus agilis	Agile wallaby	
MURIDAE	Mus musculus	House mouse	
MURIDAE	Rattus rattus	Black rat	
MURIDAE	Melomys burtoni	Grassland melomys	
PERAMELIDAE	Isoodon macrourus	Northern brown bandicoot	
REPTILES			
BOIDAE	Liasis fuscus	Water python	
CHELIDAE	Chelodina rugosa	Long-necked turtle	
COLUBRIDAE	Enhydris polyepis	Macleay's water snake	
VARANIDAE	Varamus mertensi	Merten's monitor	
FISHES			
ENTROPOMIDAE	Ambassis spp	Perchlet	
MELANOTAENIIDAE	Melatonaenia spp	Rainbow fish	
PLOTOSIDAE	Neosilurus spp.	Catfish	
AQUATIC INVERTEBRATES			
AESCHNIDAE	Unknown	Dragonfly	

Family	Species	Common Name	Conservation Status
Unknown	unknown	Damselfly	
DYTISCIDAE	Cybister tripunctatus	Predacious diving beetle	
BELOSTOMATIDAE	Lethocerus distinctifenur, Diplonychys	Giant water bugs	
unknown	Nematoda sp.	Round worm	
unknown	unknown	CRUSTACEA	
unknown	unknown	MOLLUSCA	
unknown	unknown	Leech	
MOSQUITOES			
CULICIDAE	Aedes (mac) sp 76		
CULICIDAE	Aedes funereus	Brackish water Aedes mosquito	
CULICIDAE	Aedes notoscriptus	Container breeding Aedes mosquito	
CULICIDAE	Aedes phaecasiatus		
CULICIDAE	Aedes vigilax	Salt marsh mosquito	
CULICIDAE	Anopheles annulipes	Common Australian Anopheline	
CULICIDAE	Anopheles bancroftii	Black Australian Anopheline	
CULICIDAE	Anopheles farauti	Australian malaria mosquito	
CULICIDAE	Anopheles meraukensis	Fresh-water Anopheles	
CULICIDAE	Anopheles novaguinensis		
CULICIDAE	Coquilattidia xanthogaster	Golden mosquito	
CULICIDAE	Culex annulirostris	Common banded mosquito	

Family	Species	Common Name	Conservation Status
CULICIDAE	Culex pullus		
CULICIDAE	Culex quinquefasciatus	Brown house mosquito	
CULICIDAE	Culex vicinus		
CULICIDAE	Culex Vishnui grp		
CULICIDAE	Mansonia uniformis	Water hyacinth mosquito	
CULICIDAE	Uranotaenia nivipes		

Source: P&WCNT Fauna Atlas; Kennett 1994, Whelan & Kelton (1992)

APPENDIX 3– VEGETATION MAP KNUCKEY LAGOONS CONSERVATION RESERVE



Eucalyptus tetradonta, E. miniata woodland to low woodland with mixed species mid stratum and grassland understorey.

Pandanus spiralis low woodland to very low woodland with Lophostemum lactifluus and Grevillea pteridifolia. Ground layer dominated by mixed species of grasses and sedges.

Bothriochloa bladhii, Pseudoraphis spinescens closed grassland with Eleocharis sundaica. Seasonal swamp fringing permanent lagoon.

Knuckey Lagoons Conservation Reserve Boundary

Lagoon

REFERENCE

Vegetation units from Remnant Vegetation Survey, John Brock, Greening Australia

Cadastral and topographic data from the Dept. of Lands, Planning and Environment.