CUDGEN NATURE RESERVE

PLAN OF MANAGEMENT

NSW National Parks and Wildlife Service

November 1998

This plan of management was adopted by the Minister for the Environment on 24th November 1998.

Acknowledgments

The principal author of the draft plan of management (dated June 1997) was Lisa Russ, Ranger, Lismore District. The draft plan was edited and reviewed by Graeme McGregor, Planning Officer, Lismore District.

The contribution of the Head Office Planning Unit, Field Services Division, Lismore District staff and Advisory Committee is gratefully acknowledged. Key documents referred to in the preparation of this plan are the Cudgen Lake Round Mountain Reserve Trust Draft Plan of Management ; Conservation and Recreation Plan, and Land Resource Inventory prepared by Coastal Zone Planning Pty Ltd for the Trust.

Following public exhibition the plan has been reviewed and amended by Graeme McGregor.

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FOREWORD

Cudgen Nature Reserve is 464 hectares in extent and is located on the Tweed Coast in far north-eastern NSW. The nature reserve is part of a remnant of native vegetation which is recognised as the only area large enough to be capable of providing long term protection to native plant and animal communities on the Tweed Coast.

The Tweed Coast is a very complex biogeographic region and fifteen distinct vegetation communities have been identified in the nature reserve which support an exceptionally high diversity of plant and animal species. Of particular importance is the lowland subtropical rainforest around Round Mountain and the littoral rainforests near Camp Wollumbin which include many threatened plant species.

Cudgen Nature Reserve also provides protection for a representative sample of coastal floodplain wetlands which are poorly represented within the nature conservation system in NSW.

Many native plant and animal species reach their northern or southern limits of distribution in the area and the nature reserve also provides an overwintering area for migratory and nomadic birds, flying foxes and bats.

A significant koala population resides in and around Cudgen Nature Reserve.

The nature reserve has significant landscape values in an area under pressure from increasing development and demands for recreational use. This plan of management therefore recognises the responsibility of the National Parks and Wildlife Service of NSW to ensure management of Cudgen Nature Reserve for nature conservation purposes.

It also recognises the vital role that the community plays in understanding and supporting the management and protection of its natural heritage.

The strategies outlined in the plan have been devised following detailed consideration of public submissions received on the Cudgen Nature Reserve Land Management Issues Paper (released in October 1996) and the Cudgen Nature Reserve Draft Plan of Management (released in August 1997).

This plan of management establishes the scheme of operations for Cudgen Nature Reserve. In accordance with the provisions of Section 76 of the *National Parks and Wildlife Act, 1974*, this plan is hereby adopted.

PAM ALLAN

Minister for the Environment

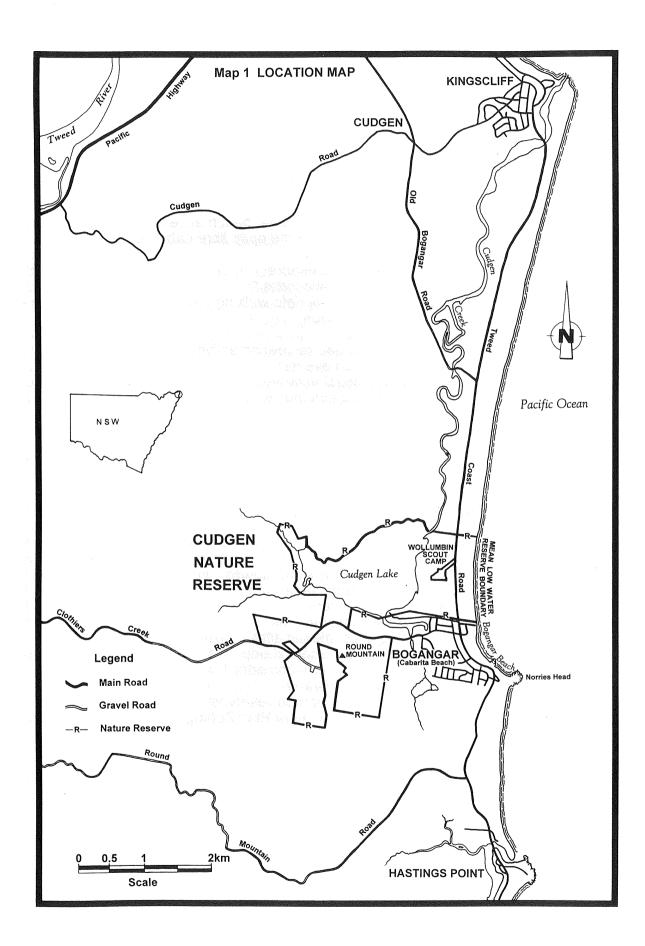
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PART A. INTRODUCTION

The National Parks and Wildlife Act, 1974, requires that a plan of management be prepared for each nature reserve. A plan of management is a legal document that outlines how the area will be managed in the years ahead.

The procedures for the adoption of a plan of management for a nature reserve are specified in the Act:

- The Director-General is required to refer the plan to the National Parks and Wildlife Advisory Council for its consideration and advice.
- The Director-General is required to submit the plan to the Minister, together with any comments or suggestions of the Advisory Council.
- The Minister may adopt the plan without alteration or with such alterations as the Minister may think fit, or may refer it back to the Director General and Council for further consideration.

Although not a requirement under the Act, the draft plan of management for Cudgen Nature Reserve was placed on public exhibition for comment on the proposals it contained. The public exhibition period was three months from mid August to mid October 1997 and it attracted 73 submissions (as well asproforma letters and a petition) covering 20 issues.

Any submissions received were referred to the Advisory Council for their consideration and advice to the Minister.

The planning process leading to the development of this plan has involved the collection and use of a large amount of information, which for reasons of documentsize, has not been included in the plan.

Now that the plan has been adopted by the Minister, no operations may be undertaken within the Nature Reserve except in accordance with the plan.

For additional information or inquiries on any aspect of the plan, please contact:

NPWS Murwillumbah Area Office World Heritage Rainforest Centre Pacific Highway Murwillumbah 2484

or by telephone on (02) 6672 6360.

Copies of all submissions, unless marked "confidential", are available for public inspection in the library of the NPWS's Head Office at 43 Bridge Street HURSTVILLE NSW 2220 (telephone: (02) 9585 6444).

PART B. MANAGEMENT CONTEXT

1 NATURE RESERVES IN NEW SOUTH WALES

Reserving areas for nature conservation purposes was introduced into Australia with the establishment of Royal National Park in 1879, some seven years after the world's first national park was created at Yellowstone in the United States of America.

Fauna reserves in New South Wales were first established under *the Fauna Protection Act, 1948.* Under the *National Parks and Wildlife Act, 1967*, fauna reserves were reclassified as nature reserves. The *Fauna Protection Act* was replaced by the *National Parks and Wildlife Act 1974*.

Under the *National Parks and Wildlife Act*, nature reserves are valuable refuge areas, where natural processes, phenomena and wildlife can be studied. They differ from national parks which include as a major objective the provision of appropriate nature based recreation opportunities.

The purposes of nature reserves are defined in the Act as:

(a) the care, propagation, preservation and conservation of wildlife;

(b) the care, preservation and conservation of natural environments and natural phenomena;

(c) the study of wildlife, natural environments and natural phenomena; and (d) the promotion of the appreciation and enjoyment of wildlife, natural environments and natural phenomena.

2. CUDGEN NATURE RESERVE

2.1 LOCATION, REGIONAL SETTING AND GAZETTAL

Cudgen Nature Reserve (referred to as the "Reserve" in this plan) is located on the far north coast of NSW, north of Cabarita Beach and the village of Bogangar, (refer to map 1). The Reserve lies in the Parish of Cudgen, County of Rous and has an area of 464 hectares and encompasses the 160 hectare Cudgen Lake. The Reserve includes the intertidal zone to mean low water mark along the 1.3 kilometre of beach frontage but does not include a number of Crown public road reserves including the Tweed Coast Road, Clothier's Creek Road and Sliprails Road. The Reserve was dedicated on 22 December 1995.

Cudgen Nature Reserve and a number of adjoining parcels of land, including Saunder's quarry, Cupitt's cattle tick dip, Wollumbin Scout Camp, southern lake foreshore permissive occupancy and sections of unformed road reserve, were previously known as the Cudgen Lake Round Mountain Reserve.

The Reserve was originally established in November 1961, as a Crown Reserve administered by the State Lands Service under the Crown Reserve System. The management responsibility was then held with the Trustee, Tweed Shire Council.

In the late 1980s permissive occupancy licences were issued over various Crown lands within the Reserve for banana growing on Round Mountain and for recreational use on the southern shores of the lake. Three areas of banana plantation occupy an area of approximately 29 hectares in the Reserve. The Department of Lands prepared a Draft Plan of Management for the Reserve which was placed on public exhibition in 1987. In November 1994, the Reserve was placed under the management of the newly formed Cudgen Lake Round Mountain Reserve Trust. The Trust was established under the *Crown Lands Act 1989*, and twelve voluntary members were appointed by the Minister

for Land and Water Conservation to manage the Reserve on that Department's behalf. The Cudgen Lake Round Mountain Reserve Trust continues to operate for those portions of the Cudgen Lake Round Mountain Reserve which were not incorporated in the Reserve.

2.2 IMPORTANCE OF CUDGEN NATURE RESERVE

Cudgen Nature Reserve is part of the largest remnant of native vegetation on the Tweed Coast. It is of local, regional and state significance for its natural values, coastal landscapes and provision of significant habitat for native wildlife.

There are a number of significant factors that contribute to the overall importance of Cudgen Nature Reserve and its conservation value. The significance of the Reserve is outlined in the following.

2.2.1 Geological and landform significance

The present day coastline, formed some 60,000 years ago in the Pleistocene, has resulted from the accretion of sand by marine processes. The coast has reached a mature stage of development, no longer accreting sand, but currently undergoing the process of coastal erosion (Roy, 1973).

Three major landforms dominate the Cudgen catchment including:

- Coastal sands, (located east of Cudgen Lake);
- Cudgen lagoonal lands (surrounding Cudgen Lake and including the south-east of Round Mountain); and
- Sediments of the Neranleigh-Fernvale Group which dominate the Round Mountain hills and upper catchment.

The diversity of landscape, substrates and hydrology within the Reserve provides an exceptional range of vegetation associations and habitats for flora and fauna species.

2.2.2 The Social environment

The Northern Rivers Region is one of the most rapidly growing regions in NSW. The population of the region grew by over 40% between 1981 and 1994, from 173,000 to 242,000 people (CZP, 1995).

The population of the Tweed Shire doubled to 54,189 people between 1976 and 1991. The 1991 Tweed Council Residential Development Strategy estimated the population of the region by the year 2006 to be between 117,020 and 126,640 people (CZP, 1995).

The existing proposals for changes in land use and urban development within the region, particularly the local area, are placing increased pressure on the Reserve to fulfil community expectations for conservation and recreation opportunities. Urban development also places a significant potential threat to some remnant bushland adjoining or close to the Reserve.

2.2.3 Biogeographic significance

The biogeographic significance of the Reserve is high (Pressey and Griffith 1993) as it is located within a region of great floristic diversity. Within this region many flora and fauna species reach their northern and southern limits of distribution.

There are many vertebrate and invertebrate species in the Reserve that are close to the northern or southern limit of their geographical range. The association of these species in the one location is therefore significant. Five mammal, twelve bird and one reptile species approach their southern breeding or distributional limits, while four bird, two reptile and two frog species approach their northern distributional limits. These considerations also apply to invertebrates, of which several species of rare and threatened butterflies are near their southern limits in the Tweed Shire (Pressey and Griffith, 1992) (refer to sections 4.2 and 4.3.1).

2.2.4 Flora values

Cudgen Nature Reserve supports 15 distinct vegetation associations, described below, many of which are poorly represented in other reserves. The vegetation associations range from coastal floodplain and estuarine wetland, floodplain forest, littoral rainforest, heathland, mangrove and dune vegetation communities (NPWS, 1989; Murray, 1989; Pressey and Griffith, 1987; Griffith, 1993).

A total of 10 nationally listed rare and threatened plants (ROTAP) species occur in the Reserve, 2 classified as endangered, 2 vulnerable and 6 rare (NPWS, 1995). Another 4 species are rare in NSW and 2 regionally uncommon in upper north-east NSW. Eight plant species in the Reserve are recognised under the *Threatened Species Conservation Act 1995*, 4 as endangered (Schedule 1) and 4 as vulnerable (Schedule 2).

The vegetation associations in the Reserve are:

(i) Littoral rainforest

The dominant species in this vegetation association is *Cupaniopsis anacardioides*. The conservation status of the subdominant *Syzygium luehmannii* - *Acmena hemilampra* suballiance is considered to be inadequate in the State (Benson, 1989; Floyd, 1990). The littoral rainforest remnant adjacent to Camp Wollumbin was part of a widespread area of rainforest that once extended to the ocean and much further north before the area was cleared for mineral sand mining operations.

Littoral rainforest is inadequately reserved in NSW and the Cudgen association contains a number of rare plant species (NPWS, 1989). Other NPWS protected areas containing littoral rainforest include Billinudgel N.R, Broken Head N.R and Iluka N.R. Littoral rainforest is further protected by State Environment Planning Policy (SEPP) 26.

(ii) Lowland subtropical rainforest on Round Mountain

The lowland subtropical rainforest that occurs in an eastern gully of Round Mountain contains a large bangalow palm forest with tree specimens of exceptional size (refer to section 6.2.2(iii)). The highest proportion of endangered, vulnerable, rare and restricted species occur within this area. Twelve species are of special interest, of which six are of state significance, while the remaining are of regional significance. The best stand of blush coondoo (*Planchonella laurifolia*) in NSW occurs in this rainforest (NPWS, 1989).

(iii) Lowland subtropical rainforest on swamp forest margins

This association occurs to the south and west of Cudgen Lake and contains the rare black walnut (Endiandra globosa). Of special interest are the groves of cabbage tree palms (Livistona australis) to the west of Cudgen Lake (NPWS, 1989).

Livistona australis - Archontophoenix cunninghamiana subtropical rainforest association is of local significance in that only small areas are conserved on the coast (NPWS, 1995).

(iv) Melaleuca quinquenervia swamp forest This forest association occurs on open depressions on sandy back barriers where soils are subject to extended periods of water logging, usually with a dense ground stratum of sedges, grasses and ferns. Cudgen has been identified as a significant area for the conservation of swamp forests particularly due to the size, habitat diversity, and number of significant species within the association. There are few areas of protected coastal swamp forests on the north coast, (NPWS, 1989).

(v) Swamp mahogany (Eucalyptus robusta) forest

This association occurs with brushbox (Lophostemon confertus) and Melaleuca *quinquenervia* in low-lying and open depressions on the sandy back barriers.

The *E. robusta* association is reasonably well reserved in parts of its range on the north coast.

The Lophostemon confertus wet sclerophyll forest association is reserved in small areas of the association's range, including 1 hectare in Broadwater National Park, and a small area in Ukerebagh Nature Reserve.

(vi) Blackbutt (Eucalyptus pilularis) forest

This association, occurring on Round Mountain and associated ridge tops and upper slopes on metasediments, is significant as no sizeable stands remain on the far north coast due to past logging operations (NPWS, 1989).

(vii) Grey gum - blackbutt tall open forest

Eucalyptus propingua - Eucalyptus pilularis tall open forest occurs on lower slopes where bedrock soils are deeper (NPWS, 1989).

(viii) Red gum - pink bloodwood - swamp turpentine forest

Eucalyptus tereticornis - Corymbia intermedia - Lophostemon suaveolens, occurs on the foot-slopes and associated flats on heavy, clay soils and grades into Melaleuca quinquenervia swamp forest as soil waterlogging increases (NPWS, 1989). The associated is well represented in Yuragir National Park (190 hectares). Only limited areas of the association are reserved elsewhere across its range, which extends north from the Hastings Valley.

The above three associations provide important habitat for koalas, much of which has been destroyed on the far north coast of NSW. Grey Ironbark Eucalyptus siderophloia, Tallowwood *Eucalyptus microcorys*, and Flooded Gum *Eucalyptus grandis* also occur.

(ix) Scribbly gum - Wallum Banksia forest

Eucalyptus signata - Banksia aemula association occurs on low relict beach barrier dunes and comprises trees and tree mallees with a closed understorey of shrubs. Eucalyptus signata at Cudgen occurs on sand, whereas it is normally restricted to bedrock derived soils (NPWS, 1989).

The E. signata association is reserved in very small areas over its range, eg. 11 hectares in Broadwater National Park and 1 hectare in Crowdy Bay National Park (Griffith, 1993).

(x) Banksia aemula heath

B. aemula heath occurs on old beach barriers to the south of Wollumbin Scout Camp and further south in association with Allocasuarina littoralis. Cudgen represents the only occurrence in the Tweed Shire (NPWS, 1989).

Broadwater National Park has 8 hectares of Banksia aemula - Allocasuarina littoralis -Callitris columellaris association (Griffith, 1993).

(xi) Wet Heath

Wet heathlands are characteristic of humus podsol soils derived from marine-aeolian sands (Griffith, 1993). The wet heath association is dominated by Banksia aemula, Banksia oblongifolia, Leptospermum liversidgei, Baeckea stenophylla and Sprengelia sprengelioides. Banksia robur has been recorded here and is of regional significance given that it has a very disjunct distribution on the North Coast (Griffith, 1993).

(xii) Baumea rubiginosa Closed Sedgeland

This association occurs in open depressions in deep standing water and is relatively rare in the region.

Areas of *B. rubiginosa* occur in Broadwater National Park (25 hectares) and minor areas in Bundjalung National Park (Griffith, 1993).

(xiii) *Triglochin procera* Sedgeland

Triglochin procera closed sedgeland occurs in very deep (50 cm) open depressions.

(xiv) Schoenoplectus litoralis Sedgeland 35 hectares of *S. litoralis* sedgeland occurs in long stretches of shallow water in Cudgen Lake, the most extensive occurrence in the region (NPWS, 1989).

(xv) Avicennia marina Mangrove Wetland

Avicennia marina occurs along sections of Cudgen Creek and lake, and provides significant habitat for fish. Mangrove communities are not well preserved in the Tweed Shire.

Cudgen Nature Reserve is significant for wetland conservation in a local, regional and state context. The Reserve provides protection for a representative sample of coastal floodplain wetlands.

Coastal floodplain wetlands are poorly represented in reserves in the State (NPWS, 1995) with only 5% of floodplain wetlands conserved in the Tweed Shire (Pressey and Griffith, 1992).

The protection of estuarine wetlands including saltmarsh and mangroves involves the conservation of relatively small areas in the state (Pressey and Harris, 1988). In the Tweed Shire mangrove vegetation is well represented in the coastal areas, however only small areas are present in the Cudgen Creek Catchment. Saltmarsh on the other hand is of limited extent in the Tweed Shire with approximately 55 hectares only.

Other vegetation communities of special significance occurring within the Reserve include Banksia robur wet heathlands and Syzygium luehmannii - Acmena hemilampra littoral rainforests. Murray (1989) identified Banksia robur -Leptospermum liversidgei - Xanthorrhoea fulva wet heathland community. This

community was considered by Griffith (1993) as regionally significant given that *B. Robur* has a particularly disjunct distribution on the north coast (NPWS, 1995).

A number of flora species in the Reserve are recognised on the *Threatened Species Conservation Act 1995* as endangered (Schedule 1) or vulnerable (Schedule 2). These include:

Endangered (Schedule 1) Acronychia littoralis Endiandra hayesii Syzygium moorei Syzygium hodgkinsoniae Vulnerable (Schedule 2) Cryptocarya foetida Dendrocnide moroides Lindsaea fraseri Randia moorei

The perimeter of Cudgen Lake contain dense stands of *Phragmites australis* and *Lepironia articulata* scattered with *Cladium procerum*. The shallow lake waters support a dense emergent growth of reeds (*Schoenoplectus litoralis*) and *Typha* on the northern side of the lake (CZP, 1995).

The aquatic vegetation of Cudgen Lake varies with the lake's salinity level which has been declining due to obstructions in Cudgen Creek downstream from the Reserve. In 1987 Cudgen Lake supported predominantly salt-intolerant species, eg. *Nymphaea capensis, Nymphaea mexicana, Schoenoplectus litoralis, Typha domingensis,* with some brackish water species including *Phragmites australis* and *Triglochin striatum* (CZP, 1995). The brackish water species persist along Cudgen Creek foreshore to near the Cudgen Valley road bridge where typical estuarine species dominate the intertidal and subtidal environments, including mangroves *Avicennia marina, Bruguiera gymnorrhiza* and seagrasses, *Zostera capricorni* (CZP, 1995).

The Schoenoplectus litoralis sedgeland occurs in long stretches of shallow water (approximately 35 hectares) in the lake and has been identified as the most extensive in the region. The *Baumea rubiginosa* sedgeland is another significant species which is rare in the region, and *Triglochin procera* is considered not well represented in national parks (CZP, 1995).

2.2.5 Fauna values

The Reserve is of regional and state significance for the conservation of native fauna. A fauna survey conducted in the Reserve by Milledge (1988) identified 137 vertebrate species, including 10 amphibian, 9 reptile, 98 bird and 20 mammal species. Examples of threatened and regionally significant species include the wallum sedge frog, wallum froglet, wompoo fruit dove, glossy black cockatoo, red-tailed black cockatoo, barred cuckoo-shrike, osprey, long-nosed potoroo, greater glider, eastern little mastiff bat, yellow-bellied sheath-tailed bat and the pink-tongued skink. Nineteen species identified as threatened under the *Threatened Species Conservation Act* are known to occur in or near the Reserve (see Appendix 1).

Several invertebrate species of rare and threatened butterflies are near their southern limits in the Tweed Region. Both the mangrove butterfly (*Acrodipsas illidgei*) and *Hypochrysops apelles* species may occur in the Reserve because of the presence of wetlands and mangroves.

The swamp sclerophyll woodland and the dry sclerophyll forest areas have been identified as areas supporting the greatest number of bird species (CZP, 1995). The Cudgen Lake and Creek system provides a significant feeding and breeding habitat for waterfowl such as cormorants, white faced herons, grey and chestnut teals, hardheads, black swans, tawny grassbird and Lewin's rail. The area is also used for feeding by brahminy and whistling kites and the white bellied sea eagle (CZP, 1995).

As part of the coastal lowlands of north-eastern NSW and south-eastern Queensland the Reserve provide an overwintering area for migrating bats and birds (Pressey and Griffith, 1992).

The wallum sedge frog (*Litoria olongburensis*) has a restricted distribution on the Reserve being found only in the deep water sedgelands with paperbark woodlands around the eastern and southern slopes of Round Mountain (CZP, 1995).

The Reserve has been identified as an area of particular importance for koala (*Phascolarctos cinereus*) conservation. No specific surveys have been conducted in the Reserve to determine the distribution and abundance of koalas. In a regional context the Reserve plays a significant role in contributing to the largest single area of relatively contiguous habitat for koalas remaining on the Tweed Coast (CZP, 1995). A report by the Australian Koala Foundation (1995) indicates that the Reserve and adjacent lands have a koala population of between 150-200.

2.2.6 Landscape values

Cudgen Nature Reserve contains high scenic values from both a local and regional perspective. An evaluation of scenic landscapes in the Tweed Shire byBrouwer (1995) identified Round Mountain and Cudgen Lake as sites of regional landscape significance (CZP, 1995)(refer to section 4.1.5).

Round Mountain provides a dramatic backdrop to the village of Bogangar. It is also the most significant landscape viewed from the coast when travelling along the Tweed Coast Road.

Cudgen Lake is a scenic landscape of regional significance and is the only coastal lake located within the Tweed Shire and is the most northern coastal lake in NSW (CZP, 1995). From the lake itself panoramic views can be seen of Forest Hills, Round Mountain and Mt Warning.

The coastal section of the Reserve is the only substantial portion of coastal lands in public ownership between the village of Bogangar and Kingscliff. Much of the privately owned land is proposed for development.

The importance of the Reserve, therefore, in terms of landscape significance is clearly identifiable given the combined values of Cudgen Lake, Round Mountain and the Bogangar Beach coastline.

2.2.7 Aboriginal significance

The Bandjalang tribe originally occupied the extreme north-east corner of NSW and the area between the Brisbane River and Evans River on the coastal strip of southern Queensland (Calley, 1964). Piper (1994a) states that this large association was probably divided into many dialect areas and local horde groups. Piper (1994a) refers to Tindale (1940) with respect to the geographical location of the Minjungbal tribe occupying the area between Byron Bay and Southport.

According to Piper (1994a), small local horde divisions described by Bray (1901) probably existed within these groups or tribes. The Aborigines of the Cudgen area were known as the "Coodjingburra", a group which extended from the Brunswick River in the south, to the Tweed River in the north and inland to the vicinity of Murwillumbah (Piper, 1994a, 1994b).

Populations were considered dense on the coastal plains, no doubt reflecting the resource rich and potential food gathering zones. As a major landscape feature and rich food resource area, it is likely that Cudgen Lake was an area of high value to the local

Aboriginal people. Numerous archaeological assessments have been undertaken in the region, particularly on parts of the coastal plain and foredunes proposed for development. There have been a number of Aboriginal sites identified outside the Reserve area, including a stone quarry on the banks of Cudgen Lake (Piper, 1994a)(refer to section 5.1).

2.2.8 Historical values

The historical development of the Reserve and surrounding lands was primarily for grazing, timber and mining before its development for coastal villages and more intensive agriculture.

The mining of coastal sands for heavy minerals (rutile and zircon) began in various areas along the northern NSW coast since the 1930s. Major mining operations commenced at Bogangar in the early 1950s, and by the mid 50s the Tweed Coast Road was constructed.

The intertidal and littoral beach areas adjacent to the Tweed Coast Road have been severely disturbed from past mineral sand mining activities. The remains of an old quarry from the past mineral sand mining activities occurs in the south-eastern section of the Reserve (refer to section 5.2).

2.2.9 Recreational values

Bogangar Beach, down to mean low water mark, forms the most easterly component of the Reserve. The beach has traditionally been extensively used for a range of recreational pursuits, including beach activities, fishing, dog exercising, horseriding, and Local Authority permitted four wheel driving (refer to sections 6.2.1 ()).

Cudgen Lake has traditionally been used for a range of recreational activities including waterskiing, paraflying, sailing, canoeing, fishing and windsurfing. More recently jet sprint boats and jetskiis have been utilising the waters for recreational pursuits (refer to section 6.2.5).

It is apparent that a conflict of recreational users exists in the Reserve in terms of passive and active recreational pursuits.

The Wollumbin District Scout Association has been utilising the Reserve since 1976 when the camp was officially opened. The Camp attracts approximately 18,000 visitors each year, mostly scout and guide groups, youth and church groups, schools and sporting associations (CZP, 1995)(refer to section 6.4.5).

A number of formal and informal walking tracks exist in the Reserve (refer to section 6.2.2).

PART C. OBJECTIVES OF MANAGEMENT

3.1 OVERALL STRATEGY

Cudgen Nature Reserve will be managed to ensure the preservation of the natural environment including the important remnant vegetation and habitat for threatened flora and fauna species. Nature conservation is the primary focus of management for the Reserve, with emphasis to be given to rehabilitation of disturbed lands and improvement of the Cudgen Lake ecosystem through an improvement in water quality. There are existing activities in the Reserve which are incompatible with the purpose of dedication of the Reserve [refer to section 49(3) of the National Parks and Wildlife Act 1974] and which are considered to be a threat to the values or maintenance of the natural systems of the Reserve.

Promotion of public awareness and appreciation of the Reserve will emphasise the importance of the natural values including the need for appropriate use of the area that will not adversely affect the natural or cultural values. Future recreational use of the Reserve will need to be nature based and compatible with the purpose of nature reserves as specified in the Act.

Cudgen Nature Reserve is a relatively small reserve surrounded by an area facing rapid regional growth and urban development. The environmental guality and integrity of the Reserve is greatly influenced through the management of the catchment. The NPWS will cooperatively involve the Cudgen Lake Catchment Coordination Group, Tweed Estuaries Management Committee, the Cudgen Lake Restoration Steering Committee and the Tweed Catchment Management Committee in matters dealing with water quality in Cudgen Lake.

3.2 GENERAL OBJECTIVES FOR NATURE RESERVES

The following general objectives relate to the management of nature reserves in New South Wales:

- protection and preservation of scenic and natural features;
- maintenance of natural processes as far as is possible;
- conservation of wildlife;
- preservation of Aboriginal sites and historic features, and
- encouragement of scientific and educational inquiry into environmental features and processes.

3.3 SPECIFIC OBJECTIVES FOR CUDGEN NATURE RESERVE

In addition to the above general objectives the management of Cudgen Nature Reserve will be subject to the following more specific objectives:

- To manage native and introduced vegetation so as to: .
- maintain natural floristic and structural diversity; conserve endangered or uncommon communities and species, and
- maximise habitat values for native animal species.
- To maintain biodiversity with priority given to the protection of those plant communities in the Reserve containing threatened species.

- To conserve and maintain the diversity and high quality of habitats for native animals in the Reserve.
- To maintain biodiversity with priority given to the protection of habitat and populations of threatened species.
- To rehabilitate communities disturbed by mineral sand mining, agriculture and other developments;
- To control, and where practicable eradicate, exotic plants introduced from past and present land uses and neighbouring properties;
- To control and where practicable eradicate pest animals;
- To promote public awareness and appreciation of the values of Cudgen Nature Reserve, with emphasis on the importance of the Reserve in the regional pattern of conservation areas on the North Coast of NSW;
- To provide minimum impact public access to designated areas for appropriate nature based recreation so that the natural and cultural values of the Reserve are not threatened.
- To preclude the off-road use of recreational vehicles in the Reserve.
- To provide a variety of nature-based recreational opportunities which complement the purpose of the nature reserve;
- To provide for water-based recreational activities which are in keeping with the purposes of dedication of a nature reserve and philosophy of nature-based recreation.
- To provide low-key visitor facilities that minimise environmental impact and promote the appreciation and enjoyment of nature.
- To ensure organised events conducted in the Reserve are managed in a manner consistent with the purposes of dedication of a nature reserve.
- To permit nature based commercial operations and commercial fishing licensed under the *Fisheries Management Act* in the Reserve provided such operations are consistent with the objectives of this plan.
- To allow the continuance of commercial fishing subject to conditions necessary to protect the natural and cultural values of the Reserve.
- To provide opportunities for Aboriginal communities to participate in the protection and management of Aboriginal sites within the Reserve, consistent with the objectives and strategies in this plan;
- To identify any Aboriginal sites and values within Cudgen Nature Reserve, and protect and preserve them with the involvement of local Aboriginal communities.
- To conserve historic sites and promote their on-going study and investigation.
- To provide for appropriate scientific study which enhances the information base or assists in the management of the Reserve;
- To preserve and protect the landscape values of the Reserve and encourage Tweed Shire Council and neighbours to protect surrounding landscape values;

- To assist in the development of management requirements for the Cudgen catchment so as to improve water quality in Cudgen Lake;
- To provide an understanding and appreciation of the natural and cultural values and appropriate recreational use in the Nature Reserve.
- To promote public awareness and appreciation of the values of Cudgen Nature Reserve, with emphasis on the importance of the Reserve in the regional pattern of conservation areas on the North Coast of NSW.
- To involve local residents, Tweed Shire Council, relevant committees and interest groups in the protection of the natural and cultural values of the Reserve;
- To manage fire on an ecological basis, except only where necessary to protect human life, property or the Reserve.
- To cooperate with neighbours to protect the Reserve and private property from wildfires.
- To control and manage activities and environmental impacts so that they do not conflict with the purpose of dedication of the Reserve (refer to section 49(3)of the *National Parks and Wildlife Act*).
- The Service will seek the addition of the Wollumbin Scout Camp to the Nature Reserve.
- To remove encroachments from the Reserve.
- To manage Saunder's quarry so it does not conflict with the purpose of dedication of the Reserve.
- To seek amendments to local government planning policies which may not be compatible with the purpose of dedication of the Reserve.

PART D. POLICIES AND FRAMEWORK FOR MANAGEMENT

This chapter contains the policies and framework for the management of Cudgen Nature Reserve together with relevant background information. Policies are summarised under the following section headings:

- 4. NATURAL HERITAGE
- 5. CULTURAL HERITAGE
- 6. USE OF THE AREA

The strategies established in this plan of management will provide the framework for management consistent with anticipated resources available to the NPWS and anticipated community trends over the next five to ten years. Management actions will be developed throughout the duration of this plan consistent with the strategies set out in this plan.

Where not specifically provided for in this plan, management will also be in accordance with the *National Parks and Wildlife Act* and NPWS policies.

4 NATURAL HERITAGE

Natural heritage comprises all aspects of the natural environment including physical features such as geology and soils, plants and animals and the relationship between these. For convenience, management of landscape values and fire are also considered in this section.

4.1 LANDFORM, LANDSCAPE AND CLIMATE

4.1.1 Geology and landform

The present day coastline which extends from Kingscliff to Cape Byron has developed from the accretion of sand by marine processes. The coast has reached a mature stage of development, no longer accreting sand, and now undergoing a long term process of coastal erosion (Roy, 1973). Ongoing erosion of the beach and foredune is likely to continue.

The sand dunes adjacent to Cudgen Creek and the area to the east towards Bogangar Beach have all been mined for mineral sands on at least three occasions during the last 20 years (NPWS, 1989; Pressey & Griffith, 1992).

Cudgen Lake is a barrier dune lake system, lying between the older inland barrier dunes and the contemporary coastal dune system, which formed when the sea level rose some 6,000 years ago. The old drainage system was blocked forming the lake, with the creek being forced northwards to emerge at Cudgen headland, Kingscliff.

Coastal lagoons typically remain closed for most of the time, opening naturally only after prolonged or heavy rain causes rising water levels to breach the sand barrier to the sea. Lagoons drop dramatically, often becoming tidal until the barrier is reformed by wave and wind action. This cycle results in distinctive ecosystems that reflect the changing salinities, nutrient levels and inundation periods (NPWS, 1996).

The hills within the Reserve, with Round Mountain being the dominant topographic feature, are comprised of sedimentary and metamorphic rocks known as the Fernvale sediments which comprise greywacke, slate phyllite and quartzite metasediments.

The lake and upper Cudgen Creek are now weakly tidal, however, human use in the upper and lower catchment has resulted in significant changes to the lake (refer to section 4.1.3).

4.1.2 Soils

The soils of the coastal dunes east of the Tweed Coast Road have been extensively disturbed by mineral sand mining. The sands forming the dunes are potentially highly unstable and, if the protective vegetation cover is disturbed, are prone to wind erosion. In conjunction with the natural erosion of the beach and foredune, inappropriate land uses and poor rehabilitation of the dunes has resulted in considerable erosion of the coastal dunes in the Reserve.

Sandy yellow podsols occur between the outer barrier dunes and Cudgen Lake. These areas support a wide range of vegetation communities including littoral rainforest, swamp forests and wet heath and are subject to flooding or seasonal water logging. Isolated patches of lithosols are found west of Round Mountain and Cudgen Lake supporting mainly dry sclerophyll forests.

In the Round Mountain and upper catchment areas, where the topography is reasonably steep, the soils are characteristically red and yellow podsols with poor structure. These soils are strongly leached, deeply weathered and low in nitrogen, potassium and phosphorus and prone to serious soil erosion if disturbed.

The Clothiers Creek and Reserve Creek floodplain soils are dark loams overlying clays and are considered to be potential acid sulphate soils. It is the disturbance of these soils that has led to the increasing acidity levels in Cudgen Lake with serious consequences to the ecology of the lake (CZP, 1995).

The Cudgen Lake Restoration Steering Committee was established in 1995 after the Minister for Agriculture formed local action committees throughout the State to research acid sulphate soils. The Committee is initially gathering information, mapping acid sulphate soils and collating results. The University of NSW is undertaking the research component of the project, involving university students. After the data gathering and information processes are completed appropriate actions will be undertaken and funding sought for implementation (refer to section 6.3.1).

The membership of the committee includes relevant state government departments, community and industry representatives and the University of NSW.

4.1.3 Cudgen Lake

The management of Cudgen Lake depends upon the effective coordination of land use planning and management in the entire catchment. To this end the NPWS has instigated a hydrolological study for Cudgen Lake.

Cudgen Lake has an area of about 160 hectares and receives water from the Cudgen catchment which is 73.2 square kilometres in area. The lake receives waters from the flood plains drained by Clothiers and Reserve Creeks to the west via a drainage system through the adjacent wetlands. The catchment area is mainly pastoral land with some cropping. The lake acts as a natural flood retention basin which attenuates floods in the creek and often inundates an area over three times that normally covered under non-flood conditions (PWD, 1982).

Cudgen Lake was originally a waterbody that intermittently closed to Cudgen Creek. The duration and frequency of the closure is commonly determined by the morphology of the entrance, the size of the catchment in relation to the size of the waterway and prevailing climatic conditions. The Cudgen Creek estuary has been engineered with permanent rock groynes and training walls which in association with periodic dredging programs, maintains a permanently open entrance channel (Lugg, 1995).

Flooding is an important component of the hydrological and ecological processes operating in coastal lagoons. It is likely to be especially important in maintaining the character and extent of fringing wetland vegetation communities (Lugg, 1995). Developments on the fringe or close to Cudgen Lake often suffer fromflood waters.

Cudgen Lake has been subject to significant changes in its ecological and hydrological regime over the past 50 years. Some of these include:

- Construction of a permanently open channel entrance leading to both changes in flood hydrology and salinity levels in the lake;
- Improved drainage of the lower catchment into Cudgen Lake with the construction
 of drains to enhance the flow of drainage waters into the lake and thereby improve
 the agricultural capability of the low lying lands;
- Changing agricultural practices in the catchment including the use of fertilisers and other materials that ultimately flow into the lake;
- Disturbances of soils in the catchment, some of which are known to be acid sulphate soils, thereby inducing significant changes to the chemistry of the waters and siltation of Cudgen Lake and resulting in periodic kills of aquatic fauna;
- Point and non-point source inputs of nutrients discharging into the lake particularly those from agricultural sources, canals and drains constructed from Bogangar into the lake. This has increased nutrient inputs inducing early stages of eutrophication and increased growth of reeds, and
- Dredging of the lake and creek.

The *Catchment Management Act, 1989* provides a total catchment management approach with the aim of cleaner water, minimal soil loss, improved vegetation cover, the maintenance of ecological processes and a balanced and healthier environment. It also provides a focus to balance conservation needs and development pressures and encourages a more aware and involved community. An important means of achieving these aims is the formation and support of catchment management committees at a local level.

In 1991 the NSW Government adopted the Estuary Management Program and through the NSW State Rivers and Estuaries Policy developed a manual which detailed the management processes to be undertaken in conjunction with Councils. Tweed Shire Council have adopted and undertaken this initiative and have prepared plans for all major estuaries in the Shire.

The Tweed Coast Estuary Management Committee was formed in 1995 with membership from all relevant state government departments, industry and the community. The Cudgen, Cudgera and Mooball Creeks Estuary Management Plan is due to be released for public exhibition in early 1997. The Estuaries Management Plan is primarily concerned with water quality and associated management issues. Cudgen Lake will be incorporated into the Estuaries Management Plan.

The NPWS has instigated a coordinated approach to the management of Cudgen Lake, Cudgen Creek and its catchment. The NPWS (as the management agency responsible for the Reserve), Cudgen Lake Restoration Steering Committee and the Cudgen, Cudgera and Mooball Creeks Estuary Management Committee will approach the Tweed Catchment Management Committee to undertake a coordinating role for the three committees operating in the Cudgen Catchment.

In order to ensure consistency with the work undertaken by the Tweed Coast Catchment Management Committee, the management of the Reserve will actively contribute to achieving the water quality objectives of "aquatic ecosystem protection" and "primary contact recreation" (ANZECC 1992) in the Reserve's waterways.

4.1.4 Climate

The Cudgen area has the highest winter maximum temperatures in NSW, with minimums rarely falling below 7 degrees Celsius and average summer temperatures between 25-30 degrees Celsius. Cyclonic weather may be experienced in summer and is the main reason for the predominance of high summer rainfall.

The average annual rainfall is 1650 mm, approximately 60% of which falls between December and April. During the same period the average relative humidity is around 70-80% and very rarely drops below 60%. The average annual evaporation is 1100 mm. The "dry season" generally occurs between May and November (CZP, 1995).

4.1.5 Landscape

An evaluation of landscape values in the Tweed Shire identified the importance of Round Mountain and Cudgen Lake as sites of regional landscape significance. The natural landscape is the main attraction for visitors to the Tweed Shire (Brouwer (1995). The Reserve contributes to the visual amenity of the area with its high diversity of landform and vegetation patterns, natural character, and water views of the lake and ocean. These features of the Reserve are apparent when viewed from various vantage points. Many other significant landscapes, such as Mt Warning, are part of the landscape importance of the area.

The rehabilitation of cleared lands and banana plantations will help to restore and enhance the scenic amenity of the Round Mountain area as well as enhance wildlife conservation values (refer to section 6.4.3).

Objectives:

To preserve and protect the landscape values of the Reserve and encourage Tweed Shire Council and neighbours to protect surrounding landscape values.

To control and manage activities and environmental impacts so that they do not conflict with the purpose of dedication of the Reserve.

To seek amendments to local government planning policies which may not be compatible with the purpose of dedication of the Reserve.

Strategies:

- * Undertaken appropriate control measures where erosion has been accelerated by human activity or is threatening significant habitats or other values.
- * All works will be designed and undertaken in a manner which minimises soil erosion.
- * The NPWS supports the principles of total catchment management and estuaries management and will liaise with local government and other authorities to maintain and improve the water quality in the Reserve and its catchment.

- * Establish a coordinated cooperative approach to undertake studies and the management of Cudgen Lake, Cudgen Creek and its catchment through the Tweed Catchment Management Committee, involving the NSW National Parks and Wildlife Service (as the managers of Cudgen Nature Reserve), the Cudgen Lake Restoration Steering Committee and the Tweed Coast Estuaries Management Committee. Such management will aim for ecological sustainability and environmental protection of Cudgen Lake, Cudgen Creek and relevant catchment areas.
- * The NPWS will encourage education of water quality and related issues with the Department of Land and Water Conservation's 'Streamwatch' Program involving local schools and community members.
- * The NPWS will encourage and assist in the organisation of a Clean Up Australia 2001 project to be undertaken in the Cudgen Catchment.
- * Encourage and where possible assist Tweed Shire Council in preparing development controls on adjacent lands and in the catchment to retain the scenic amenity of the area and improve water quality for Cudgen Lake and Creek.
- * Assess the conservation status of adjoining lands and investigate appropriate protection measures, including the feasibility of acquisition and incorporation into the Reserve.
- * Encourage and assist in the formation of local Landcare and Dunecare groups in the Cudgen Catchment and Coastal areas.
- * Prepare a proposal for a jointly funded project with the Tweed Catchment Management Committee, the Department of Land and Water Conservation and, if formed, the proposed Landcare group for the rehabilitation of the banana plantations (refer to section 4.2.4).
- * Undertake a study of the hydrology and associated natural processes, water quality and flooding scenarios of Cudgen Lake. As an outcome of the study examine management options which conserve or enhance the natural values of the lake system while addressing key community concerns (eg. flooding and water quality) relating to the hydrology of Cudgen Lake.
- * Subject to funding, key recommendations arising from the study into the hydrology of Cudgen Lake will be implemented by the Service and/or other authorities with responsibilities in catchment management and planning to reduce the risk of flooding to private property consistent with the protection and enhancement of the natural values of the Reserve.
- * Any dredging of Cudgen Lake will not take place until a full scientific assessment of the lake's hydrology, as outlined above, has been undertaken.

4.2 NATIVE AND INTRODUCED PLANTS

4.2.1 Native plants

Cudgen Nature Reserve lies within a biogeographic zone supporting an exceptionally high diversity of flora and fauna species (refer to section 2.2.4).

The vegetation of the Reserve comprises forest and woodland, mallee, shrubland, heathland and herbaceous communities, wetland and small areas of rainforest. The soils supporting coastal vegetation are mainly derived from sandy Quartenary deposits of marine-aeolian or estuarine origin (Griffith, 1993).

Regionally the Reserve has special conservation significance as part of the last remaining tract of native vegetation on the Tweed Shire Coast capable of providing long term protection for animal communities and a link to vegetation remnants in the Brunswick Valley in the south and the Tweed River estuary to the north.

The growth of reeds in the lake is probably related to the increased sedimentation and nutrients in the waterbody. Roy (1973) suggests that pollutants and enrichments associated with agricultural uses such as bananas and sugar cane cultivation may have affected the biota of the lake.

In recognition of the significant wetland and littoral rainforest values of the Reserve, the low-lying areas are covered by State Environmental Protection Policy (SEPP) 14 - "Wetlands", and the coastal rainforest adjacent to Wollumbin Scout Camp are covered by SEPP 26 - "Littoral Rainforest" (refer to map 2). SEPP 14 and 26 also affords protection to private lands adjoining the Reserve.

4.2.2 Introduced plants

An introduced species is defined in this plan as any animal or plant species, including weeds, exotic plants or native plants outside their natural range, not indigenous to the Reserve. Introduced species within the Reserve, and on adjoining land, are of concern because they have the potential to adversely affect the ecological values and spread to or from neighbouring land.

The *Noxious Weeds Act, 1993* places an obligation upon public authorities to control noxious weeds on land that they occupy to the extent necessary to prevent such weeds spreading to adjoining lands. The Far North Coast County Council is the local control authority responsible in the Tweed Council area.

A weed species list has been produced by Joseph (1996) for the Reserve which identifies some 60 introduced species. The major areas of weed infestation in the Reserve occur at:

- The Sliprails Road area;
- The banana plantations (refer to map 3);
- Track through palm forest and surrounds;
- Wollumbin Scout Camp and surrounds;
- Reserve edge behind houses (Tamarind Ave) and surrounds;
- The area around the southern lake foreshore of Cudgen Lake;
- The coastal section of the Reserve, and
- The northern and southern edges of Clothiers Creek Road.

Some aggressive weeds capable of invading native plant communities in the Reserve include:

- Chrysanthemoides monilifera spp. rotundata (Bitou Bush);
- Schefflera actinophylla (Umbrella Tree);
- Cinnamomum camphora (Camphor Laurel);
- Pinus taeda (Pine);
- Nephrolepis cordifolia (Fishbone Fern);
- Lantana camara (Lantana);
- Ageratina adenophora (Crofton Weed);
- Ageratina riparia (Mist Weed), and
- Baccharis halimifolia (Groundsel Bush).

A restoration and rehabilitation plan has been prepared for the Reserve. This plan will be progressively implemented to control weeds in the Reserve and to rehabilitate degraded areas.

Objectives:

To manage native and introduced vegetation so as to:

- maintain natural floristic and structural diversity;
- conserve endangered or uncommon communities and species, and
- maximise habitat values for native animal species.

To maintain biodiversity with priority given to the protection of those communities in the Reserve containing threatened species particularly;

- littoral rainforest communities (SEPP 26),
- subtropical rainforest communities, and
- wetland communities (SEPP 14).

To rehabilitate communities disturbed by mineral sand mining, agriculture and other developments.

To control, and where practicable eradicate, exotic plants introduced from past and present land uses and neighbouring properties.

Strategies:

- * Protect threatened and significant species, populations and communities, and implement any actions required by any recovery plan or similar document.
- * Introduced plant species will be controlled, and where practicable or where required by law, eradicated. Priority will be given to those which have been outlined in Joseph (1996) as:
 - declared noxious;

- threaten the integrity of native communities, such as the littoral rainforest, palm forest and Reserve edges;

- have a high capacity for dispersal; and/or
- are new isolated occurrences.
- * Implement the restoration and rehabilitation (including weed control) plan which seeks to prevent impact on non-target species.
- * Liaise with Tweed Shire Council in the preparation of the Shire-wide Vegetation Management Plan particularly with respect to wildlife corridors and management of areas adjacent to the Reserve.
- * The cooperation of local authorities and Reserve neighbours will be sought in assisting with implementing weed control programs, regeneration works, and to encourage retention of native vegetation in the vicinity of the Reserve.
- * Removal of exotic plants at historic sites will be based on an assessment of their historic and landscape significance and their potential to spread.
- * A rehabilitation plan will be developed for the banana plantation permissive occupancy areas, detailing the prescription for its implementation and the species required (refer to section 6.4.3).

- * Liaise with current licensees of banana permissive occupancies to finalise new lease arrangements, including requirements for weed control, fire protection measures, period of operation and conditions of operation.
- * A rehabilitation plan will be developed for the coastal section of the Reserve adjacent to Bogangar Beach. The establishment of a local dune care group will be encouraged to help coordinate the rehabilitation works.
- * A concept plan will be prepared for the permissive occupancy area on the southern foreshore of Cudgen Lake, in consultation with the Department of Land & Water Conservation and the licensee, to provide improved access for public recreation and visitor facilities (refer to map 4 and section 6.2.3).
- * Rehabilitate, and where necessary fence, the area adjacent the southern lake foreshore permissive occupancy which was previously cleared and filled (refer to map 4).
- * If considered justified in the hydrolological study for Cudgen Lake (refer to section 4.1.3) some form of reed control in the lake may be undertaken, consistent with the natural values of the lake system, particularly if the growth of reeds threatens wildlife habitats, significantly reduces the effectiveness of the lake in the control or mitigation of flooding or significantly reduces the nature based recreation opportunities of the lake. The control of reeds will be subject to an environmental assessment.
- * Following appropriate environmental assessment, some form of reed control in the lake may be undertaken if the growth of reeds threatens wildlife habitat values or significantly reduces the nature based recreational potential of the lake.
- * Investigate the viability of natural regeneration as an alternative to reafforestation of former banana plantations within the Reserve with priority being given to the relinquished banana plantation licence area over the next two years (refer to section 6.4.3). The rate and type of rehabilitation will be monitored.
- * Information brochures designed to address the problems of dumping garden refuse and other rubbish in the Reserve will be prepared and distributed explaining the impact naturalised plants and added nutrients from garden refuse has on native vegetation.
- * Subject to demand, organise a workshop for local residents and other interested people to explain:
 - the impact of weeds and added nutrients on native vegetation;
 - characteristics and destructive potential of weeds;
 - garden plants which have become or are likely to become naturalised in the bushland, and
 - removal / control methods for these plants.
- * Assess the interest of local community members and neighbouring residents to form a 'Friends of Cudgen Nature Reserve' or similar group, to assist with the management of the Reserve.

4.3 NATIVE AND INTRODUCED ANIMALS

4.3.1 Native animals

The diversity of species found within and adjacent to the Reserve is of state and regional significance for the conservation of wildlife (CZP, 1995). The Reserve lies in a region with a diversity of terrestrial vertebrates higher than most of the Australian land mass where species approach their southern or northern breeding or distributional limits (Pressey and Griffith, 1992).

Threatened species management plans need to be developed for the area including a monitoring program of koalas to determine population decline which has been reported by local community members. This emphasises the need to provide wildlife corridors for species, such as koalas, ensuring viability of habitat. At present large areas of habitat are under threat from proposed development along the Tweed Coast.

In order to maintain wildlife corridors along the Tweed Coast a range of protection measures need to be considered.

Disrupting the free movement of wildlife in the Reserve are a number of roads, particularly the Tweed Coast Road and Clothier's Creek Road, which experience high road kills of wildlife. Motorists should be advised that wildlife cross these roads through the placement of appropriate signs.

A survey by Cheers (1992) identified a relatively low number of benthic fauna in Cudgen Lake. In 1991 highly acidic waters from acid sulphate soils killed much of the fauna in Cudgen Lake. Cheers (1992) found that the general abundance of taxa other than bivalves, crustaceans and molluscs was low (CZP, 1995).

Fish diversity in Cudgen Lake is lower than that expected for a coastal lagoon. The Cudgen system was used to a small extent for recruitment by ocean-breeding fish species such as yellowfin bream, sand whiting, eastern king prawn, and the blue swimmer crab (CZP, 1995). Cudgen Lake and Creek were known to support moderately sized populations of dusky flathead, trumpeter whiting, flat-tailed mullet and greasy-backed prawn prior to the acid kill in 1991.

Until water quality of Cudgen Lake is restored it is unlikely the lake will provide useful fish breeding habitat.

4.3.2 Introduced animals

The presence of a number of pest species including the cane toad (*Bufo marinus*), black rat (*Rattus rattus*), cat, fox and dog are known to occur in the Reserve but their status is unknown.

The Reserve faces problems with the presence of domestic dogs, one of the main threats to koalas, which have been observed roaming around various locations of the Reserve. Domestic dogs are particularly a problem adjacent to Tamarind Avenue, near the lake foreshore and at the beach access.

Records held by the Tweed-Lismore Rural Lands Protection Board indicate the presence of wild dogs in and around the Round Mountain area, where numerous wild dog baiting programs have been carried out in the past. Foxes but no dingoes have been recorded in the Reserve.

Another problem is the presence of livestock on adjoining properties. The western boundary on the Round Mountain section of the Reserve is not fenced and in order to stop impacts from domestic stock it may need to be surveyed and fenced.

Objectives:

To conserve and maintain the diversity and high quality of habitats for native animals in the Reserve.

To maintain biodiversity with priority given to the protection of habitat and populations of threatened species such as red-tailed black cockatoo, osprey, glossy black cockatoo, Queensland blossom bat, long-nosed potoroo, koala, white-eared monarch, black flying fox, common planigale, black bitten, pied and sooty oystercatcher, wallum sedge frog and wallum froglet.

To control and where practicable eradicate pest animals.

Strategies:

- * Priority will be given to management strategies or programs for endangered or vulnerable species listed on the *Threatened Species Conservation Act, 1995.* As far as possible programs will be designed to conserve the full range of native animal species in the Reserve.
- * Introduced animals will be controlled, or where possible eradicated. Species will be targeted in order of priority which is reviewed in line with assessment of data from a pest species monitoring program. Control programs will be designed to avoid impact on non-target species and will be undertaken in cooperation with the Tweed-Lismore Rural Lands Protection Board and neighbouring landholders where appropriate.
- * Wild dog control may be undertaken on the Reserve boundaries to reduce the impact to livestock on adjoining land, in accordance with the NPWS's Field Management Policy on wild dogs.
- * Boundary fencing will be undertaken and maintained in cooperation with adjoining livestock properties (refer to section 6.4.2).
- * Domestic animals and livestock will be prohibited in the Reserve with the exception of guide dogs being used for the blind.
- * An introduced animal species control plan will be prepared for the Reserve setting out techniques and programs, including monitoring of effectiveness.
- * Records of native and introduced fauna will continue to be updated to appropriate NPWS data bases.
- * In consultation with Tweed Shire Council, signs will be placed on the Tweed Coast Road and Clothier's Creek Road advising motorists to drive carefully to avoid injury to wildlife.

4.4 FIRE PROTECTION AND MANAGEMENT

Fire is a natural feature of the environment of Cudgen Nature Reserve and is essential to the survival of some plant communities. Frequent or regular fire, however, can cause loss of particular plant and animal species and communities. Fire can also damage some types of Aboriginal sites, historic sites and recreation facilities and threaten visitors and neighbouring property.

Management of fire in the Reserve is an important and complex issue. Management must aim to protect life and property within and adjacent to the Reserve and to achieve long term conservation of natural communities.

4.4.1 Fire history

The pre-European fire history of the Reserve is not known. Traditional fire practices of Aborigines in NSW have not been well researched and are therefore poorly understood. Traditionally Aborigines are likely to have had burning regimes which encouraged grazing in areas in which they hunted game and kept corridors open in lands they travelled through. From research conducted elsewhere it appears likely that the frequency and intensity of fire now is different from traditional Aboriginal burning practices.

Local descendants from early settlers report that many fires used to clear land escaped from their property to the Round Mountain area. Several major and minor fires have occurred in and around the Reserve during the past decade. Documentation of fires in the area has been recorded since 1978 when the first fire control officer was appointed for the Tweed-Byron Shire areas. Ignition points for many of these fires were from the western side of the Reserve boundary along Clothiers Creek Road and Tanglewood areas. Records from 1978 to 1995 report arson to be the main cause of fires, occurring principally from roadside ignition.

The following recent intense fires have occurred in the Reserve:

- September 1979 during a dry period a major fire ignited from an electricity pole near Camp Wollumbin. Due to strong winds and dry weather extensive areas of land to the north-west of the Reserve were burnt.
- October 1989 two major fires occurred during this time, one started near the sewerage treatment works and the other on the western side of the Reserve near Clothiers Creek Road.
- August 1991 during a dry period a severe fire occurred along the Round Mountain Road to the south of the Reserve. The fire changed directions on several occasions and spotted across Cudgen Creek killing a large number of wildlife including koalas and wallabies.
- August 1996 fire entered the south western area of the Reserve as a result of uncontrolled hazard reduction work undertaken on Tanglewood estate.

4.4.2 Ecological requirements

Fire frequency, intensity and season of occurrence are major factors influencing the distribution and composition of plant and animal communities. A variety of fire regimes is needed in order to conserve floristic diversity and provide diversity of habitat for animals. Fire management aims to maintain this diversity by restricting planned and, if possible, unplanned fires to only a part of the distribution of a vegetation type within the Reserve at any one time. This approach will ultimately result in a mosaic of age classes for each of the vegetation types in the Reserve.

Some plant communities such as littoral rainforest, subtropical rainforest and mangroves, are intolerant of fire, and wherever possible, fire management practices should aim to protect these areas.

As research is undertaken into optimal fire regimes for particular flora and fauna species and communities, resulting information will be incorporated into the fire management planning process. The fire response of the rare and threatened plants in

the Reserve is not known. Many rare plants, however, tend to be fire sensitive and management should aim as far as possible to minimise the effects of fire in areas of rare species.

4.4.3 Fire protection

The Reserve has a fire management plan which was prepared by the former Reserve Trust. This plan will continue to apply to the Reserve for fire management and protection purposes until the NPWS is able to prepare a replacement fire management plan.

A variety of fire management strategies have been developed including fuel reduction, fire trails, detection and cooperative arrangements. Some, or at times all, of these are applied where appropriate to best protect life, property and natural and cultural assets within and adjacent to the Reserve. In particular, close to boundary areas, fuel reduction programs and fire trail maintenance systems will be designed and implemented in cooperation with neighbours.

Under the *Rural Fires Act, 1997* the NPWS is a fire authority and is responsible for controlling fires on the Reserve and ensuring that they do not cause damage to other land or property. An important part of the NPWS's fire management is participation in local cooperative fire management arrangements. Tweed Shire Bush Fire Management Committee aims to coordinate fire management and fire control on a district basis.

The Reserve is within the Tweed Shire Council's Bush Fire Brigade's Fire District. The Pottsville and Cudgen Volunteer Bush Fire Brigades are located within close proximity to the Reserve and have both light and heavy 4WD tankers. The NSW Fire Brigade at Kingscliff is responsible for responding to fire at Cabarita Beach and surrounding areas. NPWS will cooperate with these brigades to manage fire in the area.

Under emergency conditions, bushfire suppression operations may require the construction of temporary trails, helipads and firelines. These will be closed and rehabilitated as part of post fire operations.

Objectives:

To manage fire on an ecological basis, except only where necessary to protect human life, property or the Reserve.

To cooperate with neighbours to protect the Reserve and private property from wildfires.

Strategies:

- * A fire management plan will be prepared for the Reserve. Fire will be managed in accordance with the proposed fire management plan to:
 - protect human life and property within and adjacent to the Reserve;
 - conserve rare, endangered and significant plant and animal species and communities;

- maintain plant and animal species and communities through the provision of fire regimes compatible with their conservation;

- protect Aboriginal sites, historic places, visitor facilities and management structures, and

- where possible, to limit and control the occurrence of fire entering the Reserve from adjacent lands.

- * Upgrade existing tracks and construct new fire trails where necessary for fire control and other emergency operations. Liaise and negotiate with neighbours in relation to the use and maintenance of existing tracks on private property.
- * All fire management activities will be subject to an environmental impact assessment consistent with current NPWS policy and practices. Environmental impact assessment is unlikely to be required for emergency fire suppression activities, although fire management practices will be planned in a way which minimises impacts on environmentally sensitive areas.
- * The use of heavy machinery for fire suppression will, where possible, avoid rare plants, Aboriginal sites and historic places, swamps, sand dunes and heathland.
- * Rehabilitate areas disturbed by fire suppression operations as soon as practicable after fire.
- * Maintain records and maps of all fires as they occur.
- * Encourage research into the ecological effects of fire in the Reserve, particularly the fire response of rare and threatened plant species.
- * Close contact and cooperation will be maintained with volunteer bush fire brigades, Council fire officers and State Forests of NSW. The NPWS will continue to actively participate in the Tweed Bush Fire Management Committee.
- * As far as possible fuel management will be carried out in cooperation with neighbours for mutual protection.
- * Land use planning and development authorities and private developers will be encouraged to incorporate boundary fire breaks and other fuel reduction measures in any development adjacent, or in proximity, to the Reserve.
- * The Reserve may be closed to public use during periods of extreme fire danger.
- * Fuel reduction programs will be prepared detailing fuel reduction burns and trail maintenance requirements in accordance with the policies outlined above and the Fire Management Plan.
- * Fire should be excluded from areas within the Reserve to protect the unique vegetation associations, particularly:
 - rainforest communities;
 - SEPP 14 (Wetlands) and SEPP 26 (Littoral Rainforest)communities, and
 - habitats of rare and endangered plant and animal species where fire may threaten these species.
- * Establish a slashed fire radiation zone adjacent to the Tamarind Avenue properties while retaining significant koala habitat trees.
- * Maintain a fire radiation zone to the north of the Cabarita Caravan Park and Cyprus Crescent properties.
- * Where appropriate, the boundary of the Reserve will be surveyed before establishing buffer or radiation zones.

5 CULTURAL HERITAGE

Cultural heritage includes both indigenous and non-indigenous history. It comprises important components of the environment that may have aesthetic, historic, scientific and social significance to present and future generations.

5.1 ABORIGINAL VALUES

The earliest reference to the Aborigines of the Tweed Region was made by Captain James Cook on 15 May 1770 approximately 25 km south of Point Danger: *"We saw smoke in many places and saw a group of natives carrying the palms for their houses"* (Piper, 1994b). Aboriginal people came into contact with non-Aboriginal people when Lieutenant John Oxley's party reached the Tweed River near Chinderah on 31 October 1823 (Piper, 1994b).

The Bandjalang tribe originally occupied the area between the Brisbane and Evans Rivers (Calley, 1964).

Calley (1964) refers to the name Bandjalang in terms a clan in the neighbourhood of Lismore and not the name for the tribe as a whole. Prior to European settlement the Bandjalang were divided into some thirty politically autonomous, warring clans. Piper (1994a, 1994b) refers to the Tweed Coast Aboriginal people belonging to a local language group called the Minjungbal tribe who lived between Byron Bay and Southport.

The Aboriginal people of the coastal area belonged to the Coodjingburra, a group which extended from the Brunswick to the Tweed Rivers and inland to Murwillumbah (Piper, 1994a ,1994b).

Populations of Aboriginal people were considered dense on the coastal plains no doubt reflecting the rich food gathering potential. The area surrounding and including the Reserve on the coastal plain were favoured by Aboriginal people because of the access to a wide variety of resource rich food and raw material producing zones. These included:

- extensive areas of rainforest on basalt soils;
- vast tracts of 'wallum' scrub;
- open beaches and headlands;
- estuaries and lakes;
- dry sclerophyll forest on poorer inland soils, and
- littoral rainforests on foredune terraces (Piper, 1994b).

In the Tweed the Bungwahl fern (*Blechnum indicum*) was the major component of the vegetable diet. Heavy stone implements used in its preparation are commonly found on the banks of the Tweed River (Piper, 1994a). Cudgen Nature Reserve supports a significant *Blechnum indicum* association, (Griffith, 1993).

Piper (1976) states that the Cudgen Hills are recorded as being the source of the red ochre used for decoration in ceremony, an article of trade throughout Australia. There are a number of known significant Aboriginal sites in the Cudgen - Bogangar area including Norries Headland and sites such as middens, open camp sites, bora rings/ ceremonial areas, burials and a single natural mythological site (Nicholson and Cane, 1989).

Archaeological sites are important to Aboriginal communities as they are a testament to their culture's great antiquity. Aboriginal people may also have traditional spiritual links with an area and hold knowledge which is important for natural and cultural heritage conservation. While the NPWS presently has legal responsibility for the protection of Aboriginal sites it acknowledges the right of Aboriginal people to make decisions about their own heritage. It is therefore policy that Aboriginal communities be consulted about decisions regarding the management of Aboriginal sites and related issues and how the Aboriginal culture and history of an area controlled by the NPWS will be promoted and presented.

Many of the potential archaeological sites have been severely disturbed during past mineral sand mining operations, thus reducing opportunities for archaeological survey.

One archaeological site has been recently found in the Reserve, however, no detailed archaeological or anthropological surveys have been undertaken. Further investigation of the area may provide some insight into the pattern of habitation and significant sites.

Objectives:

To provide opportunities for Aboriginal communities to participate in the protection and management of Aboriginal sites within the Reserve, consistent with the objectives and strategies in this plan.

To identify any Aboriginal sites and values within Cudgen Nature Reserve, and protect and preserve them with the involvement of local Aboriginal communities.

Strategies:

- * The Tweed-Byron Aboriginal Land Council and other relevant Aboriginal community organisations will be involved in all aspects of research and management of Aboriginal sites and values in the Reserve.
- * Aboriginal people will be permitted to carry out cultural activities in the Reserve related to maintenance of traditional links to the land providing such activities comply with the objectives and policies of this plan of management and have minimal environmental impact.
- * Once identified, Aboriginal sites will be protected from disturbance or damage by human activities.
- * All works in undisturbed areas with the potential to impact on Aboriginal sites and values will be preceded by an archaeological and/or an anthropological and historical assessment.
- * The location of any Aboriginal sites located will not be publicised except where:

the agreement of the Tweed-Byron Aboriginal Land Council and other relevant Aboriginal community organisations has been obtained;
a conservation study has been prepared and any management works necessary to protect the site from damage have been implemented, and
the site will be interpreted to promote public knowledge and appreciation of Aboriginal culture.

* Aboriginal sites and values will only be open to the public or interpreted in partnership with the Tweed-Byron Aboriginal Land Council and other relevant Aboriginal community organisations. Impacts of such use will be monitored and the use regulated if necessary to alleviate any adverse impact.

5.2 HISTORIC VALUES

The historical development of the Reserve and surrounds was primarily for grazing, timber harvesting and mining before its development for coastal villages and for more intensive agriculture.

The mining of coastal sands for heavy minerals (rutile and zircon) occurred in various areas along the northern NSW coast since the 1930's. Major mining operations commenced at Bogangar in the early 1950's, and by the mid'50's a road was constructed between Bogangar and Kingscliff, known as the Tweed Coast Road.

By the late 1950's development began with residential lots and a hotel in nearby Bogangar. Land throughout the area was generally used for various agricultural practices and Round Mountain was selectively logged. Cudgen Lake has historically provided for commercial and recreational fishers until the late 1980's. The lake was also used for boating and water skiing activities since 1965 with the commencement of the Cabarita Gardens Lake Resort.

Since the establishment of the Reserve in 1961, many activities have been licensed to operate within the Reserve by previous managers (refer to sections 6.2 and 6.4).

There are no known places of historical significance in the Reserve, although Cupitt's cattle dip site, which although not within the Reserve is surrounded by it, may have historical values (refer to section 6.4.4). The old quarry remains south-west of Camp Wollumbin is the only known site of potential historical interest in the Reserve.

Objective

To conserve historic sites and promote their on-going study and investigation.

Strategies

- * Any potential historic places identified in the Nature Reserve will be assessed for their heritage significance.
- * Any historic places assessed as being of heritage significance will be managed to retain their significance.
- * An assessment of the heritage significance of Cupitts cattle dip site will be undertaken in consultation with the Department of Land and Water Conservation, the Department of Agriculture and other authorities. A plan for its management and the protection of its heritage values whilst addressing environmental concerns will be prepared and implemented.

6 USE OF THE AREA

Certain public and private uses may be appropriate in NPWS areas provided that they do not conflict with the primary purpose of conservation of the natural and cultural heritage and are consistent with the objectives and strategy of this plan of management and NPWS policies and legislation. The major categories of use that can be appropriate in NPWS areas are:

- education and promotion of the area, the NPWS and the conservation of natural and cultural resources;
- involvement of the public in aspects of management;
- nature based recreation;
- research; and
- management operations by the NPWS and other authorities with statutory responsibilities in the area.

The extent to which these categories of use will be provided for in the Reserve is indicated below.

6.1 PROMOTION AND INTERPRETATION

The location of the Reserve in relation to the proximity to urban development creates pressure on the Reserve to provide the public with a community resource for nature based recreation, environmental study and education.

Numerous recreation opportunities are centred around Cudgen Lake, Bogangar and the coastal beaches. Tourist visitation is seasonal being most popular in the summer months, school holidays and to a lesser extent weekends.

Promoting public awareness of the NPWS's conservation responsibilities, the values of the area and recreational opportunities is a major aspect of management of visitor use. It assists the protection of the natural and cultural heritage of the Reserve and increases visitor enjoyment and satisfaction.

Four localities have been identified where interpretation facilities would be appropriate. These include:

- The Cudgen Lake southern foreshore near the boat launching area, promoting the appropriate nature based recreational use of the lake and surrounds;
- Along the proposed walking track/boardwalk from the southern foreshore of Cudgen Lake to the small beach near the Scout Camp, where interpretation could focus on the natural and cultural heritage of the area including, traditional Aboriginal use, history and geological evolution;
- The Wollumbin Scout Camp where there are a range of significant natural features including relic dunes and littoral rainforest;
- The coastal section of the Reserve, where interpretation could focus on the geological evolution of the present coastline, traditional Aboriginal use and the history of, and environmental damage from mineral sand mining. The prohibition of dogs in the Reserve, including the beach section, needs promotion.

An important aspect of the NPWS public awareness program is to keep members of the local community, neighbours, Tweed Shire Council and other government authorities informed of Reserve management programs, particularly with respect to fire management, feral animal and weed control.

Objectives:

To provide an understanding and appreciation of the natural and cultural values and appropriate recreational use in the Nature Reserve.

To promote public awareness and appreciation of the values of Cudgen Nature Reserve, with emphasis on the importance of the Reserve in the regional pattern of conservation areas on the North Coast of NSW.

To involve local residents, Tweed Shire Council, relevant committees and interest groups in the protection of the natural and cultural values of the Reserve.

Strategies:

- * Public understanding and appreciation of the natural and cultural values of the Reserve will be promoted. The following themes will be emphasised in interpretation programs:
 - The geological evolution of the present day coastline and lake;
 - The importance of the local area and regional significance to the Aboriginal community ;

Environmental damage resulting from mining operations and land use activities;
 The importance of conserving remnant vegetation associations for the preservation of natural, cultural and landscape values;

- The appropriate recreational use of the Reserve, especially the lake and ocean foreshore, and

- Appropriate research activities.
- * Promotional material and interpretive programs, such as discovery ranger activities and 'Streamwatch', will be designed to promote care for the environment and thereby assist management to protect natural and cultural heritage values.
- * The local community will be kept informed of research and developments in Reserve management, particularly regarding lake management. Community awareness will be raised by providing a series of articles about the values and management of Cudgen Lake to local media.
- * Information and interpretive material will be targeted to the range of reserve users, including disabled and ethnic groups. Wherever practicable, prohibition signs will explain the reason for the prohibition.
- * Liaise with Tweed Shire Council and the RTA regarding the design, construction, location and maintenance of road signage directing visitors to the Reserve.

6.2 RECREATION OPPORTUNITIES

Nature based recreation is clearly an area of high potential growth in the region's tourism. The Reserve currently provides a wide range of recreation opportunities that incorporates coastal environments including beaches, forests, wetlands and the lake.

In accordance with the purpose of a nature reserve (refer to section 1.0), any recreational activities undertaken in the Reserve must complement the purpose of dedication of the area as a nature reserve. Promotion and interpretation of the Reserve should demonstrate the significance of the area from a local, regional and state perspective for nature conservation.

Objectives:

To provide a variety of nature-based recreational opportunities which complement the purpose of the nature reserve.

To provide low-key visitor facilities that minimise environmental impact and promote the appreciation and enjoyment of nature.

6.21 Vehicle access

Vehicle access to the Reserve is provided from the Tweed Coast Road, Clothiers Creek Road and Tamarind Avenue (refer to map 1). The Reserve has a limited road and track network due to its relatively small size, however, a number of informal tracks exist. Four-wheel drive use will result in further degradation of the dune system, cause constant disturbance to roosting shore birds and is potentially in conflict with other users of the Reserve.

Off the Tweed Coast Road there is one 4WD access point through the coastal section of the Reserve. Tweed Shire Council has maintained this access point in the past because it provides beach access to 4WD permit holders (refer to section 6.4.1 (i)). Other informal vehicle access points are utilised including one directly opposite the Wollumbin Scout Camp.

Public access to Cudgen Lake is provided to the lake foreshore area next to Cabarita Gardens Lake Resort. Restricted access is provided through the Wollumbin Scout Camp.

(i) Four-wheel drive beach access

The Reserve includes Bogangar Beach down to mean low water mark. Four wheel drive use on the beach and foreshore is in conflict with the purpose of a nature reserve.

The Tweed Shire Council previously licensed 250 professional and amateur fishers so they could use 4WD vehicles on the beach for the purpose of fishing only. Now that a section of the beach is within the Reserve, Council has no authority to issue licences for this use within the Reserve. Any licences will need to be obtained from NPWS.

There are a number of 4WD permit access points on the Tweed Coast, oneof which is located on the coastal section of the Reserve. The location of this access point has provided general public access to the coastal dunes, causing damage to the dune system (refer to map 3).

(ii) Access on the optic fibre cable route

Two main optic fibre cables traverse the Reserve on the east side of the Tweed Coast Road (refer to map 3). The cable route has provided access for illegal 4WD use and camping.

Objective:

To preclude the off-road use of recreational vehicles in the Reserve.

Strategies:

- * 4WD vehicles, other than those authorised for management or emergency purposes or those licensed for commercial fishing, will be prohibited on the section of Bogangar Beach within the Reserve.
- * The existing 4WD access track to Bogangar Beach, on the southern coastal section of the Reserve, will be closed to all vehicles as a beach access point. Instead, the track will be upgraded and a public carpark for up to 20 vehicles will be established behind the primary dune (refer to section 6.2.3). This facility will provide pedestrian access to the beach. Remaining sections of track will be rehabilitated.
- * A new beach access route for 4WD vehicles will be provided on or near the northern boundary of the coastal section of the Reserve, allowing for the closure of the existing beach access on the southern boundary of the Reserve. This route could be on the Reserve or adjoining private land and should also serve as a fire radiation zone. Signs will be erected advising 4WD users that access on the beach, south of this access point, is prohibited.
- * The location of the new beach access and carpark is to be negotiated between the NPWS, Tweed Shire Council and the proponents for the development of the land to the north of Cudgen Nature Reserve with the aim of locating the access off the Reserve.
- * Vehicles authorised by a permit from Tweed Shire Council will continue to be permitted access to the beach within Cudgen Nature Reserve until the alternative beach access to the north of the Reserve has been completed.
- * The routes used for the optic fibre cables owned by Telstra and Optus will be closed to all vehicles and rehabilitated (refer to section 6.4.1).
- * Gates will be erected at appropriate access points in the Reserve to restrict use to authorised vehicles only.
- * Preference will be given to any future road widening, bicycle paths, etc being undertaken on the eastern side of the Tweed Coast Road in order to protect the littoral rainforest on the western side of the road. This may involve negotiations with respect to using land within the Reserve.

6.2.2 Walking tracks

Walking tracks are a means of encouraging the appreciation and awareness by visitors of the natural and cultural values of the Reserve. Existing walking tracks have generally only been utilised by visitors of Cabarita Gardens Lake Resort, Wollumbin Scout Camp and local residents in particular.

The Round Mountain section of the Reserve has a number of tracks and trails which remain from previous land uses. Some of these trails have been used for donkey rides in the past and evidence indicates that these tracks are still used by horse riders and motorbikes.

The coastal section of the Reserve is used extensively to provide access to the beach for recreation activities including surfing, fishing and vehicular access. This area is also

actively used for passive recreation activities including walking and pet exercising. Horseriders also utilise the coastal section of the Reserve for access to Bogangar Beach as well as a general exercise area.

Two areas, identified in (i) and (ii) below, are considered appropriate for the formalising of walking tracks (refer to map 4).

(i) Lake foreshore

A walking track should be designed to link the boat launching area and the southern lake foreshore around to the small beach on the eastern side of Cudgen Lake. From the eastern side of the lake a magnificent view of Mt Warning can be seen. The construction of the existing informal track would provide a significant passive recreation opportunity for visitors to the Reserve (refer to map 4).

There is also a track from Camp Wollumbin to the eastern shore of the lake providing access for camp patrons (refer to section 6.4.5). In addition, Camp Wollumbin has constructed a number of walking trails in the Reserve which emanate from the camp.

(ii) Coastal access

The public and Camp Wollumbin patrons regularly utilise the coastal section of the Reserve to gain access to Bogangar Beach. This access is currently a maze of informal tracks. A single beach access should be formalised in this section of the Reserve to minimise the effects of uncontrolled access (refer to map 4).

(iii) Inappropriate walking tracks

Informal tracks are located within the Reserve. Two of these tracks are unsuitable to formalise for a variety of reasons.

Walking track to Palm Forest

This track begins on private property off Clothiers Creek Road, and travels through the palm forest association on the eastern side of Round Mountain (refer to 2.2.4). This area contains the highest proportion of endangered, vulnerable, rare and restricted species in the Reserve (refer to map 3).

This area has been recently damaged by vandals and utilised as a dumping ground. Due to its conservation significance, public access to this area poses a threat to the natural values of the Reserve.

Walking Track to Round Mountain

No walking track currently exists on Round Mountain, however, there have been proposals in the past to construct a formal walking track to the Trig Station on Round Mountain (refer to map 3). The trees on the top of Round Mountain and the steep nature of the landscape does not make this a feasible option.

Objectives:

To provide minimum impact public access to designated areas for appropriate nature based recreation so that the natural and cultural values of the Reserve are not threatened.

Strategies:

- * In consultation with the Department of Land and Water Conservation and the permissive occupancy licensee, a concept plan will be prepared for the southern lake foreshore to provide for general public use and an upgrade of the area.
- * Subject to the successful negotiations outlined above, a walking track from the southern lake foreshore area to the small beach on the eastern side of the lake will be constructed.
- * A walking track from the Tweed Coast Road opposite the Wollumbin Scout Camp through the coastal section of the Reserve to Bogangar Beach will be constructed.
- * Following construction of the walking tracks mentioned above, the route linking the eastern side of Cudgen Lake to the beach access track (leading from the Coast Road) will be investigated. Subject to an environmental and archaeological assessment, the track may be constructed. This track will need to avoid any littoral rainforest and will need to bypass the Wollumbin Scout Camp to ensure privacy and security for the camp.
- If the link track bypassing the Scout Camp is constructed, the track network will extend from the beach to the permissive occupancy area on the southern shore of Cudgen Lake. This track could form the part of the proposed Floral Trail where it may need to traverse the Reserve. No other route will be provided for the Floral Trail.
- * A track from the Wollumbin Scout Camp to the eastern shore of Cudgen Lake will be maintained in conjunction with the Scout Association. Signs will be erected on this track advising the public that the track to the scout camp is for camp patrons only. All informal trails near the scout camp will be assessed to determine whether they are required, safe to use, appropriately located or have the potential to threaten natural of cultural values in the Reserve.
- * A locked gate will be erected to the entrance to the Reserve on the eastern side of Round Mountain to prevent illegal rubbish dumping and minimise public use.
- * Walking track access will not be provided to the trig point on Round Mountain or to the palm forest on the eastern side of the mountain. Existing tracks or trails to the palm forest will be closed and rehabilitated.
- * Appropriate signage of the walking track system will be erected.
- * The riding of bicycles is prohibited on all walking tracks in the Reserve.

6.2.3 Visitor facilities

The NPWS recognises the provision of appropriate visitor facilities increases the enjoyment of visitors and can reduce visitor impact on the natural and cultural values of the Reserve. Bogangar Beach and Cudgen Lake foreshore have the potential to provide day use facilities for visitors without threatening the natural values of the Reserve.

Bogangar Beach currently experiences high levels of recreational use, however, some of these uses are in conflict and present a potential threat to the values of the Reserve. Indiscriminate use has resulted in serious damage to the dunes and dune vegetation behind the beach.

Some of the recreational facilities provided by Cabarita Gardens Lake Resort have been developed on public land held under permissive occupancy for recreational purposes. These include a mini golf course, hiring facility for water sport equipment and BBQ picnic shelters.

Currently the amount of land suitable for passive recreational use in or adjoining the Reserve is very limited. It may be in the public interest, and in the interests of better management of the Reserve, if portion of the permissive occupancy on the southern shore of Cudgen Lake were made available for greater public use.

The NPWS will liaise with the Department of Land and Water Conservation and the licensee of the Cudgen Lake foreshore permissive occupancy to develop and implement a concept plan for the development of this lake foreshore area for public use.

Objective:

To provide low-key day-use visitor facilities that minimises environmental impact and promotes the appreciation and enjoyment of nature.

Strategies:

- * In consultation Tweed Shire Council a car park for approximately 20 cars will be constructed immediately south of the walking track used by Camp Wollumbin patrons to reach Bogangar Beach on the site of the former gravel dump adjoining the Tweed Coast Road. The car park will be linked to the upgraded walking track to the beach (refer to section 6.2.2(ii)).
- * A public car park for up to 20 vehicles will be established behind the primary dune of the southern coastal section of the reserve (refer to section 6.2.1). Toilet facilities will not be provided unless the level of use is shown to have an unacceptable impact.
- * The southern foreshore of Cudgen Lake will be upgraded to include parking and picnic facilities, including gas barbecues (refer to section 4.2.2).
- * Negotiations will be entered into with the Department of Land and Water Conservation and the licensee of the southern lake foreshore permissive occupancy to make portion of the permissive occupancy area available for greater public use. This may involve reduction of the area covered by the permissive occupancy.
- * Boundary fencing of the day use area will be undertaken where it is necessary to restrict access to adjoining properties or necessary to protect the values of the Reserve (refer to section 6.4.2).

6.2.4 Camping

There are no formal camping areas in the Reserve but camping facilities are available nearby. A private caravan - camping park has encroached onto the southern end of the coastal section of the Reserve (refer to section 6.4.6) and Wollumbin Scout Camp provides camping opportunities for groups and families during holidays.

The coastal section of the Reserve has been extensively used for illegal camping activities. Sign need to be installed to identify the prohibited uses of the area and where necessary vehicle access will be prevented.

Objective:

To control and manage activities and environmental impacts so that they do not conflict with the purpose of dedication of the Reserve.

Strategy:

- * Camping will be prohibited in Cudgen Nature Reserve.
- * Appropriate signs will be erected advising of the "no camping" policy.
- * After appropriate survey, a fence will be erected on the southern boundary of the Reserve adjacent to the caravan park.

6.2.5 Water-based recreation activities

Water-based recreation opportunities have been held on Cudgen Lake since the 1960's and include water skiing, paraflying, wind surfing, sailing, canoeing and fishing.

Problems associated with motorised vessels in the Reserve include safety implications associated with use in shallow waters; disturbance of sediments; pollution from motor fuels, and noise disturbance generally and particularly to the nesting habitat of migratory birds.

Prior to the water quality in the lake deteriorating due to input from acid sulphate soils, recreational and commercial fishing were major activities. Fish numbers are seriously depleted and occasionally fish kills, presumably from rises in acidity levels, are reported. Recreational and commercial fishing which is conducted in a legal manner in Cudgen Lake and on Bogangar Beach will be unaffected by this plan.

Despite past recreational use of the Reserve, any future use needs to be compatible with the natural and cultural values of the Reserve and the purpose of dedication of nature reserves under section 49(3) of the *National Parks and Wildlife Act* 1974. Recreation opportunities provided in the Reserve will be passive and nature-based.

Objective:

To provide for water-based recreational activities which are in keeping with the purposes of dedication of a nature reserve and philosophy of nature-based recreation.

Strategies:

- * Only non-motorised craft (eg. yachts and canoes) will be permitted on Cudgen Lake, except for motorised vessels used for management, law enforcement, licensed commercial fishing or emergency purposes. The NPWS will seek the cooperation of the Waterways Authority of NSW to manage the use of vessels on the Lake.
- * Signs will be erected at the lake foreshore detailing prohibited uses of the lake.
- * Vehicle and trailer (for non-power boats) parking will be provided on the southern foreshore of Cudgen Lake (refer to section 6.2.3).

6.2.6 Organised events

Existing organised events in the Reserve include the use of Bogangar Beach for Surf Life Saving Club carnivals, fishing competitions and other organised activities such as weddings. Generally these activities cause no detriment to the Reserve providing they are conducted in a manner sensitive to the environment and in accordance with the provisions of this plan.

Organised events need to be licensed under the Act or receive consent from the District Manager.

Objective:

To ensure organised events conducted in the Reserve are managed in a manner consistent with the purposes of dedication of a nature reserve.

Strategy:

* Licences will only be approved, subject to appropriate conditions, for organised events which are compatible with the purpose of dedication of the Reserve.

6.2.7 Commercial activities

An Aquatic Licence for non-motorised pleasure craft currently exists for Cudgen Lake, however, the *National Parks and Wildlife Act* does not allow commercial activities, other than commercial fishing, to occur in a nature reserve. There is no provision under the Act for the granting of commercial licences within a nature reserve (refer to section 152 of the Act).

Commercial fishing activities are regulated by the *Fisheries Management Act.* Under this Act there are currently 30 ocean beach-haul, 6 bait and 4 eel fishers licensed to operate in the Reserve.

The banana permissive occupancies are not deemed to be commercial activities but will be subject to the issue of a licence (refer to section 6.4.3),

Objectives:

To permit nature based commercial operations and commercial fishing licensed under the *Fisheries Management Act* in the Reserve provided such operations are consistent with the objectives of this plan and promote the appreciation and enjoyment of wildlife, natural environments and natural phenomena.

To allow the continuance of commercial fishing subject to conditions necessary to protect the natural and cultural values of the Reserve.

Strategy:

- * Commercial operations may be permitted in the Reserve, however, such licences will only be issued where the proposed activity is consistent with the objectives of this plan and promote the appreciation and enjoyment of wildlife, natural environments and natural phenomena.
- * Except for changes to access arrangements, commercial fishing licenses in the Reserve will be unaffected by the dedication of the planning area as a nature reserve.

6.2.8 Other recreational activities

Recreational activities such as horse and donkey riding, trail-bike riding and pet exercising are known to have occurred prior to dedication of the area as a nature reserve. Under the *National Parks and Wildlife Act* and Regulations, bringing domestic

animals into a nature reserve is prohibited, while vehicles, including trail bikes, must be registered and can only be driven on roads available for public vehicular use.

6.3 RESEARCH

The purpose of scientific study in the Reserve is to improve understanding of its natural and cultural values and the processes which affect them. Research also establishes the requirements for management of particular species.

The NPWS has only limited staff and financial resources for research and efforts must be directed towards the areas of greatest need. Research by other organisations and students may also provide valuable information for management. A prospectus will be prepared to encourage involvement of other organisations in priority research areas. Some important research topics have been mentioned in earlier sections of this plan.

A number of studies have been carried out in the last decade to determine the conservation values of the area, particularly in relation to flora and fauna. Areas on private land within close proximity to the Reserve have also been studied and documented for the purpose of obtaining development consent. Studies have also been undertaken by Universities into issues relating to land management and contemporary historical use of the area.

Research projects to be undertaken in the Reserve are required to be licensed by NPWS, however, studies relating to soil and water only require the consent of the District Manager.

6.3.1 Cudgen Lake

Cudgen Lake has been subject to significant changes in its ecological and hydrological state over the past 50 years, since more intensive land use activities have developed within the catchment. In response to this and the broader issues of stream and catchment management the following committees have been established to address issues associated with Cudgen Lake including:

- Tweed Coast Estuaries Management Committee for Cudgen, Cudgera and Mooball Creeks;
- Tweed Catchment Management Committee, and
- Cudgen Lake Restoration Steering Committee.

A research priority is to investigate the nature and quantity of point and non-point source discharges of pollutants, nutrients and sediments into the lake that affect its water quality and ecology. The primary points of concern are:

- The drain in the south-eastern corner of the lake, where water is discharged from the canal system in Bogangar, and
- The drainage canals leading into the south-west corner of the lake.

6.3.2 Flora and fauna

A number of studies have been undertaken in the Reserve to identify the flora and fauna values. Detailed up to date information is required to be able to implement effective rehabilitation plans that are complementary to the needs and requirements of flora and fauna species in the area.

Baseline data needs to be established for the Reserve using appropriate methodologies that may be replicated for future surveys, using permanent transects within sites containing different vegetation associations. The purpose of such work is to establish quantitative data on the levels of abundance of species within these sites.

The increasing number of development proposals in areas adjacent to the Reserve cause concern for the sustainability of habitat for species populations. Specific work on koalas has been undertaken on lands adjacent to the Reserve (Phillips, 1994).

6.3.3 Recreation

Nature based recreation and ecotourism are areas of high potential growth in the region's tourism. The Reserve provides a range of environments and nature based recreation opportunities, however, such use can adversely impact on the environment if not properly managed. Monitoring of recreational use is necessary to provide feedback to management about visitor needs and impact.

Objectives:

To provide for appropriate scientific study which enhances the information base or assists in the management of the Reserve.

To assist in the development of management requirements for the Cudgen catchment so as to improve water quality in Cudgen Lake.

Strategies:

- * Undertake a study of the hydrology and associated natural processes, water quality and flooding scenarios of Cudgen Lake (refer to section 4.1.3).
- * Appropriate research will be encouraged in the Reserve.
- * NPWS conducted research will aim to provide information on the natural and cultural heritage and on human use in order to facilitate management of the park.
- * Researchers from external organisations will be encouraged to design programs to provide information which is directly useful for management purposes.
- * Liaison will be maintained with researchers to obtain as much mutual information and assistance as possible. The results of research will need to be provided to the managers of the Reserve.
- A prospectus will be prepared as a guide to preferred research projects in the Reserve. Preferred topics will be those of direct relevance to management and will include:

 the effects of changing agricultural practices in the Cudgen catchment;
 the effects of acid sulphate soils on Cudgen Lake;
 the point and non-point source inputs of nutrients and sediments into Cudgen

-the point and non-point source inputs of nutrients and sediments into Cudgen Lake.

6.4 MANAGEMENT OPERATIONS

Management of Cudgen Nature Reserve is undertaken by Lismore District of the NSW National Parks and Wildlife Service. General maintenance and future works will be undertaken by the Murwillumbah Sub-District works staff and other staff as required.

6.4.1 Non-NPWS infrastructure

Non-NPWS infrastructure, such as pipelines, cables and tracks, occur in the Reserve and predate its dedication as a nature reserve. Infrastructure which has significant economic and social value and doesn't threaten the values of the Reserve will be retained and an authority for its continuance will be issued.

(i) Optic fibre cable route

Both Telstra and Optus will require a licence for the optic fibre cables in the coastal section of the Reserve (refer to map 3 and section 6.2.1(ii)).

(ii) Management track system

The Lismore District will prepare a fire management plan for the Reserve which requires the provision of fire trails for emergency access as well as maintenance purposes. The existing management track system occurs largely on private land. Arrangements need to be finalised with respect to the use, standard and maintenance of these tracks with the relevant landholders involved.

(iii) Water height gauge

The Department of Land and Water Conservation maintains a water height gauge and access ramp on Cudgen Lake near the boat launching ramp. This gauge provides data for land use planning decisions in the Cudgen catchment.

(iv) Stormwater drain

An extensive drainage system in the Reserve takes stormwater from the residential areas of northern Bogangar and discharges it into the south-east corner of Cudgen Lake (refer to map 3). On the north side of the houses along Tamarind Avenue is a piped stormwater drain which connects to an open drainage system. The open drains pass through plant communities that may be adversely affected by any change to the hydrology. The drains require routine maintenance which has the potential to disturb natural areas of the Reserve. Piping the open drains would reduce maintenance and may reduce adverse hydrological effects on the Reserve.

The existing open drainage system should be assessed and drains having little benefit to the community, or which adversely impact upon the Reserve, will be investigated for closure and rehabilitation.

The drains, all constructed and maintained by Tweed Shire Council, need to be licensed.

Objective:

To control and manage activities and environmental impacts so that they do not conflict with the purpose of dedication of the Reserve. Strategies:

* A review of the existing system of drains which pass through and into the Reserve will be undertaken. The maintenance of those drains considered essential will be

subject to an assessment of their environmental impact and will be licensed under the *National Parks and Wildlife Act*. Those considered not to be essential will be closed and rehabilitated.

- * The number of inappropriate non-NPWS utilities in the Reserve will be kept to a minimum. Such occupancies will be kept under review and where feasible relocated or closed and, where necessary, the site rehabilitated.
- * New works, facilities or operations proposed by any organisation or individual will not be permitted unless they are consistent with the purposes of the dedication of the Reserve, this plan of management and NPWS policy.
- * Close liaison will be maintained with the Reserve neighbours to deal with matters of mutual concern.
- * A licence will be issued for the optic fibre cable which runs through the Reserve on the east side of the Tweed Coast Road.
- * An authority will be issued for the Department of Land and Water Conservation's water height gauge and access ramp on Cudgen Lake. The structure must be maintained in a safe manner by that Department.
- * Research into the environmental impact of the stormwater drains in the south-east section of the Reserve, and alternatives to the existing open drainage system, will be undertaken in consultation with relevant stakeholders.
- * Stormwater drains in the Reserve will need to be licensed.

6.4.2 Boundary fencing

The Reserve contains sections of old fencing previously used for grazing which are now redundant and should be removed. Sections of the Reserve boundary are not fenced, or inadequately fenced, and fencing these boundaries would assist management and protect the values of the Reserve. Wherever possible fencing will follow the Reserve boundary to minimise encroachments and to delineate the Reserve boundary. Subject to the town planning requirements (refer to section 6.4.8), firebreaks and fire radiation zones can be constructed on either side of the fence depending upon negotiations with neighbouring landholders.

Objective:

To control and manage activities and environmental impacts so that they do not conflict with the purpose of dedication of the Reserve.

Strategy:

* Generally fencing will be constructed on the Reserve boundary. The highest priority for fencing will be where stock incursions are likely and where neighbouring urban properties front the Reserve and encroachments are possible or it is necessary to clearly define the Reserve boundary. A fencing style will be chosen which is appropriate to the site and does not present a hazard to the public or detract from the aesthetics of the area.

6.4.3 Banana plantations

Two current permissive occupancy banana licences, occupying an area of approximately 16 hectares, are held by G H Nowland and P Hardy for banana production in the Reserve. A third licence, occupying an area of approximately 12.6 hectares, has been relinquished. The location of these permissive occupancies are shown on map 3.

It is the intention of NPWS to rehabilitate all banana permissive occupancy areas. Only indigenous species will be used in the rehabilitation works. The relinquished licence will be the first area targeted for rehabilitation. The other licensed areas will be allowed to continue, subject to the granting of a licence, until such time as rehabilitation of the site can be undertaken. This will reduce the potential invasion of weeds into an otherwise vacant area.

Now that the permissive occupancy banana licences occur in a nature reserve it will be necessary to license them under the *National Parks and Wildlife Act*. Liaison with current licensees needs to consider license renewal, conditions and time frame for full or partial cessation of licences.

A rehabilitation plan must be developed for each of the banana plantation areas, outlining rehabilitation priorities, methods and time frame for works, species to be used, and weed and erosion control.

Objective:

To rehabilitate plant communities disturbed by past agricultural practices.

To control and manage activities and environmental impacts so that they do not conflict with the purpose of dedication of the Reserve.

Strategies:

- * Liaison with current permissive occupancy licensees for banana growing will be undertaken to determine the transfer of licences to the NPWS, likely time frame for the full or partial cessation of licences, and conditions which will apply to the licences.
- * A rehabilitation plan will be developed for each of the banana plantation areas. Only species indigenous to the Reserve will be used in rehabilitation (refer to section 4.2.2).
- * The first priority for rehabilitation of banana plantation areas will be the relinquished licence area.
- * Banana licensees will be given not less than 2 years notice of licence termination, providing licensees with adequate time for commercial completion of the plantation and compliance with licence conditions.

6.4.4 Cupitts cattle dip site

Cupitts cattle tick dip site is excluded from, but surrounded by, the Reserve. The dip was last used in 1964 and is now largely overgrown with weeds. The dip solution initially used for treatment of cattle ticks contained arsenate salts, which was replaced by DDT in 1955 due to increasing tick resistance. This was later replaced by less persistent organic tickicides in 1962 (CZP, 1995).

It has been estimated that 90% of soils surrounding dip sites contain unacceptably high levels of arsenic and DDT (CZP, 1995). The dip site is registered with the NSW Department of Agriculture and Tweed Shire Council. Liaison with the Department of Agriculture needs to establish the management issues associated with this contaminated site so that it doesn't impact upon the Reserve.

Objective:

To control and manage activities and environmental impacts so that they do not conflict with the purpose of dedication of the Reserve.

Strategy:

- * Liaise with the Department of Agriculture to establish the management issues associated with the Cupitts cattle tick dip site so that this contaminated site does not impact upon the Reserve.
- * Cupitt's cattle dip site may be incorporated into the Reserve, along with the adjoining unmade road reserve, following decontamination of the site, preferably by the current land managers. Under this arrangement the NPWS will rehabilitate the site to native vegetation while ensuring any historic values are protected (refer to section 5.2).

6.4.5 Wollumbin Scout Camp

The Scout Camp attracts approximately 18,000 visitors each year, namely scout and guide groups, youth and church groups, schools and sporting clubs (CZP, 1995).

The Wollumbin Scout Camp is an inholding surrounded by the Reserve. Part of the camp with the main hall and amenities building, occupying an area of approximately 1.9 hectares, is Crown land managed under license by the Scout Association. The balance of the camp is on land surrounding the licensed area and is leased from the Cudgen Lake Round Mountain Reserve Trust.

The camp extensively utilises the Reserve as part of the program provided to camp patrons. There is a major walking track from the camp to a small beach on theeastern shore of Cudgen Lake and a number of informal trails into the surrounding forest. Between the camp and the lake is an outdoor chapel in the Reserve. The chapel is a clearing in the forest with rows of log seats. There is also a memorial plaque at the chapel site.

The camp patrons occasionally collect firewood from the Reserve. This practice has the potential to adversely affect the natural values of the Reserve.

The NPWS has undertaken consultation and negotiation with the Scout Association with regards to including Camp Wollumbin, in whole of part, in the Reserve or alternatively for the NPWS to enter into some other arrangement with the Association. An option is to for the Camp Wollumbin area, in whole of part, to become NPWS land but not incorporated into the Reserve. It would be leased back to the Scout Association with conditions which emphasise the protection of the natural values of the area. The feasibility of all options have yet to be assessed.

Objective:

The Service will seek the addition of the Wollumbin Scout Camp to the Nature Reserve.

Strategies:

- * Following its addition to the Nature Reserve, the Wollumbin Scout Camp will be leased back to the NSW Scout Association for continued use as a scout camp and education centre but with increased emphasis on promoting the nature conservation and heritage values of Cudgen Nature Reserve as part of cooperative programs with the Service.
- * Despite the above strategy, the NPWS will seek to renegotiate the current lease between the Scout Association, Cudgen Lake Round Mountain Reserve Trust and the Department of Land and Water Conservation so that the conditions of the lease and use of the Reserve recognise the values of the Reserve and the future working relationship between the Association and NPWS.
- * The Scout Association will be issued with an authority to retain, maintain and use the outdoor chapel. No further expansion or development of the chapel area will be permitted. The existing memorial plaque can be retained in the chapel area as part of the authority for the chapel but no further plaques will be permitted in the Reserve. Should the authority for the chapel cease or be terminated the memorial plaque should be relocated to the camp environs outside the present Reserve.
- * The collection of firewood from the Reserve will be prohibited.

6.4.6 Reserve encroachments

Encroachments of adjoining land uses or activities occur in the Reserve. Encroachments include fences, caravans (from the adjoining caravan park in Cyprus Crescent), garden sheds and a small section of a swimming pool. Some encroachments have caused environmental degradation.

Objective:

To remove encroachments from the Reserve.

Strategies:

- * Encroachments in the Reserve, except for the part of a swimming pool, will be required to move from the Reserve and where necessary, boundaries will be fenced and the encroachment area rehabilitated.
- * The part of the existing swimming pool encroachment, belonging to a residence in Cyprus Crescent, may remain in the Reserve providing it is licensed. The boundary fence, however, will need to be relocated.

6.4.7 Saunder's quarry

A gravel quarry off Clothier's Creek Road is an enclave in the Reserve. Known as Saunder's quarry, it was used for road making material by Tweed Shire Council but has not been used for several years and is naturally regenerating. Dumping of garden refuse, weed infestation along the access track and the steep, unstable quarry face are restricting successful rehabilitation.

Since the quarry's potential as a source of gravel is extremely limited the quarry should be incorporated into the Reserve and the site rehabilitated. However the quarry area incorporates an Apiary Licence which if incorporated in the Reserve would need to be licensed under the *National Parks and Wildlife (Land Management) Regulation 1995* Public access to the quarry would be discouraged due to the potentially hazardous quarry faces and to prevent the dumping of waste.

Objective:

To manage Saunder's quarry so it does not conflict with the purpose of dedication of the Reserve.

Strategy:

- * Saunder's quarry will be incorporated into the Reserve. In cooperation with the Tweed Shire Council and the Department of Mineral Resources, the quarry will be closed and the site rehabilitated to indigenous plant species.
- * The existing apiary licence at Saunder's quarry will not be renewed after the current term of the licence expires.

6.4.8 Acquisition of road reserves

Within or adjoining the Reserve there are two Crown public road reserves which are considered not to be required by other parties for access purposes. One road reserve is along the eastern bank of Cudgen Creek north of the Reserve while the other occurs to the north-east of Hardy's banana plantation (refer to map 4). Both road reserves are currently managed by the Cudgen Lake Round Mountain Reserve Trust. The incorporation of these two road reserves into the Reserve would provide additional protection to the Reserve and to the riparian vegetation along Cudgen Creek.

Objective:

To control and manage activities and environmental impacts so that they do not conflict with the purpose of dedication of the Reserve.

Strategy:

* Negotiations will be entered into with the relevant authorities to incorporate the two unconstructed Crown public road reserves shown on map 4 into the Reserve.

6.4.9 Local Environment Plan zoning

The Tweed Shire Local Environment Plan needs to be amended to recognise the dedication of the Reserve. Current zoning shown in the plan is restrictive to a number of management operations, such as the construction of a fire radiation zone (refer to map 4).

Objective:

To seek amendments to local government planning policies which may not be compatible with the purpose of dedication of the Reserve.

Strategy:

* Tweed Shire Council will be requested to amend the Local Environment Plan to show the Reserve as Zone 8(a) - "National Parks and Nature Reserves".

PART E. PLAN IMPLEMENTATION

This plan of management is part of a system of management developed by the National Parks and Wildlife Service. The system includes the *National Parks and Wildlife Act*, management policies, established conservation and recreation philosophies, and strategic planning at corporate, Regional and District levels.

The implementation of this plan will be undertaken within the annual programs of the NPWS's Lismore District. Priorities, determined in the context of district and regional strategic planning, will be subject to the availability of necessary staff and funds and to any special requirements of the Director-General or Minister.

District programs are subject to ongoing review, within which, works and other activities carried out in Cudgen Nature Reserve are evaluated in relation to the objectives laid out in this plan.

The environmental impact of all development proposals will continue to be assessed at all stages of the development and any necessary investigations undertaken in accordance with established environmental assessment procedures.

Section 81 of the Act requires that this plan shall be carried out and given affect to, and that no operations shall be undertaken in relation to the Reserve unless they are in accordance with the plan.

No term is proposed for this plan of management. If after adequate investigation, operations not included in the plan are found to be justified, this plan may be amended in accordance with section 76(6) of the Act.

Other lands may be added to the Reserve during the term of this plan. Such lands will be managed in accordance with the objectives and policies of this plan.

As a guide to the implementation of this plan, relative priorities (high, medium and low) for identified activities are given below (refer to the body of this plan for full details relating to activities):

<u>Ref.</u>	<u>Priority</u>	<u>Activity</u> (Summarised)
4.1	High	Control soil erosion using appropriate control measures.
4.1	High	All works will be designed to minimise soil erosion.
4.1	High	Liaise with local government and other authorities to maintain and improve the water quality in the Reserve and its catchment.
4.1	High	Establish a coordinated cooperative approach to undertake studies and the management of Cudgen Lake, Cudgen Creek and its catchment.
4.1	Med	Encourage education of water quality and related issues with the Department of Land and Water Conservation's 'Streamwatch' Program.
4.1	Med	Encourage and assist in the organisation of a Clean Up Australia 2001 project to be undertaken in the Cudgen Catchment.
4.1	High	Encourage and where possible assist Tweed Shire Council in preparing development controls on adjacent lands in the catchment.
4.1	High	Assess conservation status of adjoining lands and investigate appropriate protection measures.

- 4.1 High Assist in the formation of local Landcare and Dune Care groups.
- 4.1 High Prepare a jointly funding proposal for the rehabilitation of banana plantation.
- 4.1 High Undertake a study of the hydrology and associated natural processes, water quality and flooding scenarios of Cudgen Lake
- 4.1 High Subject to funding, key recommendations arising from the study into the hydrology of Cudgen Lake will be implemented.
- 4.1 High Any dredging of Cudgen Lake will not take place until a full scientific assessment of the lake's hydrology has been undertaken.
- 4.2 High Protect threatened and significant species, populations and communities.
- 4.2 High Introduced plant species will be controlled, and where practicable or where required by law, eradicated.
- 4.2 High Implement the restoration and rehabilitation (including weed control) plan which seeks to prevent impact on non-target species.
- 4.2 High Liaise with Tweed Shire Council in the preparation of the Shire-wide Vegetation Management Plan particularly with respect to wildlife corridors and management of areas adjacent to the Reserve.
- 4.2 Med The cooperation of local authorities and Reserve neighbours will be sought in implementing weed control programs, rehabilitation works, and to encourage retention of native vegetation.
- 4.2 Low Removal of exotic plants at any historic sites will be based on an assessment of their historic and landscape significance and their potential to spread.
- 4.2 High A rehabilitation plan will be developed for the banana plantation permissive occupancy areas.
- 4.2 High Liaise with current banana plantation permissive occupancy occupants to finalise new license arrangements and conditions of operation.
- 4.2 High A rehabilitation plan will be developed for the coastal section of the Reserve adjacent to Bogangar Beach.
- 4.2 High A concept plan will be prepared for the permissive occupancy area adjacent to the southern foreshore of Cudgen Lake to provide access for public recreation and day visitor facilities.
- 4.2 High Rehabilitate, and where necessary fence, the area adjacent to the southern lake foreshore permissive occupancy.
- 4.2 High If considered justified in the hydrolological study for Cudgen Lake some form of reed control in the lake may be undertaken, consistent with the natural values of the lake system. The control of reeds will be subject to an environmental assessment.
- 4.2 Low Following appropriate environmental assessment, some form of reed control in the lake may be undertaken.

- 4.2 High Examine the viability of natural regeneration as an alternative to reafforestation of former banana plantations within the Reserve.
- 4.2 Med Information brochures designed to address the problems of dumping garden refuse will be prepared.
- 4.2 Med Organise a weeds workshop for local residents and other interested people.
- 4.2 Med Assess the interest of local community members and neighbouring residents to form a 'Friends of Cudgen Nature Reserve' or similar group.
- 4.3 High Priority will be given to management strategies or programs for endangered or vulnerable species.
- 4.3 High Introduced animals will be controlled, or where possible eradicated, where they have a significant impact on native species.
- 4.3 Med Wild dog control may be undertaken on the Reserve boundaries to reduce the impact to livestock on adjoining land.
- 4.3 High Boundary fencing will be undertaken and maintained in cooperation with adjoining livestock properties.
- 4.3 High Domestic animals and livestock will be prohibited in Reserve with the exception of guide dogs being used for the blind.
- 4.3 Med An introduced animal species control plan will be prepared.
- 4.3 High Records of native and introduced fauna will continue to be updated.
- 4.3 High Signs will be placed on the Tweed Coast Road and Clothier's Creek Road advising motorists to drive carefully to avoid injury to wildlife.
- 4.4 High A fire management plan will be prepared for the Reserve.
- 4.4 High Upgrade existing tracks and construct new fire trails where necessary.
- 4.4 High All fire management activities will be subject to an environmental impact assessment, except for emergency fire suppression activities.
- 4.4 High The use of heavy machinery for fire suppression will, where possible, avoid rare plants, Aboriginal sites and historic places, swamps, sand dunes and heathland.
- 4.4 Med Areas disturbed by fire suppression operations will be rehabilitated as soon as practicable after fire.
- 4.4 High Records and maps will be maintained of all fires.
- 4.4 High Research will be encouraged into the ecological effects of fire in the Reserve.
- 4.4 High Close contact and cooperation will be maintained with volunteer bush fire brigades, Council fire officers and State Forests of NSW. The NPWS will continue to actively participate in the Tweed Bush Fire Management Committee.

4.4 High Land use planning and development authorities and private developers will be encouraged to incorporate boundary fire breaks and other fuel reduction measures in any development adjacent, or in proximity, to the Reserve. 4.4 High The Reserve may be closed to public use during periods of extreme fire danger. 4.4 High Fuel reduction programs will be prepared in accordance with the Fire Management Plan. 4.4 High Fire should be excluded from areas within the Reserve to protect the unique vegetation associations. 4.4 Hiah Establish a slashed fire radiation zone adjacent to the properties of Tamarind Avenue while maintaining significant koala habitat trees. Maintain a fire radiation zone to the north of the Cabarita Caravan Park and 4.4 High Cyprus Crescent properties. 4.4 High Where appropriate, the boundary of the Reserve will be surveyed before establishing buffer or radiation zones. High 5.1 Relevant Aboriginal community organisations will be involved in all aspects of research and management of Aboriginal sites and values. 5.1 Med Aboriginal people will be permitted to carry out cultural activities in the Reserve related to maintenance of traditional links to the land. 5.1 High Any identified Aboriginal sites will be protected from disturbance or damage. 5.1 High All works in undisturbed areas with the potential to impact on Aboriginal sites will be preceded by an archaeological and/or anthropological and historical assessment. 5.1 High The publicising of the location of any Aboriginal site, site access and interpretation, will only be undertaken in partnership with the Tweed-Byron Aboriginal Land Council and other relevant Aboriginal community organisations. 5.1 Selected Aboriginal sites may be opened to the public. Low 5.2 Med Any potential historic places identified in the Nature Reserve will be assessed for their heritage significance. 5.2 Hiah Any historic places assessed as being of heritage significance will be managed to retain their significance. 5.3 Med An assessment of the heritage significance of Cupitts cattle dip site will be undertaken. A plan for its management and the protection of its heritage values whilst addressing environmental concerns will be prepared and implemented. 6.1 Public understanding and appreciation of the natural and cultural values of High the Reserve will be promoted.

As far as possible fuel management will be carried out in cooperation with

4.4

High

neighbours.

- 6.1 Med Promotional material and interpretive programs will be designed to promote care for the environment.
- 6.1 Med The local community will be kept informed of research and developments in Reserve management, particularly regarding lake management.
- 6.1 Med Information and interpretive material will be targeted to the range of park users.
- 6.1 Med Liaise with Tweed Shire Council and the RTA regarding the design, construction, location and maintenance of road signage directing visitors to the Reserve.
- 6.2.1 High 4WD vehicles, other than those authorised for management or emergency purposes or those licensed for commercial fishing, will be prohibited on the section of Bogangar Beach within the Reserve.
- 6.2.1 High The existing 4WD access track to Bogangar Beach, on the southern coastal section of the Reserve, will be closed to all vehicles as a beach access point. Instead, the track will be upgraded and a public carpark for up to 20 vehicles will be established behind the primary dune. This facility will provide pedestrian access to the beach.
- 6.2.1 High A new beach access route for 4WD vehicles will be provided on or near the northern boundary of the coastal section of the Reserve, allowing for the closure of the existing beach access on the southern boundary of the Reserve. Signs will be erected advising 4WD users that access on the beach, south of this access point, is prohibited.
- 6.2.1 High The location of the new beach access and carpark is to be negotiated with the aim of locating the access off the Reserve.
- 6.2.1 High Vehicles authorised by a permit from Tweed Shire Council will continue to be permitted access to the beach within the Reserve until the alternative beach access to the north has been completed.
- 6.2.1 High The routes used for the optic fibre cables owned by Telstra and Optus will be closed to all vehicles and rehabilitated.
- 6.2.1 High Gates will be erected at appropriate access points in the Reserve to restrict use to authorised vehicles only.
- 6.2.1 High Preference will be given to any future road widening, bicycle paths, etc being undertaken on the eastern side of the Tweed Coast Road in order to protect the littoral rainforest on the western side of the road.
- 6.2.2 High In consultation, a concept plan will be prepared for the southern lake foreshore to provide for general public use and an upgrade of the area.
- 6.2.2 High Subject to the above, a walking track from the southern lake foreshore area to the small beach on the eastern side of the lake will be constructed.
- 6.2.2 High A walking track from the Tweed Coast Road opposite the Wollumbin Scout Camp through the coastal section of the Reserve to Bogangar Beach will be constructed.
- 6.2.2 High Following construction of the walking tracks mentioned above, the route linking the eastern side of Cudgen Lake to the beach access track (leading

from the Coast Road) will be investigated. This track will need to avoid any littoral rainforest and will need to bypass the Wollumbin Scout Camp to ensure privacy and security for the camp.

- 6.2.2 Med If the link track bypassing the Scout Camp is constructed, the track network will extend from the beach to the permissive occupancy area on the southern shore of Cudgen Lake.
- 6.2.2 High A track from the Wollumbin Scout Camp to the eastern shore of Cudgen Lake will be maintained in conjunction with the Scout Association. Signs will be erected advising the public that the track is for camp patrons only. All informal trails near the scout camp will be assessed.
- 6.2.2 High A locked gate will be erected on the entrance to the Reserve on the eastern side of Round Mountain.
- 6.2.2 High Walking track access will not be provided to the trig point on top of Round Mountain or to the palm forest on the eastern side of the mountain. Existing tracks or trails to the palm forest will be closed and rehabilitated.
- 6.2.2 High Appropriate signage of the walking track system will be erected.
- 6.2.2 High The riding of bicycles is prohibited in the Reserve.
- 6.2.2 Med In consultation Tweed Shire Council a car park for approximately 20 cars will be constructed immediately south of the walking track used by Camp Wollumbin patrons to reach Bogangar Beach.
- 6.2.2 Med A public car park for up to 20 vehicles will be established behind the primary dune of the southern coastal section of the Reserve. Toilet facilities will not be provided unless essential.
- 6.2.3 High The southern foreshore of Cudgen Lake will be upgraded to include parking and picnic facilities, including gas barbecues.
- 6.2.3 High Enter into negotiations to make some of the permissive occupancy area on the southern lake foreshore available for greater public use.
- 6.2.3 High Boundary fencing of the day use area will be undertaken where necessary.
- 6.2.4 High Camping will be prohibited in the Reserve.
- 6.2.4 High Signage will be erected advising of the no camping policy.
- 6.2.4 High A fence will be erected on the boundary adjacent to the caravan park to the south of the coastal section of the Reserve.
- 6.2.5 High Only non-motorised craft will be permitted on Cudgen Lake, except for motorised vessels used for management, law enforcement, licensed commercial fishing or emergency purposes.
- 6.2.5 High Signs will be erected at the lake foreshore detailing prohibited uses.
- 6.2.5 Med Vehicle and trailer parking will be provided on the southern foreshore of Cudgen Lake.

- 6.2.6 Med Licences will only be approved, subject to appropriate conditions, for organised events which are compatible with the purpose of dedication of the Reserve.
- 6.2.7 Med Commercial operations may be permitted in the Reserve, however, such licences will only be issued where the proposed activity is consistent with the objectives of this plan and promote the appreciation and enjoyment of wildlife, natural environments and natural phenomena.
- 6.2.7 Med Commercial fishing licenses in the Reserve will be unaffected by the dedication of the planning area as a nature reserve.
- 6.3 High Undertake a study of the hydrology and associated natural processes, water quality and flooding scenarios of Cudgen Lake.
- 6.3 Med Appropriate research will be encouraged in the Reserve.
- 6.3 Med NPWS conducted research will aim to facilitate management of the park.
- 6.3 Med Researchers will be encouraged to design programs to provide information which is directly useful for management purposes.
- 6.3 Med Liaison will be maintained with researchers. The results of research will need to be provided to the managers of the Reserve.
- 6.3 High A prospectus will be prepared as a guide to preferred research projects in Reserve. Preferred topics will be those of direct relevance to management.
- 6.4.1 High A review of the existing system of drains which pass through and into the Reserve will be undertaken. The maintenance of those drains considered essential will be subject to an assessment of their environmental impact and will be licensed. Those considered not to be essential will be closed and rehabilitated.
- 6.4.1 High The number of inappropriate non-NPWS utilities operating under lease or licence within the Reserve will be kept to a minimum.
- 6.4.1 Med New works, facilities or operations proposed by any organisation or individual will not be permitted unless they are consistent with the purposes of the Reserve and this plan of management.
- 6.4.1 High Close liaison will be maintained with the Reserve neighbours to deal with matters of mutual concern.
- 6.4.1 High An authority will be issued for the Department of Land and Water Conservation's water height gauge and access ramp on Cudgen Lake.
- 6.4.1 High Research into the environmental impact of the stormwater drains in the south-east section of the Reserve, and alternatives to the existing open drainage system, will be undertaken.
- 6.4.1 High Stormwater drains in the Reserve will need to be licensed.
- 6.4.2 High Generally fencing will be constructed on the Reserve boundary. The highest priority for fencing will be where stock incursions are likely and where neighbouring urban properties front the Reserve and encroachments are possible or it is necessary to clearly define the Reserve boundary.

- 6.4.3 High Liaison with current permissive occupancy licensees for banana growing will be undertaken to determine the transfer of licences to the NPWS, likely time frame for the full or partial cessation of licences, and conditions which will apply to the leases.
- 6.4.3 High A rehabilitation plan will be developed for each of the banana plantation areas. Only species indigenous to the Reserve will be used.
- 6.4.3 High The first priority for rehabilitation of banana plantation areas will be the relinquished lease area.
- 6.4.3 Med Banana licensees will be given not less than 2 years notice of licence termination.
- 6.4.4 High Liaise with the Department of Agriculture to establish the management issues associated with the Cupitts cattle tick dip site so that this contaminated site does not impact upon the Reserve.
- 6.4.4 Low Cupitt's cattle dip site may be incorporated into the Reserve, along with the adjoining unmade road reserve, following decontamination of the site. Under this arrangement the NPWS will rehabilitate the site to native vegetation while protecting any historic values.
- 6.4.5 High Following its addition to the Reserve, the Wollumbin Scout Camp will be leased back to the NSW Scout Association for continued use as a scout camp and education centre but with increased emphasis on promoting the nature conservation and heritage values of the Reserve as part of cooperative programs with the Service.
- 6.4.5 High Despite the above strategy, the NPWS will seek to renegotiate the current lease between the Scout Association, Cudgen Lake Round Mountain Reserve Trust and the Department of Land and Water Conservation so that the conditions of the lease and use of the Reserve recognise the values of the Reserve and the future working relationship between the Association and NPWS.
- 6.4.5 High The Scout Association will be issued with an authority to retain and use the outdoor chapel. The existing memorial plaque can be retained in the chapel area as part of the authority for the chapel but no further plaques will be permitted in the Reserve.
- 6.4.5 High The collection of firewood from the Reserve will be prohibited.
- 6.4.6 High Encroachments in the Reserve, except for the part of a swimming pool, will be removed and, where necessary, boundaries fenced and the encroachment area rehabilitated.
- 6.4.6 High The part of the existing swimming pool encroachment, belonging to a residence in Cyprus Crescent, may remain in the Reserve providing it is licensed. The boundary fence, however, will need to be relocated.
- 6.4.7 Low Saunder's quarry will be incorporated into the Reserve. In cooperation with the Tweed Shire Council the quarry will be closed and rehabilitated.
- 6.4.7 High The existing apiary licence at Saunder's quarry will not be renewed.

- 6.4.8 Med Negotiations will be entered into with the relevant authorities to incorporate the two unconstructed Crown public road reserves shown on map 4 into the Reserve.
- 6.4.9 High Tweed Shire Council will be requested to amend the Local Environment Plan to show the Reserve as Zone 8(a) - "National Parks and Nature Reserves".

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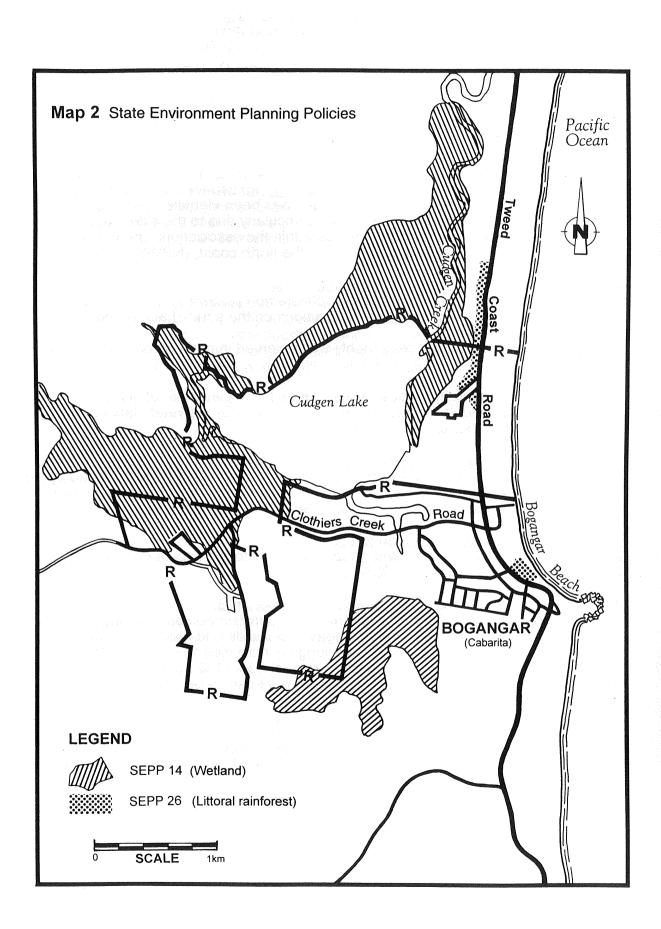
PART G

APPENDIX 1

THREATENED FAUNA RECORDED FROM CUDGEN NATURE RESERVE

SCIENTIFIC NAME Ptilinopus magnificus	COMMON NAME Wompoo Fruit-Dove	LEGAL STATUS V
Amaurornis olivaceus	Bush-hen	V
Haematopus longirostris	Pied Oystercatcher	V
Haematopus fuliginosus	Sooty Oystercatcher	V
Calidris tenuirostris	Great Knot	V
Ephippiorhynchus asiaticus	Black-necked Stork	E
Ixobrychus flavicollis	Black Bittern	V
Anseranas semipalmata	Magpie Goose	V
Pandion haliaetus	Osprey	V
Calyptorhynchus banksii	Red-tailed Black-Cockator	o V
Calyptorhynchus lathami	Glossy Black-Cockatoo	V
Monarcha leucotis	White-eared Monarch	V
Phascolarctos cinereus	Koala	V
Potorous tridactylus	Long-nosed Potoroo	V
Pteropus alecto	Black Flying-fox	V
Syconycteris australis	Queensland Blossom Bat	V
Miniopterus australis	Little Bent-wing Bat	V
Chelonia mydas	Green Turtle	V
Crinia tinnula	Wallum Froglet	V
Litoria olongburensis	Wallum Sedge Frog	V

V=Vulnerable E=Endangered



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