

NARRAN LAKE NATURE RESERVE

PLAN OF MANAGEMENT

NSW National Parks and Wildlife Service

May, 2000

This plan of management was adopted by the Minister for the Environment on 5th May 2000

Acknowledgments

This plan of management was prepared by staff of the Field Services Division of NSW National Parks and Wildlife Service in association with Narrabri District.

Photograph of Narran Lake Nature Reserve by S. Hogg.

NSW National Parks and Wildlife Service

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FOREWORD

Narran Lake Nature Reserve is located in the central north of NSW, between Brewarrina and Walgett. It has an area of 5,538 ha. A further 3,547 ha owned by the Service adjoining the south eastern boundary of the nature reserve is managed as an integral part of the nature reserve.

The nature reserve comprises extensive wetlands, associated lunettes and adjacent sandy and rocky ridge country.

The wetlands are part of the Narran Lake system, an area of lakes and channelised country fed by the Narran River. They are predominantly open lake, large areas of dense lignum and river redgum *Eucalyptus camaldulensis*, coolibah *E.coolabah*, river cooba *Acacia stenophylla* woodland. The wetlands are in a relatively natural condition and provide important breeding and feeding habitats for a diverse range of waterbirds, including one of the largest ibis rookeries in Australia. The nature reserve is recognised as a Wetland of International Importance under the Ramsar Convention.

The plan of management recognises that the primary requirement for protection of wetland values is for the reserve to continue to receive adequate inundation. It proposes as a high priority the preparation of a water management plan. The water management plan will establish optimal water requirements for habitat conservation within the reserve. The information in the plan will contribute to the NSW government's water reform process and the Queensland government's Water Allocation Management Plan (WAMP) process.

The ridges support cypress pine *Callitris glaucophylla*/bimble box *Eucalyptus populnea* woodland which has been affected by former stock grazing. They contain several plant species and communities with limited occurrence. Regeneration of natural vegetation cover in the woodlands is an important objective of the plan of management.

The nature reserve contains a highly significant complex of Aboriginal sites, most notably mythological sites and very extensive areas of artefact scatters, shell middens and hearths on the lunettes. The plan of management gives high priority to survey and recording of archaeological material and conservation works to prevent erosion of significant areas. It provides for active involvement of Aboriginal people in management of the reserve.

Public access will be permitted for appropriate activities such as Aboriginal community visits, educational programs and bird watching but use will be controlled to prevent damage to the very significant natural and cultural heritage of the reserve.

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

Bob Debus
Minister for the Environment

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1. 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, a plan of management for Narran Lake Nature Reserve was placed on public exhibition from 31 December 1998 until 5 April 1999. A total of 12 submissions which raised 17 issues were received on the plan. All comments received were carefully considered by the National Parks and Wildlife Advisory Council. The submissions and the recommendations of the Council were in turn considered by the Minister for the Environment before adopting this plan of management for Narran Lake Nature Reserve.

No operations may be undertaken within Narran Lake Nature Reserve unless they are in accordance with this plan.

Additional information about the nature reserve or this plan of management may be obtained from the Service's Narrabri District Office at 165 Maitland Street, Narrabri or by phone on (02) 6799 1740.

2. MANAGEMENT CONTEXT

2.1 NATURE RESERVES IN NEW SOUTH WALES

Reserving areas for nature conservation as a general purpose was introduced into Australia with the establishment of Royal National Park in 1879.

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 areas of special scientific interest containing wildlife or natural environments or natural phenomena.

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.'

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 recreation opportunities.

2.2 NARRAN LAKE NATURE RESERVE

2.2.1 Location, Gazettal and Regional Setting

Narran Lake Nature Reserve is located in the central north of NSW, between Brewarrina and Walgett, in the Murray Darling Basin (see Locality Map, page 3). It was dedicated in 1988 and has an area of 5,538 ha. An adjoining 3,547 ha formerly known as the property 'Lumeah' is owned by the National Parks and Wildlife Service and managed as part of the reserve. This land has not been dedicated as nature reserve because of objections by the Department of Mineral Resources.

The nature reserve covers part of a large terminal wetland of the Narran River. The Narran River is a tributary of the Balonne River, part of the Condamine River system with headwaters in southeastern Queensland. Other tributaries of the Balonne include the Culgoa and Bokhara Rivers.

The surrounding district is part of the semi-arid pastoral zone and is used primarily for sheep and cattle grazing. Some cropping occurs on floodplain and lakebed areas. There are extensive opal fields to the northeast and east of the reserve which attract tourists to the town of Lightning Ridge.

2.2.2 Importance of Narran Lake Nature Reserve

The most important conservation values of the nature reserve are outlined below. More detailed information is provided in sections 4.1 and 4.2.

Geomorphological Values

The nature reserve makes up about one third of the Narran wetlands, a system of lakes and channelised wetlands at the end of the Narran River. Narran Lake Nature Reserve is in a relatively natural condition, although it has a long history of high grazing pressure and mean water flows to the nature reserve have been significantly reduced. The nature reserve has been subject to only low levels of clearing and frequency of large floods is currently according to a natural regime. The Narran wetlands are geomorphologically significant as a relatively undisturbed terminal lake system.

The nature reserve also samples part of the Lightning Ridge land system, which comprises undulating sandy and rocky ridge country.

Biological Values

The Narran wetlands provide important waterbird breeding areas. They have national significance as a major breeding site of many species and are on the Register of the National Estate. Narran Lake Nature Reserve is listed as a site under the Ramsar Convention, thereby receiving world recognition as a wetland of international importance.

The Narran wetlands flood more frequently than most other wetlands in northwestern NSW and therefore provide important habitat for waterbirds in this semi-arid area. They contain a considerable diversity of wetland types including some of the largest expanses of lignum *Muehlenbeckia florulenta* in NSW (Aldis 1987). Lignum is vital for ibis breeding. The habitats of the Narran wetlands are in a relatively natural condition, unlike many other floodplain areas including the important Macquarie Marshes to the south, where large areas of lignum have been cleared. Because of human interference with the hydrological regime of river systems combined with clearing and agricultural activities, inland waterfowl habitat and breeding grounds have substantially declined and are continuing to do so (Briggs, 1994).

The Narran wetlands support a variety of aquatic and semi-aquatic organisms, such as plants, native fish, invertebrates, mammals, amphibians and reptiles. High numbers of the native golden perch *Macquaria ambigua* in particular have been recorded in the nature reserve (D. Moffat, pers. comm., 1999).

At least 46 species of waterbirds breed in the Narran area; several in very large numbers (Ley, 1998a & Henderson, 1999). The largest recorded ibis breeding event in Australia was in the nature reserve in 1983, with estimates of 200,000 pairs (Marchant & Higgins, 1990). The Narran Lake Nature Reserve is one of only 12 significant ibis breeding sites in Australia. All of these sites are affected by upstream development or other threatening processes. Narran Lake Nature Reserve has contained the largest recorded colonies in Australia of Straw-necked Ibis *Threskiornis spinicollis*, Little Black Cormorant *Phalacrocorax sulcirostris* and Royal Spoonbill *Platalea regia*.

Many waders, including species that breed in Australia and international migrants, feed on the lake margins in the summer months. During drying of flooded areas the Narran wetlands can support very large numbers of waders. Eight of the wader species recorded are listed under international agreements for migratory waders (Ley, 1998a & 1998b).

A number of waterbirds listed under the NSW *Threatened Species Conservation Act* 1995 have been recorded breeding in the Narran wetlands. These include the Brolga *Grus rubicundus*, Blue-billed Duck *Oxyyura australis*, Freckled Duck *Stictonetta naevosa* and Magpie Goose *Anseranas semipalmata*. The small colony of Magpie Geese recorded on Narran Lake is the most westerly breeding record in NSW (Ley, 1998a).

The endangered Australian Bustard *Ardeotis australis* and the vulnerable Grey Falcon *Falco hypoleucos* and Pink Cockatoo *Cacatua leadbeateri* have been recorded in the nature reserve. The Painted Honeyeater *Grantiella picta* and Red-tailed Black Cockatoo *Calyptorhynchus magnificus* have been recorded in the district and are likely to occur in the reserve.

A relatively large number of native mammal species have been recorded in the nature reserve, which is significant given the disappearance of mammals from the arid and semi-arid zones since European settlement.

The reserve contains representatives of some major vegetation communities that have been greatly disturbed throughout their range. These include buck spinifex *Triodia mitchellii* and low woodlands, mulga *Acacia aneura* low woodlands, riparian open forests, lignum *Muehlenbeckia florulenta* shrublands and cumbungi *Phragmites australis* reedbeds. Two ROTAP and threatened plant species have been recorded. Winged peppergrass *Lepidium monoplacoides* is listed as endangered under the NSW Threatened Species Act 1995 and Macbarrons Goodenia *Goodenia macbarronii* is listed as vulnerable. In addition, eleven plant species of regional conservation significance have been recorded (Hunter, 1999).

Aboriginal Cultural Value

The Narran Lake area is of extremely high archaeological value and has very high traditional and contemporary social and spiritual significance to local Aboriginal people.

The lake area was a common meeting place for people of the Ngemba, Euahalyi and Murawari tribes and possibly others, and a number of Aboriginal people in the district have historical links to the area. Today it is used by local communities for education of children; providing impressive evidence of the traditional way of life. The Aboriginal importance of the Narran area has been summarised by the Barwon Aboriginal Community Limited. It is important because of:

- widespread and unique evidence of Aboriginal peoples existence in the area;
- the traditional status of the lakes as a meeting place of the tribes in the region;
- dreaming paths which culminate at the lakes; and
- Aboriginal peoples need for involvement with land which has areas largely unspoilt (from letter to NPWS, 1987).

The Narran area has rich and abundant Aboriginal site complexes including shell middens, shell mounds, hearth sites with clay ovens, quarries, artefact scatters and scarred trees, all of which are sampled in the nature reserve. Sites in the nature reserve are of particular importance as they can be seen in a relatively natural environmental context.

The shell middens are the most extensive complex known from north west New South Wales (Geering and Roberts, 1991). Several different stone tool assemblages

are present consisting of areas with microblade assemblages (including backed blades) and areas with only core and flake tool assemblages.

The silcrete quarries are archaeologically important as few quarries are known, despite the predominance of this tool manufacturing material.

The distinctive suite of sites at Narran Lake is probably not found elsewhere in north west NSW (Witter, 1986). Narran Lake is the only area within much of north west NSW which has the stratigraphic controls necessary for intensive archaeological research and technological analysis of culture sequences (Geering and Roberts, 1993). Some sites contain organic material which will be vital for answering questions such as whether the variation in stone artefact assemblages is due solely to chronological changes in artefact manufacture or more directly linked to environmental factors and/or specialised site functions.

Narran Lake is of major mythological significance as the site of convergence of several Aboriginal Dreaming Paths which link the lake area to other landscape features in the region. One of these paths extends from Dirranbandi in Queensland south to Narran Lake. A sequence of springs, waterholes, bends in the Narran River and the lake are part of the dreaming path of Baieme, the sky hero who was central to Aboriginal beliefs and laws in the area. It was believed that Baieme led the tribes to their tribal areas and made the natural landscape features. The laws, customs and religion of Aboriginal people were set down by Baieme. Baieme bestowed on humans their various items of material culture, gave them their social laws and, above all, instituted the initiation rites. The dreaming path still has considerable significance to local Aboriginal people, both in its traditional sense and also as a reminder of traditional lifestyle and laws.

European Cultural Value

The nature reserve contains evidence of former grazing use. Remaining structures are fence lines, ground tanks, bores, stockyards, a boundary riders hut and shearing shed. The significance of these features has not been assessed.

Summary Statement of Significance

Narran Lake Nature Reserve is of **international and national significance** as an area of extensive, frequently available, breeding and feeding habitat in a natural condition for a large number of waterbird species, including one of Australia's largest ibis rookeries and waders protected under international agreements. Narran Lake Nature Reserve is listed as a site under the Ramsar Convention, thereby receiving world recognition as a wetland of international importance.

The reserve is of **state significance** for the following:

- it contains a distinctive suite of important Aboriginal sites including extensive archaeological deposits with high potential to add to knowledge about Aboriginal use of northwestern NSW;
- the reserve is part of an area of very high Aboriginal cultural significance as an important meeting and ceremonial site for several tribal groups and the place of convergence of a number of major dreaming paths;
- the reserve provides habitat for a number of waterbird species listed under the NSW Threatened Species Act 1995, such as the Brolga, Freckled Duck, Blue-billed Duck, Magpie Goose and Black-tailed Godwit, and at least eight species of conservation concern in western NSW;

- it contains important vegetation communities, two plant species listed under the NSW Threatened Species Act 1995 and eleven plant species of regional conservation significance; and
- the reserve supports populations of a number of mammal species which have disappeared from many areas of their former range in western NSW.

Significance of area not dedicated as nature reserve

That part of Lumeah over which there continue to be mining objections is an area of high conservation value. It is contiguous with Narran Lake Nature Reserve and comprises ridge country and deep sandy soils containing some major vegetation communities that have been greatly disturbed in a regional context and are poorly reserved throughout their range. In particular, it contains mulga *Acacia aneura* low woodlands and triodia hummock grasslands and low woodlands that are not represented in the nature reserve.

The extensive woodland environments of Lumeah provide habitat for a diversity of native fauna, complementing the smaller area of woodland found in the nature reserve. The threatened Pink Cockatoo has been recorded specifically in the ridge country of Lumeah.

Lumeah contains areas of cultural heritage significance, including the site of a timber mill and woolshed complex, built in the 1940s. The area is highly regarded by the Aboriginal community due to its proximity to the culturally significant Narran Lake area and the existence of sites, including artefact scatters and scarred trees.

3. OBJECTIVES OF MANAGEMENT

3.1 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 enquiry into environmental features and processes.

3.2 SPECIFIC OBJECTIVES FOR NARRAN LAKE NATURE RESERVE

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

- * maintenance of diverse, healthy and productive wetland habitat and the value of the reserve as a major waterbird breeding area;
- * improvement in knowledge of the species diversity and management needs of the reserve;
- * fulfilment of the objectives of the Ramsar Convention and other international nature conservation agreements to which Australia is signatory;
- * protection of significant Aboriginal sites from further erosion and improvement in knowledge about traditional Aboriginal use of the area;
- * encouragement of regeneration of a natural vegetation cover in areas degraded by past grazing;
- * control, and if possible elimination, of introduced species; and
- * promotion of community awareness and appreciation of the conservation value of the Narran Lake system.

3.3 OVERALL STRATEGY

There are two primary objectives for management of Narran Lake Nature Reserve - protection of its value for waterbird breeding and conservation of Aboriginal cultural values. The strategy below is designed to achieve these objectives.

- * Adequate inundation is recognised as being of fundamental importance. Major effort will be directed to ensuring that the Narran wetlands continue to receive adequate inundation to maintain the health of the vegetation communities and regular successful waterbird breeding.

- * High priority will be given to adequate documentation of archaeological resources and conservation of significant areas.
- * Controlled public use will be permitted for educational and other appropriate purposes. Public vehicle access will be limited to protect Aboriginal sites and prevent damage to wetland areas.
- * The Aboriginal community will be consulted about all aspects of management of Aboriginal sites in the reserve and encouraged to become actively involved in protective management and interpretive programs.
- * Close cooperation will be encouraged between the Service, landcare organisations, landholders and other land use authorities to protect significant habitat values in other parts of the Narran Lake system and facilitate mutually beneficial management programs such as pest control.

4. POLICIES AND FRAMEWORK FOR MANAGEMENT

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

- 4.1 NATURAL HERITAGE
- 4.2 CULTURAL HERITAGE
- 4.3 USE OF THE AREA

The policies established in this plan of management provide the framework for management consistent with anticipated resources available to the Service and with anticipated community trends over the next five to ten years.

The actions identified are those proposals to which priority will be given in the foreseeable future. Other management actions may be developed over the life span of this plan consistent with the policies set out in the plan.

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

4.1 NATURAL HERITAGE

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

4.1.1 Landform, Geology, Soils and Hydrology

Landform

Roughly half the nature reserve consists of wetland areas subject to inundation from the Narran River, comprising the northeastern part of the Narran Lake system. The reserve contains two small lakes, Clear Lake and Back Lake, and extensive channelised wetlands between and around the lakes. Narran Lake itself is located at the southern end of the system and is not within the reserve. The Narran River forms the southwestern boundary of the reserve.

The eastern half of the reserve is low, gently undulating sandy and rocky ridge country. A number of semi-saline playa lakes and drainage depressions that fill from local rainfall and groundwater are located in this area east of Clear Lake.

Between the wetland shore and the ridge country is an area of discontinuous aeolian lunettes and sandy levees. These were formed by deflation of the lake beds and accumulation of sand grains and salt by strong westerly and south westerly winds.

Geology and Soils

Cretaceous sandstone and quartzite sediments of the Rolling Downs Group are exposed on the ridge country in the eastern part of the nature reserve and extensively in the surrounding district. The ridges are capped in places by Cainozoic silcrete, which was quarried by Aborigines. There are scattered silcretized sandstone cobbles on some slopes.

Soils on the ridges are generally red sandy loams. The highest areas are gravelly. The soft red soils are prone to erosion and gullyng associated with tracks occurs in some areas. Gullyng is currently minor and localised and may be naturally rehabilitated as ground cover improves following cessation of grazing, although the timescale of natural revegetation is comparatively slow in semi arid areas.

The Rolling Downs sediments are overlain by Quaternary sediments on the Narran River floodplain. These consist of cracking grey clay soils in the lakes and adjacent wetlands and light grey clays in nearby playa lakes.

The lunettes are composed of orange sand while the younger dunes, closer to the existing lake, consist of yellow-white sands. Soils are sodic and strongly alkaline. The lunettes contain abundant silcrete chips resulting from Aboriginal tool production.

Severe wind and water erosion following grazing in the lunette area has resulted in extensive scalding and production of claypans. Revegetation of these areas will be difficult and labour intensive. Preparation of a stabilisation and revegetation program is covered in section 4.2.1 because of the over-riding need to protect Aboriginal sites in this area.

Hydrology

The Narran River is one of a network of distributary channels of the Condamine - Balonne Rivers which originate in Queensland. The other branches, the Culgoa, Birrie and Bokhara Rivers, enter the Barwon River.

Narran River, like a number of other inland rivers, has a small, shallow main channel with contiguous floodplain. A number of lakes lie along the floodplain and the river terminates in the lakes and wetlands of the Narran Lake system. In earlier, wetter geological periods the river probably flowed to the Barwon. Large floods still reach the Barwon in current times (Aldis, 1987).

The river flows intermittently as a result of heavy rainfall in Queensland and annual flows are highly variable. Inundation occurs predominantly in summer and autumn, consistent with the northern areas of the Murray Darling Basin. The Narran Lake system receives water at lower flows than the lake beds further north along the river and hence fills more often and holds water for longer periods.

On average, inundation of the Narran wetlands occurs approximately every two years (Magrath, 1991). During a large flood event, the Narran River branches west of Clear Lake to fill Clear Lake whilst simultaneously flowing toward Narran Lake and filling that lake. Once Clear Lake has filled, the water overflows to fill the smaller lakes in the nature reserve. When Clear Lake is at full capacity more water flows toward Narran Lake. Water levels in the nature reserve can drop quickly unless flows are sufficiently large to keep Clear Lake inundated. During times of low flow water may not reach Narran Lake proper. Once inundated, the nature reserve can hold water for up to twelve months while Narran Lake proper will hold water for up to two years.

Policy

- * Erosion is recognised as a naturally occurring process in the nature reserve. Where erosion has been accelerated by human activity or is threatening significant habitats or other values, appropriate control measures will be undertaken.
- * The maintenance of natural water flows in the Narran Lake system will be supported (refer section 4.1.4).

Action

- * Areas of gully erosion on the ridge country will be monitored and will be treated if erosion continues to occur.

4.1.2 Native Vegetation and Introduced Plants

A total of 325 plant species have been recorded in Narran Lake Nature Reserve. There are six major vegetation communities, including chenopod low open shrub and ephemeral herbfield, lignum shrubby thickets, mixed low woodland, mulga low woodland, riparian open forest and spinifex hummock grassland and low woodlands. These communities are associated with the wetlands and floodplain, littoral zone and sandy ridge country (Hunter, 1999).

Wetlands

The wetlands contain a complicated array of associations of the following species:

- sedges, grasses and ephemeral herbs on playa lakes and the main lake beds following receding of flood water;
- extensive areas of lignum *Muehlenbeckia florulenta*, forming dense shrubland in the littoral zone of Clear Lake and Back Lake;
- small areas of cumbungi *Phragmites australis* among the lignum;
- stands of river redgum *Eucalyptus camaldulensis*, coolibah *E. coolabah*, black box *E. largiflorens* and river cooba *Acacia stenophylla* fringing the river and wetland channels. Understorey species include lignum, *Myoporum sp.*, *Alstonia constricta*, *Acacia brachystachya* and *Paspalidium jubiflorum*;
- aquatic plants such as red azolla *Azolla filiculoides* following inundation of wetland areas.

There are extensive areas of river cooba with lignum between Clear and Narran Lakes and a relatively large area of river redgum northwest of Clear Lake.

The nature reserve contains some of the largest expanses of lignum in NSW. Lignum occurs as vast expanses in the lakebeds. There are few areas left in NSW where lignum occurs as an expanse. Typically, lignum occurs along river and creek channels. Within the lignum are small areas of regenerating cumbungi reedbeds. Cumbungi assemblages are poorly represented in conservation reserves and many are grazed.

Lignum, river redgum, river cooba and coolibah, all require inundation to grow and regenerate. Lignum is normally best maintained by inundation every 3 to 10 years. The large dense lignum at Narran Lakes, however, may require inundation at least every three years (Smith, 1993). River redgum requires inundation every 6 to 10 years, or more frequently if access to good groundwater supplies is not available (Elliot and Jones, 1986, cited in Smith). River redgum should not be continuously flooded for more than 18 months as it can die (Leitch, 1989 cited in Briggs et al 1994). The requirements of river cooba and coolibah are not known.

Higher areas

The sandy lakeshore and dune areas are generally treeless and are badly scalded, possibly as a result of past heavy grazing in combination with inherent instability .

The less heavily eroded areas have a scattered cover of windmill grass *Chloris truncata*, woollybutt *Eragrostis eriopoda*., *Agrostis deilsii* and chenopods such as *Sclerolaena diacantha* and *S. decurrens*. The former species composition in these areas is not known.

The sand ridge country east of the lake supports predominantly a woodland of bumble box *Eucalyptus populnea* and white cypress pine *Callitris glaucophylla*, with ironwood *Acacia excelsa*, whitewood *Atalaya hemiglauca*, budda *Eremophila mitchellii*, western beefwood *Grevillea striata* and wilga *Geijera parviflora*. Dominant shrubs include *Enchylaena tomentosa*, *Sclerolaena bicornis*, *Dodonea attenuata* and *Pimelia microcephala*. Old man salt bush *Atriplex nummularia* is found in a few places. Small areas of mulga *Acacia aneura* occur on more rocky areas, especially those ridges with outcropping ironstone formations.

Two areas of the sand ridge country have a woodland of silver-leaved ironbark *Eucalyptus melanophloia*, kurrajong *Brachychyton populneum*, coolabah apple *Angophora melanoxylon*, wilga and beefwood with spinifex *Triodia mitchellii*, *Acacia murrayana* and *Hakea leucoptera*. As stated in section 2.2.2, this community is of regional conservation significance.

The vegetation of the sand ridge country has been altered by former grazing and clearing. Dense cypress pine regrowth is dominant in many areas and associated with this regrowth are large areas of bare ground supporting little ground cover. It is probable that the woodlands previously had greater grass cover (Aldis, 1987)). The vegetation is expected to slowly return to a more natural condition.

Two ROTAP and threatened plant species have been recorded. Winged peppergrass *Lepidium monophlooides* is listed as endangered under the NSW Threatened Species Act 1995 and Macbarrons Goodenia *Goodenia macbarronii* is listed as vulnerable. In addition, eleven plant species of regional conservation significance have been recorded (Hunter, 1999).

Weeds

Noogoora burr *Xanthium occidentale* and Bathurst burr *Xanthium spinosum* are common weeds along the river. Golden dodder *Cuscuta campestris* is a weed that has invaded the wetlands area of the nature reserve, particularly in areas of lignum. These weeds can be controlled but not eliminated as they are re-introduced with each flood. Some African boxthorn *Lycium ferrocissimum* also occurs. These species are noxious weeds and will be treated.

A number of other introduced species occur but are not currently considered a problem.

Policy

- * Native vegetation will be managed to:
 - maintain floristic and structural diversity;
 - conserve endangered or uncommon communities and species;
 - encourage regeneration of areas previously cleared or grazed; and
 - maximise habitat values for waterbirds and other native animal species which utilise the reserve.

- * Introduced plant species will be controlled and if possible eliminated where they threaten the integrity of native communities, have the potential to spread rapidly or have been declared noxious.

Action

- * Known occurrences of noxious weeds will be treated.
- * A weed control plan will be prepared providing for survey and monitoring of introduced plant species and treatment of noxious or invasive species.

4.1.3 Native and Introduced Animals

As for many areas of NSW, knowledge of native animal species in the reserve and their management needs is limited and further research will be required.

Waterbirds

Sixty-five species of waterbirds have been recorded in the Narran Lakes since survey began approximately 10 years ago. Forty-six of these have been observed to breed in the area (Ley, 1998a, 1998b & Henderson, 1999).

Five waterbird species listed under the NSW Threatened Species Act 1995 have been recorded in the nature reserve, including the Brolga *Grus rubicundus*, Freckled Duck *Stictonetta naevosa*, Blue-billed Duck *Oxyura australis*, Magpie Goose *Anseranas semipalmata* and Black-tailed Godwit *Limosa limosa*. At least eight species have been recorded that are of conservation concern in western NSW, such as the Darter *Anhinga melanogaster*, Straw-necked Ibis and Royal Spoonbill *Platalea regia*.

Waterbird species recorded breeding in significant numbers include the Little Black Cormorant *Phalacrocorax sulcirostris*, Great Cormorant *P. carbo*, Pied Cormorant *P. varius*, Nankeen Night Heron *Nycticorax caledonicus*, Straw-necked Ibis *Threskiornis spinicollis*, Glossy Ibis *Plegadis falcinellus*, Sacred Ibis *Threskiornis molucca*, Black Swan *Cygnus atratus*, Eurasian Coot *Fulica atra*, Pink-eared Duck *Malacorhynchus membranaceus*, Black-tailed Native Hen *Gallinula ventralis*, White-eyed Duck *Aythya australis*, Royal Spoonbill *Platalea regia* and Australian Pelican *Pelecanus conspicillatus*.

Ibis, spoonbills, cormorants, pelicans and several waterfowl species breed in the lignum while fringing river red gum and river cooba are used for nesting and roosting by egrets, herons, spoonbills, cormorants and darters. Many swans and duck species also breed on the main Narran Lake and associated channels, south of the nature reserve. In the 1988 survey the greatest number of ducks were seen in the overflow country southwest of Narran Lake (Smith, 1989).

The extensive area of lignum on channels surrounding and between Back and Clear Lakes is a particularly important part of the wetland system for waterbird breeding. A large ibis rookery is located between the two lakes. Surveys in 1988 recorded that 65% of the waterbirds breeding in the reserve were straw necked ibis (Smith, 1989).

Protection of rookeries from human disturbance during breeding periods is necessary.

The small ephemeral lakes provide feeding areas which complement the Clear Lake breeding grounds. They hold water after local rain, at times when the main lakes may be dry.

Narran lake, which holds water for longer than Clear and Back Lakes, is an extensive and important feeding area for birds which breed in the reserve, as well as providing breeding areas itself. Important breeding records such as the Magpie Goose *Anseranas semipalmata* and Australian Pelican *Pelecanus conspicillatus* have been recorded on Narran Lake only.

Large numbers of waders congregate in the area when there are extensive freshly exposed mudflats during drying out of flooded areas. Species include the Red-kneed Dotterel, *Erythrogonys cinctus*, Masked Lapwing *Vanellus miles*, Black-fronted Plover *Charadrius melanops*, Sharp-tailed Sandpiper *Calidris acuminata*, Black-tailed Godwit *Limosa limosa*, Common Greenshank *Tringa nebularia* and Red-necked Avocet *Recurvirostra novaehollandiae*. Migratory waders require feeding areas during the period September to April.

Waterbird breeding and water requirements

Waterbird breeding is stimulated by inundation of the wetlands. Determination of inundation requirements for successful breeding is complicated. Important factors include size of area flooded, rate of water build up, time of year and length of time the flood lasts. Water depth may also be a factor for some species, possibly because adequate depth is necessary to ensure continuous inundation during breeding and protection from predators.

The length in time of inundation needed is made up of the actual breeding time and a lag time between inundation of nest sites and initiation of breeding. Individual waterbird species vary considerably in the lag time needed. Ibis may begin breeding shortly after a flood as they obtain food from the surrounding country. Waterfowl may also begin breeding soon after a flood in response to build-up in aquatic invertebrate populations. Breeding of species which forage predominantly on fish, amphibians and large invertebrates, such as egrets, cormorants and darters, may be delayed as the prey species require a sufficient period of warm temperatures to re-populate the lakes. An autumn flood therefore may not result in breeding until spring. Additionally, breeding begun in late summer/autumn can fail during low winter temperatures.

Continuous inundation for at least six months is generally needed for successful breeding of waterbirds. A study of breeding in southern NSW (Briggs et al, 1994) found that 6-7 months was needed for ducks, 8 months for little pied or little black cormorants and 12 months for great egret. Floods of shorter duration result in mortality and failure of the breeding colonies. Ibis generally require water to remain at the colony site until young are near independence and will abandon the nests if floodwaters recede before this. There are indications that egrets no longer breed at a number of their former sites in NSW because water extraction has resulted in insufficient length of inundation (Briggs, S pers. comm.).

Large fluctuations in inundation are a normal part of the wetland system and the biota is adapted to such a regime. Periodic drying out is essential for the health of many of the vegetation types in the wetlands and for aerobic decomposition of soil nutrients. Re-inundation then results in large increases in invertebrate populations and hence in the food resource for waterbirds and fish.

There is on average a successful breeding season in the Narran Lakes every 2 to 3 years. Because of its location in northern NSW, inundation requirements may differ from those in more southerly locations. There is insufficient knowledge of the ecology of the Lakes to accurately determine the length, timing and amount of inundation needed although the above provides a reasonable guide. Clearly it would

be preferable for the wetlands to continue to receive large floods of a similar size and timing to what naturally occurred. Water management is discussed in section 4.1.4.

A waterbird monitoring program will be developed for the nature reserve which aims to determine how the numbers of breeding birds relate to hydrology and other environmental variables.

Landbirds

One hundred and five species of landbirds have been recorded in the Narran area, most of which depend upon the woodlands. Common species include the Crested Pigeon *Ocyphaps lophotes*, Mallee Ringneck *Platycercus zonarius*, Black-faced Cuckoo Shrike *Coracina novaehollandiae*, Grey-shrike-thrush *Colluricincla harmonica*, variegated Fairy wren *Malurus assimilis*, Spiny-cheeked Honeyeater *Acanthogenys rufogularis* and Little Friarbird *Philemon citreogularis*. The Emu *Dromaius novaehollandiae* generally occurs in small numbers but at times can be extremely abundant.

Landbirds recorded in the nature reserve and listed under the NSW Threatened Species Act include the Australian Bustard *Ardeotis australis*, Barking Owl *Ninox connivens*, Masked Owl *Tyto novaehollandiae*, Grey Falcon *Falco hypoleuco* and Pink Cockatoo *Cacatua leadbeateri*.

Native fish

The ephemeral wetlands of Narran Lake Nature Reserve provide good habitat and nursery grounds for native fish, typical of other wetlands in the semi-arid areas of NSW. Surveys conducted on Clear Lake recorded five native fish species. A high abundance of golden perch *Macquaria ambigua* have been recorded (D. Moffat. pers. comm., 1999).

The drying and inundation regime of the Narran wetlands is important in providing a nutrient rich habitat for native fish. The regime sustains plants such as lignum *Muehlenbeckia florulenta* which provides important nursery habitat for the golden perch. Once the wetlands are inundated, it is important to sustain the duration of inundation to enhance fish recruitment. Juvenile fish need time to grow to adult stage and swim out of the lakes into the river system before the lakes dry up.

Mammals

Mammals recorded during a survey in 1992 (Smith, 1993) were the eastern grey kangaroo *Macropus giganteus*, red kangaroo *Macropus rufus*, swamp wallaby *Wallabia bicolor*, short-beaked echidna *Tachyglossus aculeatus*, narrow-nosed planigale *Planigale tenuirostris*, fat-tailed dunnart *Sminthopsis crassicaudata*, common brushtail possum *Trichosurus vulpecula* and seven species of bat - the little mastiff bat *Mormopterus loriae*, Goulds wattled bat *Chalinolobus gouldii*, little red flying fox *Pteropus scapulatus*, little forest Eptesicus *Eptesicus vulturinus*, lesser long-eared bat *Nyctophilus geoffroyi*, Goulds long-eared bat *Nyctophilus gouldi* and western broad-nosed bat *Scotorepens balstoni*. The water rat *Hydromys chrysogaster* has been recorded nearby and almost certainly occurs in the reserve.

The western grey kangaroo *Macropus fuliginosus* occurs in small numbers. It is near the easterly limit of its range.

Koalas *Phascolarctos cinereus* occur just outside the reserve and may use the riverine area of the reserve at times. Koalas are near their western limit in the area. The koala colony depends upon maintenance of river red gum and coolibah forests along the river.

Woodlands along the Narran River are important habitats for arboreal mammals as the river holds water more often than other parts of the reserve.

The endangered kultarr *Antechinomys laniger* is likely to occur in the reserve. A number of mammal species such as the water rat, common brushtail possum and swamp wallaby are of conservation concern in the region, the latter two because of declining tree cover (Dickman et al. in Smith, 1993)

The ground-dwelling narrow-nosed planigale, fat-tailed dunnart and the paucident planigale *Planigale gilesi* (which has been recorded nearby and is likely to occur in the reserve) shelter within cracks in the soil. The two planigale species occur only sparsely in western NSW. While the planigale species are not presently under threat in the district, further expansion of cropping and cattle grazing on the floodplain could severely reduce their numbers, as has happened in other areas such as the Macquarie Marshes. Grazing and frequent cropping destroy soil crack systems and alter soil structure, rendering it unsuitable for small mammals. Protection within the nature reserve and of other areas of their habitat through conservation agreements is important for their survival.

Reptiles and amphibians

At least 25 species of reptiles and amphibians have been recorded in the nature reserve and in the Narran wetlands area. These include the spotted grass frog *Limnodynastes tasmaniensis*, desert tree frog *Litoria rubella*, sand monitor *Varagus gouldii*, bearded dragon *Pogona barbata*, soft-spined gecko *Diplodactylus williamsi*, beaked gecko *Rhynchoedura ornata*, striped skink *Ctenotus robustus* and the long-necked tortoise *Chelodina longicollis* (Smith, 1993 & Henderson, 1998).

The long-necked tortoise is of conservation concern in western NSW because of hydrological change, water pollution and predation by foxes (Smith, 1993).

As for the mammals, the riverine woodland, where there is access to long-term water, is particularly important habitat for amphibians and a number of reptile species (Dick and Andrew, 1993). Maintenance of good ground cover is important.

Introduced species

Foxes, feral cats, pigs, rabbits, hares and carp are found in the nature reserve. Rabbits occur in only a few areas of the reserve. Foxes and cats can take large numbers of juvenile birds when water levels fall sufficiently to allow them access to breeding areas.

An introduced animal species control plan has been prepared for the nature reserve. Regular feral pig control programs keep numbers at relatively low levels and fox and hare baiting are undertaken as needed. The Service works closely with the Walgett Rural Lands Protection Board and neighbours in control of feral animals in the nature reserve and adjacent areas.

Research into the effective control of carp is being carried out by specialist government and scientific authorities. Unfortunately, there are currently no effective carp control measures. The maintenance of natural flood regimes and water flows is probably the most reliable control mechanism. When an effective and suitable method is available, the Service will support the control of carp in the Narran River and river catchment.

Habitat outside the nature reserve

The wetlands of the nature reserve are an integral part of the Narran Lake system and cannot be managed in isolation. As well as being part of the one hydrological system and providing breeding areas for a number of species, wetland areas outside the reserve provide important feeding areas for waterbirds breeding in the reserve and allow use of the area by large numbers of birds. Neighbouring land holders have an important role to play in maintenance of the high diversity and productivity of the wetland system. Similarly, dry land habitats outside the nature reserve may be important for particular species and contribute to the long term viability of native animal populations in the reserve and the district generally.

In association with neighbours and local organisations, the Service will encourage protection of important habitats outside the nature reserve through such methods as promotion of Total Catchment Management and Landcare principles.

Policy

- * The Service recognises that the Narran Lake Nature Reserve is an integral part of the whole Narran Lake system and that its ecological value depends upon protection of other important habitat areas within the system.
- * The principles of Total Catchment Management and Landcare are supported by the National Parks and Wildlife Service and will be promoted in cooperation with local organisations.
- * The Service will continue to work closely with Walgett Rural Lands Protection Board and neighbouring land holders to control introduced animal species in the reserve. Priority will be given to control of feral pigs to keep numbers as low as possible.

Action

- * A program for monitoring of waterbird breeding in the reserve will be developed and implemented.
- * On-going feral pig, fox, hare, rabbit and cat control will be undertaken in accordance with the introduced animal species control plan for the nature reserve.

4.1.4 Water Management

The rich and diverse wildlife of the Narran wetlands has evolved with the natural flooding pattern of the Narran River. Extensive changes to the flood regime will have an adverse impact on the vegetation, fauna and invertebrates of the Narran wetlands. This has happened extensively in other inland and coastal wetlands.

The Balonne River is dammed above the town of St George in Queensland. In 1994 it was estimated that the impacts of diverting flows for irrigation in Queensland had reduced annual average flows to Narran Lake by about 30%. In 1999 it is estimated that annual average flows are reduced by a further 30% (Kingsford, 1999). Continued reduction in water flowing into the nature reserve will inevitably impact upon the ecology of the wetlands, including the frequency and size of waterbird breeding events.

In 1984 concern was raised about the impact on the Narran wetlands of water extraction for irrigation. This led to the NSW Government imposing an embargo on further water extraction from the Narran River in NSW, pending studies into the water requirements and management strategies necessary to maintain the ecological values of the Narran River, its floodplain and the terminal wetland system. The Murray-Darling Ministerial Council has imposed a cap on water extraction in both NSW and Queensland, set at 1993/94 levels of development.

It is essential that the Narran Lake wetlands and the river/floodplain receive sufficient water. Large floods are needed for waterbird breeding but it is just as important for the wetlands to receive small and medium floods in order to keep the lignum, red gums and other wetland vegetation healthy and thus maintain breeding habitat. Adequate inundation is also important to maintain native fish populations and other aquatic organisms. Adequate inundation requires restriction of the number and size of irrigation projects and of flood water harvesting in Queensland and allocation of the majority of surplus flows below Beardmore Dam to maintenance of a flow regime as near as possible to that which occurred naturally.

Narran Lake Nature Reserve is a Ramsar site of international significance. Compared to many other wetlands in south-eastern Australia it is relatively undisturbed. The nature reserve provides significant opportunities for major waterbird breeding and protection and management of semi-arid floodplain and wetland habitat.

As well as affecting inundation of the Narran wetland system, increased irrigation and floodplain cultivation upstream would result in loss of natural habitat on the floodplain and could result in salinity and pesticide pollution of the water entering the wetlands. This would adversely affect the health of the wetland vegetation, fish, amphibian and invertebrate populations and the success of waterbird breeding, and reduce populations of native animals relying on floodplain habitats.

A decline in water levels or other changes in the Narran system would also affect the Aboriginal dreaming path described in section 2.2.2 and be regarded by the Aboriginal community as desecration of these highly significant mythological sites.

In addition to the Narran wetlands, periodic inundation is vital for maintenance of the ecology of the whole Narran River floodplain, including for existing agricultural, domestic and stock use.

The recent rapid development of irrigation capacity at and below St George in Queensland threatens the natural inundation patterns that have created the Narran wetland's range of values. The Queensland government is undertaking a Water Allocation Management Plan (WAMP) process on the Condamine-Balonne river system. The WAMP will determine the allocation of water between environmental and agricultural interests. The close involvement of the NSW government will be essential to effectively manage the whole river system.

The Service must play an active role in defining the importance of water flows for the Narran wetlands ecosystem and ensuring that these flows are protected. Development of a monitoring system and water management planning in the nature reserve will be important in order to determine the success of water regimes and improvements needed, and the effects of any upstream agricultural development.

Policy

- * It is recognised that maintenance of the high habitat values of the nature reserve, the entire Narran Lakes system and of the floodplain depend upon receipt of close to natural amounts and timing of inundation and protection of water quality. The Service aims to maintain the status of Narran Lake Nature Reserve as a Wetland of International Importance, and meet the objectives of the Ramsar Convention, by maintaining the biological diversity of the wetland ecosystem, including frequency and size of waterbird breeding events.
- * Close liaison will be maintained by the Service with Queensland authorities and through the whole of government process currently operating to implement water reforms in NSW.

Action

- * The Service will provide for research into the water needs of the Narran wetlands and monitoring of the effects of various water regimes.
- * The Service will continue to monitor waterbirds in relation to water flows, depths etc, and compile a water management plan outlining the water required to successfully sustain significant waterbird breeding in the nature reserve and wider Narran wetlands.
- * The Service will, through the NSW government water reform process and WAMP, seek to inform the Queensland authorities of the conservation values of the Narran wetlands and request the allocation of sufficient water to maximise the ecological health of the wetland system, to maximise diversity and productivity of the wetland habitat and in particular provide conditions suitable for waterbird breeding.

4.1.5 Fire Management

Fire is a natural feature of the environment of Narran Lake Nature Reserve and is an important factor in influencing the distribution of plant and animal communities. Little is known of the fire regime in the reserve before the commencement of European land use or of the most appropriate regime for management of the native vegetation. Anecdotal evidence suggests that the woodlands of the district were burnt by Aborigines to produce edible grass seed and fresh grass to attract kangaroos. It appears that the occurrence of fire has been reduced by loss of grass cover through stock grazing, leading to increased shrub density (Aldis, 1987).

Because of its semi-arid environment and history of grazing use, the reserve generally has low fuel levels. Historically, fires are thought to have occurred every 10-15 years following a series of good seasons which result in heavy grass growth. Fires are usually started by lightning strikes.

Fires of moderate to high intensity can result in extensive damage to fire sensitive vegetation such as chenopods and cypress pine and could endanger visitors, historic structures and Aboriginal sites such as scarred trees. On the other hand, sufficiently intense fire may be needed to stimulate regeneration of some species. Further research is required into the effects of fire on native fauna and flora. It may be appropriate in the future to undertake prescribed burning for ecological purposes.

Management tracks and the Narran Lake Road provide access for fire fighting and act as firebreaks. The Narran River acts as a natural firebreak on the western side of

the reserve. Fire breaks are needed along boundary fencelines where there are no existing tracks.

The Service, like other landowners in NSW is bound by the *Rural Fires Act 1997* and is required to take all practicable steps to prevent the occurrence of fires on, and to minimise the danger of spread of fires on or from, the reserve. The Service is an active participant on Bush Fire Management Committees set up under the Rural Fires Act. These aim to coordinate and monitor fire management and fire control on a local government area basis. The Service regards cooperative fire management as critical for the protection of property and the conservation of natural and cultural heritage.

Policy

- * Fire will be managed in accordance with the principles below and relevant fire management plans in order to ensure:
 - protection of human life and property within and adjacent to the reserve;
 - protection of Aboriginal sites and historic structures;
 - protection of lunettes and scald areas degraded by grazing use; and
 - protection and perpetuation of native fauna and flora, including threatened species.
- * Close contacts will be maintained with Council fire officers, volunteer bush fire brigades and neighbouring landholders. The Service will continue to actively participate on Bush Fire Management Committees.
- * The National Parks and Wildlife Service will immediately deploy personnel to a fire, if resources are not committed to other fire operations. Due to distance and travel times, the Rural Fire Service will generally act as a first response agency who will liaise with the NPWS Duty Officer on appropriate strategies to be employed.
- * Heavy machinery will not be used on Aboriginal sites. The use of heavy machinery will be avoided in regenerating areas, such as lunettes and scald country, and in wetland areas.
- * Preference will be given to using the following suppression methods, wherever practicable:
 - use of hand tools and sulphate based aerial retardants;
 - use of existing roads and tracks, and natural features as control lines;
 - backburning; and
 - allowing wildfires to burn out to appropriate control lines.

Action

- * A fire management plan will be prepared for the reserve by the end of 2000.
- * Boundary fire breaks will be created where necessary along fencelines on the western, eastern and southern boundaries of the reserve where there are no existing tracks.

- * Research will be undertaken into fire needs for the perpetuation of native fauna and flora. The results of research will contribute to the development of a fire management plan.
- * Ecological burns will be undertaken where it can be established that such burns are necessary for the conservation of a significant population or community.

4.2 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.

4.2.1 Aboriginal Sites

The highly productive Narran Lake area was a rich economic resource for the Aboriginal people of the district and played a vital role in the Aboriginal settlement pattern of the region. It probably supported a relatively large, possibly semi-permanent, Aboriginal population (Martin, 1979). It was also a major meeting and ceremonial centre.

Because of its concentrated use the Narran Lake area, and the nature reserve in particular, contains a very large number and variety of Aboriginal sites, as outlined in section 2.2.2. Along the greater Narran Lake shore archaeological material is exposed in every eroded area, indicating that the entire zone has scattered flaked stone, numerous hearth sites and a number of middens.

It is not feasible to define site boundaries amongst this continuous material. There are, however, variations in the exposures. Several different stone tool assemblages are present consisting of areas with microblade assemblages (including backed blades) and areas with only core and flake tool assemblages.

Only a very small amount of the archaeological material in the nature reserve has been documented because of its great abundance and complexity. Three sites have been described by Witter, 1986:

- A shell mound northeast of Clear Lake. The mound is at least 50 m diameter and 1 m high. It consists mainly of freshwater mussel shell but fire-cracked rock and stone artifacts are also common. The large numbers of hafted flake tools, large debitage and low number of cores indicates that this was a special use site; presumably a base for collection and consumption of shellfish. The implements were brought onto the site as ready made flakes or as chert pebbles to be flaked on an anvil as a hafted 'adzing' tool.
- Dune site on the margin of the Clear Lake shore. This site is stratigraphically below the shell mound. It is a zone of flaked stone, stone hearths and an occasional lens of shell along the edge of a large dune. Most of the artefacts are backed blades and other items of the microblade industry.
- Lunette site. This is a deposit of flaked stone and a few hearths along the base of a small lunette east of Clearwater Lake. The implements are mostly forms which are not in an advanced stage of reduction and few specialised types are present. Witter suggested that this site may be a domestic camp associated with the shell mound or may be Early Holocene or earlier in age.

As well as the continuous archaeological material on the lake shore, middens are present along the river and on the boundary of the floodplain and there are scarred trees along the river and lake shore and in the sand ridge woodland. Artefact scatters occur on the sand ridge country and quarries are found in some of the silcrete outcrops. Burials also occur in the reserve.

The known silcrete quarries are small, showing bedrock anvils and a low density of flaked material. This suggests that quarried material was taken elsewhere for tool manufacture (Geering and Roberts, 1991).

The lake sites and those on the ridge country would have been part of a hunting and foraging area containing family camps and various specialised sites. Further research is needed to determine the pattern of sites.

The archaeological material along the lake shore has been exposed by destabilisation of the dunes and sandy shore through grazing prior to reservation. Continued erosion threatens the sites described above and the area in general. Stabilisation of significant sites is needed to prevent further erosion and loss of the scientific value of archaeological material. In particular, middens which contain datable organic material should be protected.

Vehicle tracks are located along the length of the scald area, as a result of past grazing activities, reserve management and public visits to Aboriginal sites. In most cases these are located on clay pans and are unlikely to contribute significantly to further erosion, although relocation of the track across the shell mound is needed.

Aboriginal community involvement in management

The strong attachment of Aboriginal people to the land is slowly being acknowledged. 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 nature conservation.

The nature reserve is within the area of the Walgett Local Aboriginal Land Council. The local Aboriginal community takes a strong interest in the nature reserve and wishes to be actively involved in its management.

Recording of traditional knowledge held by Aboriginal people of the district about the use and significance of Narran Lake has been undertaken. Further work is needed to ensure that knowledge is not lost.

Policy

- * Walgett Local Aboriginal Land Council and other relevant Aboriginal community groups will be consulted and actively involved in all aspects of Aboriginal site management.
- * Aboriginal people will be permitted access to the reserve for purposes related to maintenance of traditional links with the land.
- * Aboriginal sites will be protected from human disturbance other than for authorised research purposes. As far as possible, Aboriginal sites will be protected from accelerated erosion resulting from past stock grazing.
- * All works proposed for the nature reserve will be preceded by a survey for Aboriginal sites.

- * The location of Aboriginal sites will not be publicised. Supervised educational access may be permitted in accordance with the policies in section 4.3.1.

Action

- * Systematic survey and recording of archaeological material and sites will be progressively undertaken in the nature reserve.
- * Where necessary and feasible, stabilisation works will be undertaken to prevent further erosion of significant Aboriginal sites.
- * The vehicle track across the shell mound northeast of Clear Lake will be re-routed. Any other management tracks found to be located on significant archaeological material will be relocated.
- * Discussions will be initiated with the Aboriginal community to make arrangements for Aboriginal use of the reserve and discuss Aboriginal involvement in management.
- * Further recording of knowledge held by Aboriginal people in the district about the use and significance of sites and traditional land management practices will be undertaken.

4.2.2 Historic Places

Thomas Mitchell was the first known European to travel through the Narran area. His party passed through lignum beds just south of Clear Lake in 1846 on route to the Culgoa River (Aldis, 1987). Settlement of the district by Europeans began soon after Mitchell's visit.

The nature reserve was formed from several Western Lands leases. It contains fencelines, sheep and cattle yards and a number of watering points consisting of ground tanks and bores with windmills and troughs. Most of these features are in poor condition.

A three-roomed corrugated iron boundary riders hut and a set of timber yards with steel crush and loading ramp are located close to a ground tank on the northeastern side of Back Lake. The hut is in a stable but dilapidated condition.

A timber frame, galvanised iron clad shearing shed and engine room, with accompanying yards is located close to the eastern boundary of the reserve (on Lumeah). It is in an advanced state of disrepair.

Close to the shearing shed complex is a set of timber structures which may have been a bush timber mill, possibly used to mill wood for construction of the shearing complex.

The date of construction of these buildings and structures is not known and their historical value has not been assessed. At this stage they are thought to be of local interest only.

Policy

- * Historic places will be conserved in accordance with the Australia ICOMOS Charter for the Conservation of Places of Cultural Significance and the Heritage Act, 1977.

- * All historic features except the boundary riders hut, shearing shed and associated yards will be retained in situ and allowed to weather.

Action

- * Historic features in the reserve will be recorded.
- * The historical significance of the boundary riders hut, shearing shed and associated yards will be assessed and management strategies developed.
- * The former use of the possible timber mill will be determined.
- * Cleared areas will be maintained around the shearing shed and boundary riders hut and associated yards.

4.3 USE OF THE AREA

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

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

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

4.3.1 Public Use and Promotion

The primary purposes of nature reserves are conservation of wildlife, natural environments and significant cultural features, and scientific research into these. Educational use is appropriate where it does not conflict with conservation.

Existing public use of the reserve consists of visits by the Aboriginal community, educational groups, bird watchers and illegal shooters. The first three of these are legitimate uses of the reserve and will continue to be permitted, on a controlled basis. Aboriginal use of the reserve is discussed in section 4.2.1.

The reserve has the potential to be a valuable educational resource for local schools and community groups for cultural and ecological studies. It will be necessary to ensure that such visits are conducted in a manner which does not cause damage to archaeological sites and habitat values. This will be achieved by limiting vehicle access to suitable tracks, requiring prior permission to visit the reserve and promoting appreciation of the area's significance.

Tourist visitation such as commercial guided tours are not considered appropriate because of the high associated impacts on fragile cultural sites and disturbance to waterbirds which would result from frequent visits, visits during bird breeding periods and large groups.

There are currently no facilities for visitors and it is not proposed to provide facilities other than to permit use of appropriate management tracks.

Access to the nature reserve is via the Narran Lake Road and other roads from Brewarrina, Walgett or Cumborah (see map, centre pages) from which several vehicle tracks lead into the reserve. Tracks across the wetlands are impassable following rain or floods and public use is not appropriate because of the damage caused by formation of multiple tracks and the likelihood of visitors becoming stranded. Public access arrangements must also be regulated to minimise disturbance of bird rookeries and cultural sites, and erosion of sandy areas.

Policy

- * Public access will be permitted to the reserve for purposes such as education and bird observation where it will not interfere with waterbird breeding or cause damage to Aboriginal sites. Prior permission will be required from the NPWS District Office and use of particular tracks will be subject to their condition and requirements for protection of the natural and cultural values of the reserve.
- * Camping may be permitted if essential for educational or study purposes. Visitors seeking permission to camp in the reserve will be directed to suitable locations and will be required to remove all rubbish and signs of a camp.
- * Understanding and appreciation of the natural and cultural values of the nature reserve will be encouraged through appropriate means such as discussions with community organisations, field days and media releases. Such means will also be used to inform the community about the types of activities which may be appropriate and the need to obtain permission to visit the reserve.
- * Aboriginal sites will only be made available for visitor access following:
 - the agreement of the Walgett Local Aboriginal Land Council and other relevant Aboriginal community organisations; and
 - implementation of any management works necessary to protect the site from damage.
- * The reserve will be closed to public access during management programs such as pig shooting.

Action

- * Signs will be erected on access tracks, a short distance from boundaries, identifying the reserve's status and informing visitors that shooting is prohibited.

4.3.2 Research

Because of its isolation, little research has been carried out in the nature reserve other than archaeological and wildlife survey by the National Parks and Wildlife

Service and hydrological investigations by the Department of Land and Water Conservation. Further research, particularly ongoing monitoring of waterbird breeding, is needed to improve understanding of the management needs of the reserve. Some important research topics are listed in earlier sections of the plan.

The reserve has high potential for student or other research into Aboriginal use, wetland ecology and the biology of a number of native plant and animal species. It is primarily in a natural condition, has relatively regular waterbird breeding events and contains diverse and extensive Aboriginal sites.

Policy

- * Narran Lake Nature Reserve will be available for appropriate research.
- * Research will be managed to ensure that environmental impact and conflicts with natural and cultural values are minimised.
- * All research into Aboriginal heritage will be carried out with appropriate liaison and full consultation with the Aboriginal community.
- * Researchers will be encouraged to design programs to provide information which is of direct benefit to management.
- * Close liaison will be maintained with researchers to obtain as much mutual information and assistance as possible. The results of research will be required to be provided to the reserve managers.
- * Bird watchers will be encouraged to provide species lists and other observations to the Service.

Action

- * A prospectus will be prepared as a guide to priority research projects in the reserve for use by students and other researchers.

4.3.3 Management Operations

Management operations on the nature reserve

As discussed in earlier sections there is a network of tracks in the reserve created prior to reservation. Some of these tracks are unsuitable for use following wet weather except by light vehicles such as 4WD motorcycles.

Boundary fencing around the reserve, particularly in flooded areas, requires regular maintenance and the Service assists by provision of fencing materials where possible. Internal fences are not needed.

A number of tanks and wells, most in poor condition, are located in the reserve. These do not have management value as fire control is carried out by dry methods. Native animals are adapted to natural conditions and do not need the water storages. Water storages may, however, support pig populations, which rely on regular access to water. For these reasons, the tanks and wells will not be maintained. The closure of ground tanks is an important means of controlling feral animals in the park, in particular rabbits and goats. The removal of artificial watering points on the park should also reduce the population of kangaroos in the moderate to long term.

Management of area not yet gazetted as nature reserve

As stated in section 2.2.2, that part of Lumeah not dedicated as nature reserve because of high mineral prospectivity has high conservation value and is regarded as a sensitive area. Any mining activity could impact upon the area's natural and cultural integrity.

Policy

- * Fencing assistance will be provided for boundary fences when resources are available.
- * Close liaison will be maintained with reserve neighbours to deal with matters of mutual concern.
- * Tanks, wells and internal fences will not be maintained.
- * Only light vehicles such as 4WD motorcycles will be used on wetland tracks during wet periods.
- * The Service recognises the high conservation value of Lumeah and will continue to manage Lumeah as an integral part of Narran Lake Nature Reserve. The Service aims to maintain the natural and cultural heritage values, particularly in relation to the conservation of native plant and animal communities and protection of cultural sites.
- * The Service will continue to recommend gazettal of Lumeah as a nature reserve or pursue other suitable protection measures.

Action

- * The Service will seek to ensure protection of the area's natural and cultural values by pursuing gazettal of the entire area of Lumeah as a nature reserve through negotiation with the Department of Mineral Resources to prevent mining on Lumeah. Failing this, the Service will consider other options for protection of key values including a Voluntary Conservation Agreement.

5. 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 Service's Narrabri 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 Narran Lake 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 effect to, and that no operations shall be undertaken in relation to the nature reserve unless they are in accordance with the plan. However, 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.

As a guide to the implementation of this plan, relative priorities for identified activities are summarised below:

ACTIVITY	PLAN REF
High Priority	
* Treat noxious weeds	4.1.2
* Control introduced animals in accordance with control plan	4.1.3
* Develop and implement program for monitoring waterbird breeding	4.1.3
* Seek continued adequate inundation	4.1.4
* Prepare water management plan	4.1.4
* Create boundary fire breaks	4.1.5
* Relocate vehicle track across shell mound	4.2.1
* Initiate discussions with Aboriginal community about use and involvement in management	4.2.1
* Maintain clearings around shearing shed and boundary riders hut	4.2.2
* Erect signs on access tracks	4.3.1

Medium Priority

- * Prepare weed control program 4.1.2
- * Undertake research into fire response and Aboriginal burning 4.1.5
- * Undertake ecological burns 4.1.5
- * Prepare fire management plan 4.1.5
- * Survey and record Aboriginal sites 4.2.1
- * Stabilise significant Aboriginal sites where necessary 4.2.1
- * Continue to record Aboriginal traditional knowledge 4.2.1
- * Record historic features 4.2.2
- * Assess historical significance and develop management strategy for boundary riders hut, shearing shed and yards, determine use of possible timber mill 4.2.2
- * Prepare research prospectus 4.3.2
- * Pursue dedication of Lumeah 4.3.3

Low Priority

- * Monitor, and if necessary treat, erosion 4.1.1

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