

**LAKE INNES NATURE RESERVE  
PLAN OF MANAGEMENT**

**NSW National Parks and Wildlife Service**

**November, 1999**

This plan of management was adopted by the Minister for the Environment on 23 November 1999.

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## FOREWORD

Lake Innes Nature Reserve is located on the mid-north coast of New South Wales, approximately 400 kilometres north of Sydney. It covers an area of approximately 3,510 hectares on the southern boundary of Port Macquarie.

The nature reserve contains significant natural and cultural resources. The vegetation complexes include wetlands dry heath, saltmarshes and open forests result in high species diversity.

This plan covers, in addition to the gazetted nature reserve, a section of the Lake Innes peninsula which is not yet formally gazetted as part of Lake Innes Nature Reserve. The peninsula contains the ruins of Innes House, a major historic monument to pre 1850 settlement of the region.

This plan of management proposes that diverse wildlife habitats are protected and preserved. The Innes Peninsula and the Christmas Bell Plains will be managed for species diversity and to accommodate the established Koala population. It also proposes to protect the important cultural elements associated with Innes Ruins, to facilitate the on going archaeological investigation of the site and provide an opportunity to interpret its historical significance.

The plan supports the investigation of returning Lake Innes to a freshwater system and includes guidelines on the use of the waterways as well as outlines how other sections of the reserve may be used by visitors.

It discusses the management of fire and the involvement of the community in protecting their assets from wildfire. The plan also indicates that research into endangered fauna, biological control of weeds, effects of fire and Christmas Bells will continue to be encouraged.

Bob Debus  
Minister for the Environment

## CONTENTS

	<b>page</b>
1. INTRODUCTION	1
2. MANAGEMENT CONTEXT	2
2.1 NATURE RESERVES IN NSW	2
2.2 LAKE INNES NATURE RESERVE	2
2.2.1 Location and Dedication	2
2.2.2 Importance of Lake Innes Nature Reserve	3
3. OBJECTIVES OF MANAGEMENT	6
3.1 GENERAL OBJECTIVES FOR NATURE RESERVES	6
3.2 SPECIFIC OBJECTIVES FOR LAKE INNES NATURE RESERVE	6
4. POLICIES AND FRAMEWORK FOR MANAGEMENT	7
4.1 NATURAL HERITAGE	7
4.1.1 Geology and Geomorphology	7
4.1.2 Hydrology	8
4.1.3 Native and Introduced Plants	11
4.1.4 Native and Introduced Animals	13
4.1.5 Fire Management	15
4.2 CULTURAL HERITAGE	19
4.3 USE OF THE AREA	22
4.3.1 Promotion, Interpretation and Education	23
4.3.2 Recreational Opportunities	24
4.3.3 Commercial Operations	26
4.3.4 Scientific Research	27
4.3.5 Management Operations	29
5. PLAN IMPLEMENTATION	31
SELECTED REFERENCES	34
SUMMARY MAP	35

## 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:

- \* Where a plan of management has been prepared, 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 or may refer it back to the Director-General and Advisory Council for further consideration.

Once such a plan has been adopted by the Minister, no operations may be undertaken within the nature reserve except in accordance with the plan.

Although not a requirement under the Act, a draft plan of management for Lake Innes Nature Reserve was placed on public exhibition from 3rd April to 3rd July 1998. The exhibition of the plan attracted 44 submissions which raised a total of 11 issues. All comments received were referred to the National Parks and Wildlife Advisory Council for its consideration and advice. The comments and suggestions of the Council were in turn considered by the Minister before adopting this plan of management for Lake Innes Nature Reserve.

The planning process leading to the development of this plan has involved the collection and use of information, which for reasons of document size, has not been included in the plan. For additional information or enquires on any aspect of the plan or the management of Lake Innes Nature Reserve, please contact the Service's Port Macquarie District Office at 152 Horton St, Port Macquarie or by phone on (02) 6584 2203.

## 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.

Nature reserves in New South Wales arose out of fauna reserves. Fauna reserves were first established under the Fauna Protection Act of 1948. Under the National Parks and Wildlife Act 1967, fauna reserves were reclassified as nature reserves. The 1967 Act has since been replaced by the *National Parks and Wildlife Act, 1974*.

Under the National Parks and Wildlife Act 1974, nature reserve 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. Nature reserves may also contain Aboriginal and historic heritage. They differ from national parks which include as a major objective the provision of appropriate recreation opportunities.

### 2.2 LAKE INNES NATURE RESERVE

#### 2.2.1 Location and Dedication

Lake Innes Nature Reserve is located on the mid north coast of New South Wales, approximately 400 km north of Sydney. It covers an area of approximately 3510 hectares on the outskirts of the township of Port Macquarie. The reserve is bounded by the industrial estate of Port Macquarie to the north and the village of Lake Cathie to the south. The Lake Cathie road bounds the reserve to the east and the western edge of Lake Innes generally forms the western boundary. The nature reserve includes the beds of Lake Innes and Lake Cathie.

The area around Lake Innes was originally part of a land grant to Major Innes in 1830. It was reserved for drainage in March 1906 and prior to gazettal Lake Innes was a game reserve dedicated in April 1971. Lake Innes Nature Reserve was dedicated on 10 February 1984 over an area of 2900 hectares including Lake Innes, Innes Swamp and Lake Cathie. 610 hectares on the Christmas Bell Plains and Kooloonbung Creek was added in November 1985.

The Innes peninsula (422 hectares) which contains the ruins of Innes House was purchased in 1992 but will not be formally gazetted as part of the reserve until the concurrence of the Department of Mineral Resources has been granted.

### **2.2.2 Importance of Lake Innes Nature Reserve**

Lake Innes Nature Reserve is one of a number of small to moderately sized national parks and nature reserve on the mid north coast of NSW. Other regional conservation areas include Hat Head National Park (6446 ha) north of Crescent Head, Limeburners Creek Nature Reserve (9123 ha) north of the Hastings River, Sea Acres Nature Reserve (76 ha) within the township of Port Macquarie, Kattang Nature Reserve (58 ha) east of Laurieton and Crowdy Bay National Park (8005 ha) north-east of Taree. These areas protect a range of erosional and depositional landforms and related biological features which demonstrate the evolution of the coastline between the Manning and the Macleay Rivers.

The primary purpose for dedication of Lake Innes Nature Reserve was to preserve an area which contains significant biotic communities and cultural resources available for scientific research, public education and appreciation.

The reserve comprises coastal plains and wetlands. The vegetation consists of wet and dry heath, saltmarshes, open forests of *Melaleuca/Casuarina*, *Blackbutt/Tallowwood* and *Flooded Gum/Brushbox*. The pockets of rainforest provide seasonal food supply for both migratory and resident fruit-eating birds.

The terrestrial habitats support a wide range of species from all terrestrial fauna groups. 47 mammals, 231 birds, 15 reptiles and 10 frogs have been recorded in the reserve. Twenty of these species are listed on schedule 2 in the Threatened Species Conservation Act 1995 making it a highly valuable conservation resource. They included the Powerful Owl *Ninox strenua*, Yellow-bellied Glider *Petaurus australis*, Koala *Phascolarctos cinereus* and Osprey *Pandion haliaetus*.

The reserve supports a healthy population of approximately 600 Koalas. The reserve forms an important corridor linking the Port Macquarie area to the large area of State Forest to the west and ultimately to the Great Dividing Range.

The reserve is also an important corridor for species movement along the coast.

The Lake Innes area was undoubtedly an important area to the local Aboriginal people. Many of the photographs of the "Dick collection", which depict Aboriginal lifestyle, are thought to have been taken around the Lake Innes area. There are also references of Aboriginal occupation in this area in the journals of Major Innes' niece.

Innes Ruins is a major historic monument to early European settlement, the estate played a key role in the development of the region. It contains extensive archaeological resources for studying colonial architecture, gardens and farming techniques. There is also a suite of associated historic elements including the 'home farm', brick clamps and a unique convict-built road. The road traverses a swamp by way of a carefully constructed log corduroy.

Lake Innes and Lake Cathie are joined by Cathie Creek to form an estuarine system which enters the ocean at the village of Lake Cathie. Prior to 1933, when it was deliberately drained, Lake Innes was not part of the Cathie estuarine system but a separate freshwater lake. A feature of the freshwater lake was its abundant and diverse waterbird population. Although Lake Innes is no longer freshwater it supports a variety of salt tolerant bird species in a secure land tenure. Its reversion back to freshwater would enhance the waterbird habitats and provide a significant coastal freshwater habitat.

Much of the reserve is designated as Wetland No. 509 under State Environmental Planning Policy No. 14 (see map, centre pages). Wetlands not only provide wildlife habitat but play a vital role in flood mitigation, maintaining the soil and providing opportunities for recreation, enjoyment and education. The shoals and flats of Cathie Creek are important feeding habitat areas used by migratory waders. Many of these waders are protected by international treaties which Australia has entered into with Japan and China.

The location of Lake Innes Nature Reserve on the edge of the high growth centre and popular tourist destination of Port Macquarie means the reserve is a potential ecotourism resource, especially for historic, wildlife and scenic touring. The Christmas Bell Plains are popular with walkers and for photography. They support an array of heathland flowers including spectacular displays of Christmas Bells. The Lake Cathie/Port Macquarie tourist road provides excellent access in contrast to many other coastal reserves. The waterways and lake bodies are ideal sites for a variety of water-based recreational activities.



The importance of Lake Innes Nature Reserve can be summarised as:

- \* It is one of a group of national parks and nature reserves which protect important natural heritage features of the mid north coast of NSW.
- \* Much of the nature reserve is a designated under SEPP 14 as wetland.
- \* It contains one of the few major wetlands on the coast of NSW which is not affected by flood mitigation drainage schemes.
- \* Contains critical seasonal coastal food trees for the fruit eating Top-knot and White-headed Pigeons.
- \* Contains a viable population of Koalas in a healthy state.
- \* Includes Innes Ruins and associated elements which are of State and National significance.
- \* Contains the remnants of a convict built corduroy road which is a unique structure in Australia.
- \* Provides outstanding opportunities for the study of Innes Ruins.
- \* Provides accessible ecotourism opportunities near a high growth centre and popular tourist destination including bushwalking, photography, bird watching and canoeing.
- \* Provides opportunities for scientific study of coastal processes particularly in relation to geomorphology, wetlands and fauna.
- \* Subject to a decision in the future, Lake Innes could provide opportunities to study ecological succession in the process of reversion from a salt to freshwater ecosystem.

### **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:

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

#### **3.2 SPECIFIC OBJECTIVES FOR LAKE INNES NATURE RESERVE**

In addition to the above objectives, the following specific objectives apply to the management of Lake Innes Nature Reserve:

- \* to maintain the high diversity of native plant and animal species within the reserve;
- \* to maintain the water quality of the lakes and wetlands in the reserve;
- \* to provide a valuable fresh water habitat within the reserve;
- \* to maintain a viable Koala population within the reserve;
- \* to maintain a display of Christmas Bells on the Christmas Bell plains;
- \* to manage fire with the local community to protect the natural and cultural features of the reserve as well as the adjoining urban areas;
- \* to protect and interpret the Aboriginal culture of the area in association with the Birpai Local Aboriginal Land Council;
- \* to conserve the Innes Ruins and associated features and to promote the on-going study and archaeological investigation of the site; and
- \* to provide an opportunity for the public to view and understand the Innes Ruins which complements other historic features in Port Macquarie.

## **4. POLICIES AND FRAMEWORK FOR MANAGEMENT**

This chapter contains the policies and framework for the management of Lake Innes 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 will provide the framework for management of Lake Innes Nature Reserve consistent with anticipated resources available to the Service and with anticipated community trends for the next five years. Other management actions may be developed over the life span of this plan consistent with the policies set out in the plan.

### **4.1 NATURAL HERITAGE**

#### **4.1.1 Geology and Geomorphology**

Lake Innes Nature Reserve generally consists of low lying coastal plains which are composed primarily of sandy Pleistocene deposits although these have been reworked and modified by aeolian, fluvial and biotic processes. Holocene outer barrier sands of limited extent overlap the Pleistocene deposits to the east.

A low ridge running north-south forms a peninsula which intrudes Innes swamp to the east and Lake Innes to the west. The rocks of the peninsula consist of sedimentary and meta-sedimentary rocks (siltstone, sandstone, conglomerate, chert, breccia and slate) with limited outcrops of metadolerite and serpentinite. The slate possibly provided the clays used for the brick pits associated with the Innes Ruins.

Lake Innes and Innes Swamp are filled with very fine (300 micron) rounded sands and organic muds. There is immature peat in the layers. Below the alluvium there are yellow clays leading at depth to cherts and slates. It is suggested that in the recent past the sea may have flowed into Kooloonbung Creek behind the present township of Port Macquarie, into Lake Innes and on to Lake Cathie.

The serpentinite dykes which intrude the rock beds of the peninsula reach great depths in the crust and the elements associated in this assemblage are platinum, cobalt, nickel, chrome magnesium and iron. Magnesium silicate or talc is also related to serpentine in this area. There are several major faults running through this area which often act like traps for mineralisation. Consequently the Lake Innes peninsula has attracted many prospectors.

Some of these prospecting activities have resulted in mining activities. In the 1930s an iron mine was worked just north of the reserve boundary. In the 1940s and 1950s a manganese mine south of Innes Ruins produced 10,000 tonnes of ore, most of which was used in gun barrels during the war. From 1968 to 1972 Innes Star Talc Mine produced 30,000 cubic tonnes of talc which was sent to Newcastle. The mine is now flooded leaving a permanent water body. The talc and manganese mines are included in the guided tours to the Innes Ruins.

The Innes peninsula is currently subject to mineral exploration for nickel and cobalt. When the Department of Mineral Resources lift their objections to the dedication of this area it will be formally gazetted as an addition to Lake Innes Nature Reserve.

### **Policies**

- \* Research into the geology and geomorphic processes of the reserve will be encouraged.
- \* Fossicking will not be permitted in the reserve.
- \* The talc mine and manganese mine will be interpreted to visitors on guided walks.
- \* Vehicular access to the flooded talc mine will be maintained for fire fighting purposes.
- \* NPWS opposes any mining exploration or extraction in the reserve or in areas owned by the Service adjoining Lake Innes Nature Reserve.
- \* The land on the Innes peninsula will be gazetted as part of Lake Innes Nature Reserve.

#### **4.1.2 Hydrology**

The Lake Cathie/Lake Innes system forms a complex estuarine system covering 920 hectares. It includes Lake Innes, Lake Cathie and Cathie Creek. The total catchment for this system is around 100 square kilometres. Although much of the wetlands immediately surrounding Lake Innes is within the nature reserve a large portion of the catchment has been cleared for agriculture and increasingly for urban development. A general increase in residential development within the catchment will increase stormwater runoff, gross pollutants, nutrients, bacteria and particulate matter and it is essential that preventative measures are undertaken. Gross pollutant traps, sediment traps and artificial wetlands should be incorporated in future developments to ensure the water quality entering the reserve's wetlands and lakes is maintained.

Lake Innes was once the largest freshwater lake on the NSW coast. Prior to 1933 the lake was of State, if not National, significance as a coastal fresh water habitat. With permanent islands and other floating vegetation and complex margins of Melaleuca forest and reeds, the lake provided safe nesting habitat for a variety of birds.

In 1929 Albert Dick reported 8,000-10,000 Hardhead Ducks *Aythya australis* on the lake. It also supported breeding Pacific Black Ducks *Anas superciliosa*, Black Swans *Cygnus atratus*, Chestnut Teal *Anas castanea*, Australasian Shovelers *Anas rhynchos*, Eurasian Coots *Fulica atra*, Swampheens *Porphyrio porphyrio*, Black-necked Storks *Ephippiorhynchus asiaticus* and Comb-crested Jacanas *Irediparra gallinacea* prior to the saline intrusion.

In 1933, as part of a proposed land subdivision, a "drain" 6 feet wide and 1 foot deep was dug between Lake Innes and Cathie Creek. Out flowing water and subsequent tides and floods have increased the size of the drain such that it is now over 30m wide and 3m deep. The introduction of saline water and tidal water variations has resulted in extensive changes to the biology of the lake, including the loss of most of the freshwater habitat. The lake is now an established estuarine system.

As the largest freshwater body on the mid north coast, the loss of the freshwater habitat of Lake Innes is considered regionally critical. Its reversion will provide a secure permanent breeding habitat for many species of waterbird, both freshwater and salt-tolerant species, and will provide a drought refuge to those species restricted to freshwater. It will increase the available open freshwater on the mid north coast from 40 hectares to more than 700 hectares.

A freshwater lake will also result in a higher biomass of aquatic vegetation and a more complex lake margin. This in turn will lead to more species diversity, an increase in frog and turtle species and expand the food supply for microbats and birds.

Comprehensive studies were undertaken in 1994 investigating the environmental impacts of closing the lake. However more work will need to be carried out exploring the engineering, social and economic impacts of reverting the lake back to fresh water. A working party, representing all the interested parties and organisations, will be established to prepare a brief for an environmental impact statement to ensure all relevant issues are examined. Closing Lake Innes and reverting it to fresh water is a separate issue to the entrance opening and closing of the estuarine system to the sea.

The ocean entrance of the system is regularly closed by natural accretion of sand. The entrance area is a popular swimming spot and tourist attraction during holiday periods. Hastings Council have a policy of opening the entrance of the lake when the water level reaches 1.8m Australian Height Datum (ADH), in order to revitalise the water in the entrance and reduce possible localised flooding. Although the opening and entrance are outside the nature reserve boundaries, the draining can affect the breeding areas of some waterfowl contained within the reserve.

Salt tolerant and salt water bird species such as waders and shorebirds use the lake now, however breeding is extremely difficult as the water fluctuates from fresh to saline. For example a sudden increase in salinity levels following the opening and a reduction in water level of over a metre can result in high chick mortality rates for Black Swans *Cygnus atratus*.

### **Policies**

- \* The water quality of the wetlands and lakes will be protected.
- \* Further research into the impacts of catchment runoff on fringing wetlands, estuarine sediments and water quality will be encouraged.
- \* Lake Innes Nature Reserve will be protected from runoff from developments within the catchment.
- \* The reversion of Lake Innes to fresh water will be supported pending further investigation of its feasibility.

### **Actions**

- \* The Service will liaise with Hastings Council to establish runoff quality guidelines for residential developments surrounding the nature reserve and to ensure that developers construct gross pollutant traps, sediment traps or Council-approved alternatives on drainage lines leading from residential developments.
  - \* The existing water quality monitoring stations will continue to be used to check the level of pollutants in catchment sediments and runoff.
  - \* The impacts of the lake opening strategy on the physical, water quality and biological processes of the estuarine system will be assessed.
  - \* Consultation will be undertaken with Hastings Council to review the strategy for the intermittent opening of the estuarine system to the sea, taking into account environmental and social constraints, water and salinity levels and time of year.
  - \* A community education programme to limit the use of fertilisers and detergents, control soil erosion and encourage disposal of rubbish appropriately will be undertaken.
- The National Parks and Wildlife Service will prepare an Environmental Impact Statement on the proposed closure of Lake Innes.

### 4.1.3 Native and Introduced Plants

Lake Innes Nature Reserve contains extensive wetland habitats and open water totaling 3,200 hectares. Innes Swamp is fresh water and Lake Innes, Lake Cathie and Cathie Creek are estuarine systems. Fresh water wetlands within NSW have been depleted to a greater extent than estuarine communities and are significant. The wetland areas are designated under State Environmental Planning Policy 14 as Wetland No. 509.

The lower elevations (surrounding Lake Innes and Lake Cathie and Innes Swamp) supports wetlands, including sedges, rushes, reeds, salt marshes and Melaleuca and Casuarina dominated swamp forests. Innes Swamp contains sedges and rushes (*Eleocharis*, *Carex*, *Scirpus*, *Gahnia*, *Baumea* and *Restio* species). The fringes of the lakes and swamp are dominated by Melaleuca swamp forests (*M. quinquenervia*) and heath while the wetter areas support freshwater reed swamps, sedges and saline shrublands.

Freshwater vegetation originally occurred around most of Lake Innes extending inland to a distance of 1.5 kilometres. Sedges and rushes such as *Cladium procerum*, *Eleocharis equisetina*, *Baumea articulata* and a *Typha* species were originally dominant. Two species tolerant to saline conditions, the sedge *Baumea juncea* and the rush *Juncus kraussii*, presently dominate large areas of former freshwater wetland. Typical freshwater sedgeland and rushland communities are restricted to the northern end of the Lake Innes. These freshwater wetlands are of high value as waterfowl habitat.

The Christmas Bell Plains contain a mosaic of coastal heath, and heath/swamp associations. The dry/wet heath complex includes displays of Christmas Bells *Blandfordia grandiflora* which was a primary reason for its addition to Lake Innes Nature Reserve. Four research plots, each 100 square metres, were established by the National Parks and Wildlife Service to find the optimum fire regime for Christmas Bells. Three of these plots have been burnt on a three, six and nine year cycle, while the last was kept free of fire as a control. Results show that in order to optimise Christmas Bell flowers, the species diversity within the heathland is reduced. The three research plots will be managed to provide a continual display of Christmas Bells and the fourth plot will be retained as a control. The rest of the Christmas Bell Plains will be managed for its species diversity.

The higher ground of the peninsula is covered by dry sclerophyll forest. Blackbutt *Eucalyptus pilularis* is dominant with associated species including Tallowwood *E. microcorys*, Red Mahogany *E. resinifera*, Pink Bloodwood *E. intermedia* and Forest Oak *Allocasuarina torulosa*. The lower slopes and gullies display patches of wet sclerophyll forest dominated by Flooded Gum *E. grandis*, with Blackbutt, Brush Box *Tristania conferta* and Turpentine *Syncarpia glomulifera*.

There are many introduced plant species present in Lake Innes Nature Reserve. Two of these are particularly aggressive invaders of native plant communities. They are:

*Bitou Bush:* A noxious weed introduced to Australia from South Africa. This plant rapidly colonises the dunes and adjacent areas to the exclusion of all native species. It can form clumps which change the velocity of the wind causing it to accelerate either side of the plant thus leading to tussock erosion. Biological control using the Bitou Tip Moth has been trialed on the Christmas Bell Plains. Other biological control agents have been released in nearby areas and, should they prove successful, their introduction in the reserve will be encouraged. Significant infestations of Bitou Bush also occur on the Innes peninsula under existing forest cover.

*Mysore Thorn:* This plant from India was brought into Australia at Innes House in the 1830s, most likely as an ornamental garden plant. It is a barbed plant which runs rampant over existing vegetation creating an impenetrable mass. When the property was acquired it had engulfed the ruins and adjoining gullies, choking out the native vegetation. Over the past few years there has been a large effort to control the infestation and it is now limited to a few small areas. Continuing control will be required for many years to come.

Some other remnants of the exotic gardens and orchards associated with the Major Innes' estate also remain on the peninsula. The most obvious are the bamboo groves near the Innes Ruins. Garden plants such as bulbs and roses continue to bloom. A few citrus trees and a mature common olive tree indicate the location of the orchard. These exotic plants are generally restricted to the area around the Innes Ruins and are of historical horticultural value. Any non-invasive plants associated with the Innes Ruins will be retained, otherwise they will be treated as weeds (such as Mysore Thorn) and removed.

Other weeds on the reserve include patches of lantana on the peninsula and a small infestation of serrated tussock near the Innes Ruins.

## **Policies**

- \* Native plant communities will be protected and research will be encouraged.
- \* The Christmas Bell plots will continue to be managed for Christmas Bells.
- \* The rest of the reserve will be managed to maintain the diversity of habitats and species.
- \* Weeds will be controlled and where possible eliminated, with priority given to the control of Mysore Thorn.
- \* Research into biological controls for weed species will be encouraged.



## Actions

- \* A weed control plan for the reserve will be prepared.
- \* The Mysore Thorn infestation will be contained and eradicated through an on-going weed control programme.

### 4.1.4 Native and Introduced Animals

The faunal habitats of the nature reserve are diverse. There are 25 basic vegetation communities containing 117 associations. There are also areas of open water, sand shoals, shallow mudflats and exposed sand/mud flats. The diversity of habitats, their distribution and species composition make Lake Innes Nature Reserve a valuable refuge for native fauna.

A fauna survey was undertaken in 1994. It concentrated on avifauna and large mammals. There have been no detailed surveys for small mammals or micro-bats.

Forty seven mammal species, 231 species of birds, 15 species of reptiles and 10 frogs have been recorded to date. These include 20 fauna species which are listed on Schedule 2 of the Threatened Species Conservation Act 1995. Of particular interest are the Powerful Owl *Ninox strenua*, Tiger Quoll *Dasyurus maculatus* and Yellow Bellied Glider *Petaurus australis*. The first two are top order carnivores, having large home ranges, which indicates a healthy terrestrial ecosystem. Other rare and endangered species include the Koala *Phascolarctos cinereus*, Squirrel Glider *Petaurus norfolcensis*, Eastern Chestnut Mouse *Pseudomys gracilicaudatus*, Osprey *Pandion haliaetus*, Glossy-black Cockatoo *Calyptorhynchus lathami*, Black-necked Stork *Ephippiorhynchus asiaticus*, Australian Bittern *Botaurus poiciloptilus* and Mongolian Plover *Charadrius mongolus*.

Lake Innes Nature Reserve is important for many species of wading birds which use the shoals in Cathie Creek as well as Lake Innes and Lake Cathie. Some of these species are covered by international conservation agreements, particularly:

The Agreement between the Government of Australia and the Government of Japan for the Protection of Migratory Birds and Birds in Danger of Extinction and their Environment (JAMBA); and

The Agreement between the Government of Australia and the Government of the Peoples Republic of China for the Protection of Migratory Birds and their Environments (CAMBA).

Species recorded in Lake Innes Nature Reserve which are covered by these agreements include the Lesser Golden Plover *Pluvialis domonica*, Eastern Curlew *Numenius madagascariensis*, Whimbrel *Numenius phaeopus*, Bar-tailed Godwit *Limosa lapponica* and Ruddy Turnstone *Arenaria interpres*.

The reserve is identified in the Management Plan for Koalas in the Hastings Municipality as an important refuge and release site for Koalas in the Port Macquarie area. The reserve supports a large population of Koalas (approximately 600) which are in a healthy state. Almost 50% of the land area of the reserve contains Koala food trees and is most likely to be used by Koalas. Lake Innes Nature Reserve also forms an important Koala corridor between Port Macquarie and the large areas of State Forest to the south and ultimately to the escarpment to the west.

Introduced animals found in the nature reserve include Cats *Felis catus*, Foxes *Vulpes vulpes* and cattle which on occasion escape from neighbouring properties. In recent times Cane Toads *Bufo merinus* have been reported from areas bordering the reserve. Wild dogs have also been reported in the nature reserve. No trapping or baiting programmes have been undertaken to date, however a control programme for cats and foxes will be developed for the reserve.

### **Policies**

- \* Emphasis will be placed on protecting the habitats of animals listed under the Threatened Species Conservation Act and those covered by international agreements.
- \* Fauna surveys, with emphasis on small mammals and micro-bats, will be encouraged.
- \* The co-operation of adjoining land-holders and Hastings Council will be sought to ensure that wildlife corridors adjoining the nature reserve are maintained.
- \* Introduced animals will be controlled and where practicable eliminated.
- \* No domestic or other introduced animals will be allowed within the reserve.
- \* Cattle and other live stock found in the nature reserve will be impounded or removed.

## Action

- \* A feral animal control programme will be developed, with a priority on the control of foxes and cats.

### 4.1.5 Fire Management

Fire is an important factor influencing the environment of Lake Innes Nature Reserve. The correct management of fire is essential to avoid the extinction of native plant and animal species. Since European settlement of the north coast the frequency of fire has increased dramatically from that arising from Aboriginal use of the land.

A variety of fire regimes are needed to maintain natural diversity. Accordingly the management of fire should aim to provide a pattern of fires of high, moderate and low intensity, frequency and extent. Extinctions are most likely to occur when fire regimes are of a relatively fixed frequency, intensity and extent which prevails without variation.

Scientific understanding of the fire requirements for plant communities is generally more advanced than that for animals. Fire regimes will be aimed at major plant communities or particular ecosystem rather than individual species. Further scientific research will refine the optimum fire regimes but currently the ideal fire frequencies for the major plant communities in Lake Innes Nature Reserve are as follows:

- **Tall moist eucalypt forests:** A fire every ten to fifteen years is acceptable. Avoid a fire frequency that exceeds two fires in quick succession every twenty years or a high intensity fire which scorches the tree canopy more than twice every hundred years.
- **Open forest and woodlands:** A fire every five to eight years is acceptable. Avoid a fire frequency that exceeds two fires in quick succession in a five year period or an absence of fire for a thirty year period.
- **Wet and dry heath:** A fire every eight to twelve years is acceptable. Avoid a fire frequency of more than two fires in quick succession in an eight year period, three fires within a fifteen to thirty year period or an absence of fire for a thirty year period.
- **Tall shrubland, swamp forest and sedgeland communities:** Similar to wet and dry heath

These fire frequencies refer to ideal fire regimes for plant communities only, they do not account for certain social, cultural or geographical constraints which will influence and modify the way fire is managed in the reserve. The reserve will be divided into management zones which will as far as possible be bounded by existing roads, management tracks, natural boundaries. Each zone will be

managed according to the resources they contain and those that surround them.

An important consideration is the need to manage the urban/bushland interface along the boundary of the reserve. The reserve borders the industrial estate of Port Macquarie to the north and the village of Lake Cathie to the south. Further developments exist between Lake Cathie and Lake Innes, and along the western side of Lake Innes and the eastern side of Lake Cathie. Future developments are expected to occur on the Innes peninsula, the north-eastern flank of Lake Innes and the western side of Lake Cathie.

This continuing urban development abutting the reserve boundary will necessitate establishing perimeter fire trails, radiation zones and, in some cases, maintaining reduced fuel levels. In the past these management strategies have seldom been situated outside reserves and parks but, in future in so far as Lake Innes NR is concerned, must be incorporated into plans for future residential or industrial subdivisions if the joint objectives of protecting property and maintaining the integrity of the nature reserve are to be achieved.

Approximately 80% of the nature reserve is designated wetland or open water. Because most of the perimeter of the reserve is common with the wetland boundaries it is often difficult to contain fires within the reserve. Although every effort will be made to contain fires within the reserve, fire control lines will be developed with the co-operation of adjoining property owners.

Certain ecological considerations must be taken into account. Many small mammals and most birds breed in spring and summer and are vulnerable to fire during this crucial period. Koalas using the reserve are prone to high intensity widespread fires.

The reserve contains important cultural resources which further complicates fire management. The Innes Ruins consist of a complex of historic elements which are scattered over the Innes peninsula. Fire has been largely responsible for degrading these historically significant resources. Future fires can further damage the main complex, Home Farm and other outlying structures. Of particular concern is the convict-built corduroy road which traverses Innes Swamp. Fire has badly affected the corduroy's structure which is imbedded in peat soils and it remains prone to future fires.

The Service is a member of a committee established under Section 52(1) of the Rural Fires Act 1997 which is responsible for the preparation of fire operational plans and bush fire risk plans for each council area. In addition, a Fire Management Plan for the reserve is being drafted and will be available for public comment. This Fire Management Plan will form part of the input into the Operational and Fire Risk Management Plan for the Hastings Council area.

The primary objectives for the Fire Management Plan of Lake Innes Nature Reserve are as follows:

- to protect life and property within and adjoining the reserve;

- to maintain species and community biodiversity;
- to aim for a fire regime which creates a mosaic of communities with different ages and structures;
- to protect the important cultural resources associated with Innes Ruins;
- to work with neighbours and other organisations, particularly the local bush fire brigades, in managing fire;
- to raise community awareness of fire management and enlist their support to establish an ecologically acceptable fire regime for the reserve; and
- to ensure that fire management strategies are considered and incorporated into future residential development bordering the reserve;

Strategies that will be developed in the Fire Management Plan will include:

- Developing fuel reduction areas and fire management zones to protect major plant communities and cultural features from un-scheduled fires.
- Developing fire management zones for asset protection and to protect adjoining industrial, rural and residential developments.
- Maintaining reduced fuel levels in strategic locations including areas north of Lake Cathie village and the industrial estate of Port Macquarie to assist in the protection of community assets.
- Liaising with Council's Fire Control Officer to ensure that fire management is included in future developments that neighbour the reserve.
- Retaining essential fire trails in the reserve to the east of Lake Innes and expand the perimeter fire trail system on the western side of Lake Innes and Lake Cathie as urbanisation increases.
- Rationalising the existing fire trail system within the reserve.
- Implementing "Community Fire Guard" programmes in the Lake Innes Drive area, and the isolated properties west and south of Lake Cathie to assist the community in protecting their assets from wildfire.
- Managing where possible low fire intensities on the Innes peninsula and Christmas Bell Plains where stands of wet and dry sclerophyll forests exist to reduce impacts on arboreal mammals.
- Promoting research to determine the ecological effects of fire on heathland communities and koala populations.

## **Policies**

- \* Fire in Lake Innes Nature Reserve will be managed in accordance with the Section 52(1) Plan, the District Fire Action Plan, the reserve's Fire Management Plan and this plan of management.

- \* Wherever practical, wildfires within the reserve will be suppressed in order to avoid an unacceptable fire regime.
- \* Liaison will be maintained and co-operative strategies developed with local bush fire brigades, local government agencies and neighbours to ensure a co-ordinated approach to fire management within the nature reserve and on adjoining lands.
- \* An education program will be implemented to raise community awareness of the importance of establishing an ecologically acceptable fire regime for Lake Innes Nature Reserve.
- \* Research into fire behaviour, fire hazard, and the impact of fire on the reserve's plant and animal communities will be encouraged.
- \* The fire trail system within the reserve will be reviewed as part of the Fire Management Plan.
- \* New tracks may be constructed for fire management or control operations. All new tracks constructed for emergency operations will be closed and rehabilitated as soon as possible after the fire.
- \* The Christmas Bell Plains will be managed for species diversity with the exception of the Christmas Bell plots. The three burn plots will be managed for Christmas Bell displays and the control plot will be left unburnt.
- \* A fuel management plan will be developed which protects the Koala habitat.
- \* Liaison will be undertaken with Hastings Council to ensure that fire advantage lines are incorporated into all future neighbouring developments.
- \* Fire will be used as a management tool to control fuel levels.
- \* Fires will be kept out of the Innes Ruins precinct and from near the corduroy road.
- \* No fire places will be provided in the reserve and fires will not be allowed for recreational purposes.

### **Actions**

- \* A fire management plan for the reserve has been prepared and will be placed on public exhibition in 1999.
- \* A fuel reduction zone will be established north of Lake Cathie village.

- \* Community Fire Guard training will be undertaken.
- \* A system of fire trails will be developed and maintained around the Innes Ruins and along the peninsula.
- \* Fire reduction lines along the western boundary of the reserve will be established with the agreement of the neighbours.

## 4.2 CULTURAL HERITAGE

The region around Lake Innes was used by the local Aborigines for thousands of years. There are numerous camp sites and middens along the coast line, two of which are contained in the reserve. The huge number of waterfowl attracted to Lake Innes while fresh water would have been a major food resource for the Birpai Aboriginal people. The Thomas Dick photos (taken in the 1920s) depict life and activities of the Birpai people in the Hasting valley. Some of these photos have been confirmed as being taken within Lake Innes Nature Reserve. Annabella Boswell, the niece of Major Innes, kept a diary detailing the day to day events of life on the Innes estate. Her journal also confirms that Aborigines were present on the estate and reports them burning along the western side of the lake.

Lake Innes Nature Reserve contains a major historical monument to the pre-1850 period of European settlement in Australia. Innes House was a large rambling estate built by Major Archibald Innes who played a key role in the development of the Port Macquarie and the New England regions. Lake Innes House was an important social centre on the edge of the Port Macquarie settlement. The large colonial mansion was built between 1831 and 1840. The walls are of handmade sandstock bricks, made nearby by convict labour. It includes a substantial stable complex of 20 rooms around a central courtyard.

Innes Ruins provides an extensive archaeological resource for the study of Australian architecture, gardening, farming history and 19th century domestic arrangements. A valuable insight into day to day life is gained through the historic account in Annabella Boswell's journal.

The peninsula contains a number of associated elements including outbuildings, the home farm and the convict-built corduroy road across Innes Swamp. Recent archaeological investigations have revealed other buildings, footings, brick clamps, refuse dumps and paved areas. Other remains likely to be uncovered include fence lines, cultivation patterns, brick foundations, road formations, drains, quarry sites and further brick clamps.

In 1987 a conservation analysis and draft conservation policy was produced which outlined management strategies for the site. This document has been the basis for management of the site. It needs however to be reviewed and updated in the light of recent research and this plan of management.

In 1993-94 the main building and stable complex underwent stabilisation work including re-pointing of the brickwork, capping of the walls and stabilising of doorways and wall sections. Further stabilisation works are required to both protect the fabric of the buildings and to ensure public safety. The ruins are an attraction to the local community and there is pressure to open the site to the public.

The main complex is prone to damage by large Flooded Gums which have encroached into the area within the building alignment. These trees have affected the building's foundations and can shed limbs which damage the brickwork.

The remains of Lake Innes House have been studied by historians and archaeologists but it is only recently that a detailed archaeological survey has been undertaken. This has been undertaken by senior students of the Department of Archaeology and Palaeoanthropology at the University of New England. Continuing work will be monitored and proposals for further work will be evaluated on the basis of its value for assisting conservation and interpretation of the site.

Home Farm, which is on the point of the peninsula, requires further investigation and protection measures to ensure its survival. The extent of the site is uncertain and will be revealed with further studies and surveys. The site is prone to fire and is compromised by an existing fire trail which comes extremely close to the brick work. It also provides access to the corduroy road.

The convict-built corduroy road, constructed in 1836, is a unique structure in Australia. It was part of a road which traversed Innes Swamp and continued across the Christmas Bell Plains to the coast. The wide drains on either side of the road through the sand plains are still evident. The section through the Melaleuca swamp is mostly imbedded in peat, which has been affected by fires over the years destroying much of the corduroy's structure. The section on the eastern side of the swamp is however largely intact. Due to the fragile nature of the landscape and vegetation, it is not possible or desirable to re-construct an access way from the Christmas Bell Plains to the peninsula.

Since the turn of the century the area has been subject to mining and logging activities. The evidence of the talc and manganese mining on the peninsula is easily recognised. The area where sand mining occurred on the Christmas Bell Plains near the Lake Cathie road has been regenerated. Logging was extensive in the 1960s however there are no known archaeological remains of this activity within the reserve. Two large clearings exist near the ruins which were established for agricultural pursuits in the 1970s.

## **Policies**

- \* Aboriginal archaeological surveys and assessments of Aboriginal cultural values and history will be encouraged.



- \* The Birpai Local Aboriginal Land Council (and local Aboriginal communities) will be consulted regarding conservation management of Aboriginal sites within the reserve.
- \* The fabric of the Innes House complex will be stabilised and the buildings managed as a ruin.
- \* No new work or activities on the peninsula will obscure any of the historic evidence of the place.
- \* Activities within the viewshed of the ruins will not detract from its evocative historical character and will be restricted to public walkways, interpretive signs, clearing of vegetation and weeds to protect the buildings, and low key access tracks for management.
- \* Any other facilities will be kept out of sight of the ruins, and constructed with minimal impact on the native vegetation.
- \* The convict-built corduroy road across Innes Swamp will be conserved.
- \* The peninsula will be systematically surveyed for further physical evidence.
- \* A program of on-going archaeological investigation, including archaeological excavation, will be established and administered by the National Parks and Wildlife Service.
- \* The public will be given access to the site through guided tours only.
- \* Regrowth of native plants and weeds within the interpretive path around the building will be controlled.
- \* A view of the lake from the house complex will be maintained.
- \* Items and artefacts removed from the site will be suitably conserved.
- \* No vehicular or pedestrian access will be permitted along the corduroy or through Innes Swamp to the peninsula.

### **Actions**

- \* The Birpai Local Aboriginal Land Council will be approached to participate in a systematic archaeological and anthropological survey of the reserve.
- \* The Conservation Analysis and Policy will be revised in the light of on-going research and this plan of management.
- \* A program of long-term archaeological investigation including excavation of Innes Ruins and associated sites will be established.

- \* All known historic elements associated with the ruins will be surveyed, described, recorded and protected.
- \* The main house structure will be stabilised and made safe for public inspection and education.
- \* The fire trail to the Home Farm will be re-routed to avoid impact on the remains of the complex.
- \* The corduroy road will be investigated and interpreted.
- \* Flooded Gums growing amongst the ruins will be removed.

### **4.3 USE OF THE AREA**

Lake Innes Nature Reserve will be managed to ensure that its use, whether by the general public, special interest groups, Service officers or other authorities is appropriate and consistent with the National Parks and Wildlife Act 1974, Service policies and the management objectives outlined in this plan of management.

The major categories of use that may be appropriate within Service areas are:

- promotion of the conservation of natural and cultural heritage;
- environmental education;
- recreation in a natural setting;
- scientific research; and
- management operation by the Service and other authorities.

The extent to which these categories of use are appropriate to Lake Innes Nature Reserve are listed in the following sections of the plan.

### 4.3.1 Promotion, Interpretation and Education

Lake Innes Nature Reserve is ideal for environmental education given its close proximity to Port Macquarie and ease of access from the tablelands and other coastal centres. The diversity of habitat in the reserve provide opportunities to study coastal plant communities, wetlands and native fauna. Extensive opportunities also exist to research the historic features contained in the reserve.

The changes which have resulted from converting Lake Innes from fresh to saline environment provide additional scope for study. This would be greatly enhanced if the lake is reverted back to a freshwater regime. This unique situation has led to Lake Innes being included as a case management summary in a Higher School Certificate geography textbook. High schools are using the site as part of their senior geography curriculum.

Regular Discovery Ranger tours are conducted to the nature reserve, including spot lighting, canoeing and bush walking activities. These guided tours are an effective way to provide the public with an opportunity to experience the natural and cultural features of the peninsula whilst ensuring their integrity is preserved. Recently the Innes Ruins has become a special attraction. Regular guided tours have proved popular and 1,800 people have visited the ruins over the past three years.

Public access to the Innes Ruins will only be provided by way of guided tour. Guided tours to the site will ensure that public safety is optimised and that the protection of the fragile fabric of the buildings is ensured. Controlled visitation to the site will also minimise the amount of vandalism and unauthorised removal of artefacts.

An interpretive brochure for Innes Ruins has been developed along with interpretive signs on-site. However no general interpretive material has been produced for the rest of the nature reserve. Where resources allow interpretive material will be produced which highlights the importance of the reserve in its regional context, its significance for conservation of native plants and animals, the appropriate recreational use of the reserve and effective management techniques. The Christmas Bell Plains is a high priority for both directional and interpretive signs.

Lake Innes Nature Reserve complements other areas close to Port Macquarie such as Macquarie Nature Reserve and Seas Acres Nature Reserve. In combination with these area Lake Innes Nature Reserve can offer a unique educational opportunity. The outstanding natural and cultural features of these nature reserves and their setting within the township of Port Macquarie provides an unusual juxtaposition worthy of interpretation.

## Policies

- \* The nature reserve will be promoted as an area for the study of coastal plants, wetlands and European history within the Port Macquarie area.
- \* Environmental education groups, particularly school groups studying the hydrology of the lake, will be encouraged to use the nature reserve.
- \* Guided educational tours will be permitted under licence or will be carried out by Service staff through the Discovery programme.

## Actions

- \* A range of information including brochures and broadsheets will be developed to help people understand and appreciate Lake Innes Nature Reserve.
- \* All commercial operators conducting tours on the reserve will be licensed.
- \* Directional and information signs on the Christmas Bell Plains will be developed and installed.

### 4.3.2 Recreational Opportunities

Lake Innes Nature Reserve was proclaimed over an area that has been used for recreation by locals since the 1950s. The lakes and waterways were used for fishing and boating. The peninsula was a popular picnic destination and the flooded talc mine was used as a swimming hole.

The waterways are still popular for recreation and the spectacular Christmas Bells attract bushwalkers, sightseers and photographers to the Christmas Bells Plains.

The Perch Hole is a popular fishing spot, particularly when the prawns are running. Unregulated use of the foreshore has resulted in a maze of badly eroded tracks. The Perch Hole track has recently been gravelled and vehicles will be restricted to it. All other tracks around the Perch Hole will be closed and rehabilitated. A small car park will be provided at the Perch Hole and day facilities (tables only) will be provided if demand warrants. Access for low impact recreation use of the lake will be investigated as part of the environmental impact statement on the proposed reversion of the lake to fresh water (see section 4.1.2).

The level of visitation to the Innes Ruins will require certain basic visitor facilities to be provided. A toilet, water tank and picnic tables will be provided near the ruins. No other facilities will be provided due to the relatively small size of the reserve and its close proximity to Port Macquarie where adequate visitor facilities are available.

A range of camping facilities are provided in nearby towns and in other Service areas such as Limeburners Creek Nature Reserve. Camping will not be permitted in Lake Innes Nature Reserve.

Power boats and non-powered craft have access to the lake system at present. There are no restrictions on size and type of craft. Lake Innes is shallow (less than two metres in depth), and is unsuitable for boats with large horse power motors or jet skis which churn up the sediments. The lake is better suited to non-powered craft or small, electric powered runabouts which do not disturb the environment or other users. Should Lake Innes become fresh water, vessels will be restricted to power craft with electric outboards and non-powered craft.

There is a system of management tracks across the Christmas Bell Plains. These are important for fire management but are also popular for bushwalking. They will be regularly maintained and gates will be installed closing them to recreational vehicles. The track to the Perch Hole will be left open to the public.

The management tracks across the Christmas Bell Plains could form part of the Gogik Heritage Walking Track, proposed by local residents and supported by the Local Aboriginal Land Council, a coastal walking track linking Laurieton and Port Macquarie via Lake Cathie, the Christmas Bell Plains and Kooloonbung Creek. Such a proposal offers opportunities to interpret the Christmas Bell plots, the Koala corridor and the convict-built corduroy. If the route is along the existing management tracks, the impact would be minimal. Investigation into the feasibility of this concept will be undertaken. The connection between Kooloonbung Creek Nature Park and the fire trails on the Christmas Bell Plains will need to be developed. The proposed route is along the eastern bank of Kooloonbung Creek subject to appropriate environmental assessment.

Horse riding is an acceptable form of recreation in some areas however horse riding is not permitted in nature reserves under general Service policies. Horses have the potential to cause unacceptable impacts such as initiating or contributing to soil erosion, particularly in a coastal environment, and the introduction of weeds. The riding of horses on walking tracks can have undesirable and unacceptable social impacts by diminishing walkers' enjoyment of the reserve. There is evidence of horses using the peninsula at present.

## **Policies**

- \* Camping and fires will not be permitted within Lake Innes Nature Reserve.
- \* Only limited visitor facilities will be provided in the reserve. Picnic facilities may be provided at Innes Ruins and the Perch Hole.
- \* Vehicles will only be permitted on the designated vehicle access system outlined on the map unless otherwise authorised for emergency, management or licensed commercial purposes.

- \* The impacts of visitor use will be monitored. Activities will be prohibited if unacceptable damage is found to be occurring or conflict with other users.
- \* Horse riding will not be permitted in Lake Innes Nature Reserve.
- \* The feasibility of establishing the Goojik Heritage Walking Track through the reserve will be investigated.
- \* No speed boats or jet skis will be permitted on the waterways.
- \* Only non-powered craft or vessels with small electric outboards will be allowed on Lake Innes if it reverts to a fresh water system.

### **Actions**

- \* Bollards will be installed along the Perch Hole track to restrict vehicles to the track and a small parking area established at the Perch Hole.
- \* The provision of picnic tables at the Perch Hole will be investigated.
- \* Gates will be installed on all tracks on the Christmas Bell Plains with the exception of the Perch Hole track and the Cathie Village track.
- \* A composting toilet, water tank and picnic tables will be installed in a clearing near the Innes Ruins subject to appropriate environmental investigation.
- \* Negotiations with the Waterways Authority will be undertaken to institute a 4 knot speed limit and a 15 horsepower outboard limit for Lake Innes while it is an estuarine system.

### **4.3.3 Commercial Opportunities**

There are a number of existing commercial activities undertaken in the nature reserve, including water craft operation and canoe safaris. These tours are based in the village of Lake Cathie and are carried out by a commercial operator under a licence from the Service. Any commercial activities will be under licence and will be appropriate to the management objectives outlined in this plan.

Lake Innes and Cathie Creek are used for a small scale commercial fishing operation. About 15 licensed fishermen use the lake depending on the season and entrance conditions. These fishermen mesh net for bream, mullet, flathead, whiting and tailor. Other activities are prawn hauling for school prawns, pocket hauling for blue swimmer crabs and catching mud and mangrove crabs with crab and eel traps.

Lake Innes is viewed by NSW Fisheries as an important breeding area for juvenile fish and prawns. It may also offer calm waters for fish sheltering from rough sea conditions when the entrance is open and is used by the commercial fishermen when coastal conditions are too rough.

### **Policies**

- \* All commercial activities will be consistent with the management objectives of the reserve and be carried out under licence with the Service.
- \* Liaison with NSW Fisheries, NSW Waterways and commercial operators will be undertaken to determine management of commercial activities on the waterways.

### **4.3.4 Scientific Research**

The purpose of scientific study is to improve the Service's understanding of its natural and cultural heritage and the processes which affect them. Research will also establish the requirements for the management of particular species. Data and findings from research studies and surveys will be utilised in reserve management.

Recent research undertaken in Lake Innes Nature Reserve has included general vegetation surveys and fauna surveys. Specific studies include:

#### **Lake Innes Koala Study:**

Following a wildfire event in 1994, 99 Koalas were transported to the Koala Hospital in Port Macquarie. This removal of almost the entire population for the Christmas Bell Plains presented the opportunity to study the health and behaviour Koalas recolonising an area after fires. The study aimed to document their ranging behaviour after fire and monitor their health and survival rates following rehabilitation.

#### **Christmas Bell Plots:**

A long term study by NPWS is continuing into optimum fire regimes for Christmas Bells. The study will also provide insights into ideal fire frequencies for heath communities and how to optimise species diversity. The study is showing that the ideal fire regime for Christmas Bells would significantly reduce species diversity and viable wildlife habitats in the surrounding heath.

### **Archaeological Investigation:**

The remains of Lake Innes House have previously been studied by both historians and architects, but it is only recently that a detailed archaeological survey has been undertaken at the site. Senior students of the Department of Archaeology and Palaeoanthropology at the University of New England, under the direction of Professor Graham Connah have recorded detailed evidence of visible remains prior to undertaking any excavations. The on-going investigation not only provides important information on this site of national significance but can form an important part of the university's curriculum. Formal arrangements to continue this investigation will be pursued with interested universities.

### **Mysore Thorn Eradication:**

Mysore Thorn was first introduced into Australia at Lake Innes. The barbed Mysore Thorn, which originally came from India, has engulfed the ruins and choked up the surrounding gullies. Little is known on how best to control it, how the seeds are dispersed or how long they remain viable. A comprehensive eradication programme began in 1994 when the ruins and surrounding gullies were cleared of Mysore Thorn. Follow up work has continued and the area has been divided into units where various eradication methods will be trialed.

### **Policies**

- \* All research will be subject to Service policies and procedures for the granting of permits, conduct of research and the production of results.
- \* Research applications will be granted where:
  - the research has the potential to facilitate the better management of the reserve; and
  - the research does not conflict with the objectives and policies in this plan of management.

### **Action**

- \* 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:
  - habitat requirement for threatened species;
  - biological control of introduced plants;
  - survey of Aboriginal sites and historic sites;
  - base line data in the event of Lake Innes' reversion;
  - the ecological significance of fire in the reserve;
  - the impact on aquatic environments of acidic runoff resulting from peat fires; and
  - small mammal surveys.



### 4.3.5 Management Operations

There are a number of management tracks in Lake Innes Nature Reserve (see map, centre pages). The primary purpose of the management track system is for fire management, but these tracks are also important for other essential management operations such as weed control and research. The management tracks in Lake Innes Nature Reserve also form an important component of the reserve's walking track system. Those tracks which no longer serve a useful purpose for management or are not of historic significance will be closed and rehabilitated.

The old garbage tip on the Christmas Bell Plains has been closed for some years. There are weed infestations at the site of the old tip as well as exposed car bodies. The site requires further rehabilitation and a weed control programme.

There are a number of drainage canals in the northern end of the reserve behind the industrial estate of Port Macquarie. These drains were established prior to the dedication of the reserve and are maintained by the local council for flood mitigation. Some of these drains serve as useful control lines for fire management. Liaison with the council to maintain this system of flood mitigation channels will continue.

The proposed ring road for Port Macquarie is planned to cross a narrow section of the reserve. The proposed road would cross Kooloonbung Creek near Lake Road. This area is an important wildlife corridor which facilitates Koala and other fauna movements between the township of Port Macquarie and the nature reserve.

There are a number of easements through the reserve including water mains, powerlines and sewage. All these easements are concentrated in the northern end of the reserve. All existing easements will be formalised, as will the proposed road. No other easements will be permitted in the reserve unless they have a direct benefit to the reserve.

The Port Macquarie District Depot and workshop is situated at the end of Blackbutt road in the industrial estate of Port Macquarie. It lies within the boundaries of Lake Innes Nature Reserve. The two hectare compound is bounded by the industrial estate to the north, a canal to the south-west and a wetland to the east. The compound contains a marine mammal grave yard. There will be no expansion of the compound and any additional buildings will be located within the existing clearing.

### Policies

- \* No further easements or canals or other non-Service facilities will be allowed in the reserve unless they benefit the management of the reserve.

- \* Council will be allowed to maintain the flood mitigation channels behind the industrial estate in accordance with the proper environmental investigations.
- \* There will be no expansion of the workshop compound area.

**Actions**

- \* The network of management tracks shown on the map (centre pages) will be maintained. All others will be closed and rehabilitated.
- \* A rehabilitation plan for the old tip will be developed and implemented.

## 5. PLAN IMPLEMENTATION

The 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 programmes, and strategic planning at corporate, regional and district levels.

The orderly implementation of this plan will be undertaken within the annual programmes of the Service's Port Macquarie 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 programmes are subject to ongoing review, within which works and other activities carried out at Lake Innes 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 orderly implementation of this plan, relative priorities for identified activities are summarised below:

<b>Activity</b>	<b>reference (in plan)</b>
<b>HIGH PRIORITY</b>	
Liaison will be undertaken with Council in regard to establishing water quality guidelines for developments in the catchment	4.1.2
An EIS into the closure of Lake Innes will be undertaken	4.1.2
A weed control plan for reserve will be prepared	4.1.3
The Mysore Thorn infestation will be contained by continuing the control programme	4.1.3
A Fire Management Plan will be prepared	4.1.5

**HIGH PRIORITY (continued)**

A system of fire trails will be formalised and maintained around the Innes Ruins and along the peninsula	4.1.5
Fire advantage lines will be established along the western boundary	4.1.5
The main house structure will be stabilised and made safe for public enjoyment	4.2
Directional and interpretive signs will be installed on the Christmas Bell Plains	4.3.1
Bollards will be installed along the Perch Hole track and a small carpark established at the Perch Hole	4.3.2
Gates will be installed on all fire trails	4.3.2

**MEDIUM PRIORITY**

The impacts of the lake opening strategy will be assessed and the strategy reviewed	4.1.2
The water quality monitoring programme will be continued	4.1.2
A community education programme re run-off will be developed	4.1.2
A feral animal control programme will be developed and implemented	4.1.4
A fuel management zone will be established north of Lake Cathie village	4.15
Community Fire Guard training will be undertaken	4.1.5
All known historic elements associated with the Innes estate will be surveyed and described	4.2
A long-term archaeological programme to study the Innes Ruins will be developed	4.2
The flooded gums amongst Innes Ruins will be removed	4.2
The fire trail to Home Farm will be re-routed to avoid impact on the remains of the complex	4.2
Licenses for all guided educational tours will be implemented	4.3.1

**MEDIUM PRIORITY (continued)**

A composting toilet, water tank and picnic tables will be installed near the Innes Ruins	4.3.2
A prospectus for research will be prepared	4.3.4
Management tracks no longer required will be closed and rehabilitated	4.3.5
A rehabilitation plan for the old tip will be developed and implemented	4.3.5

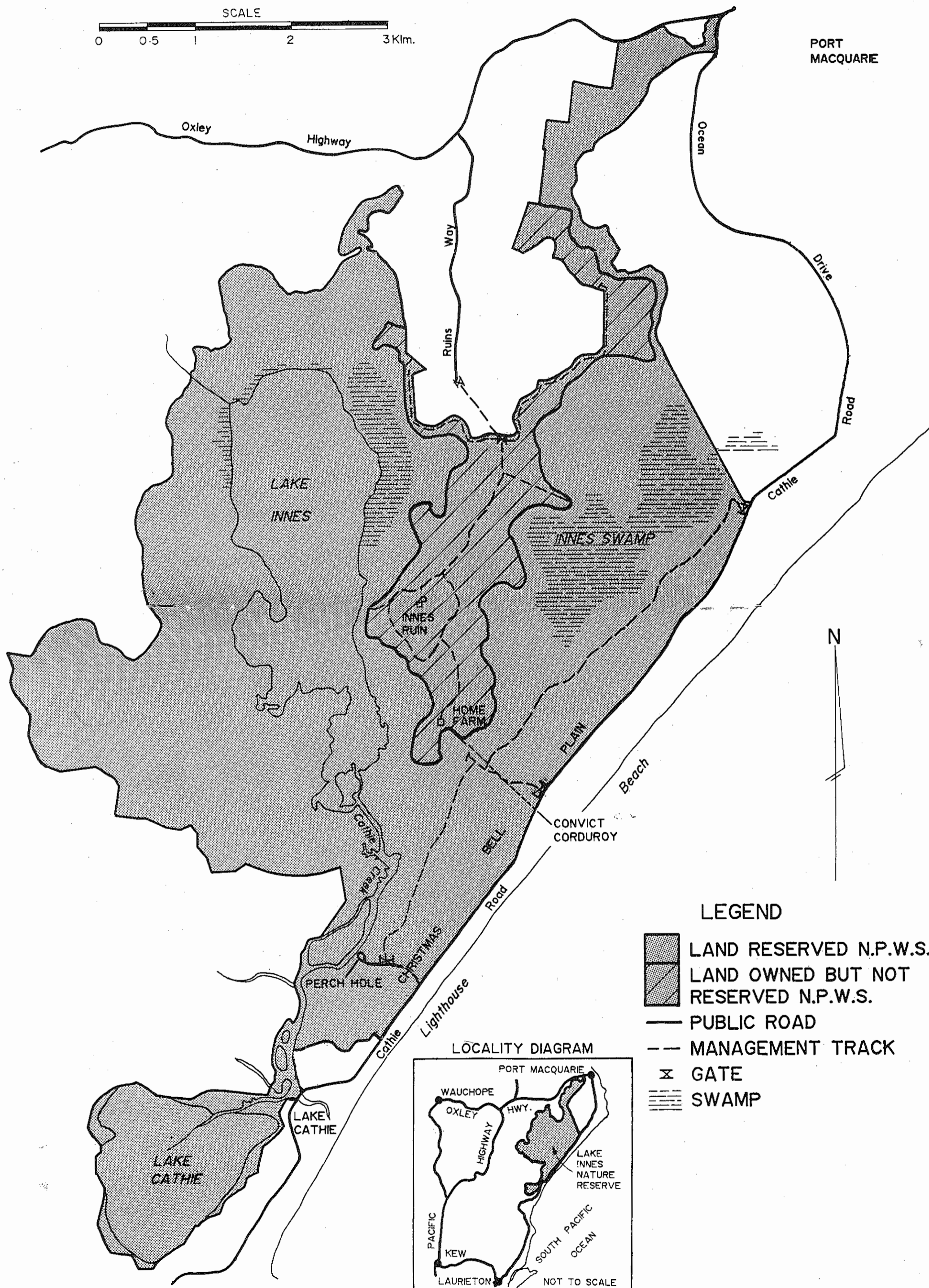
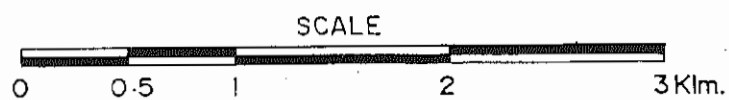
**LOW PRIORITY**

The impacts of the opening strategy will be monitored	4.1.2
The Birpai community will be approached regarding surveys in the reserve	4.2
The Conservation Analysis and Policy will be revised and formally adopted	4.2
The eastern section of the corduroy will be investigated and interpreted	4.2
Information brochures will be developed	4.3.1
Provision of picnic tables at the Perch Hole will be investigated	4.3.2
Negotiations will be undertaken with Waterways to institute speed and power limits on the lake	4.3.2
A prospectus will be prepared as a guide to research	4.3.4

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





# LAKE INNES NATURE RESERVE



PORT  
MACQUARIE

N

## LEGEND

-  LAND RESERVED N.P.W.S.
-  LAND OWNED BUT NOT RESERVED N.P.W.S.
-  PUBLIC ROAD
-  MANAGEMENT TRACK
-  GATE
-  SWAMP

## LOCALITY DIAGRAM

