HASTINGS COUNCIL

Interim Draft

LAKE CATHIE/LAKE INNES

WATERWAY USERS STUDY

OCTOBER, 1997

WEBB, McKEOWN & ASSOCIATES PTY. LTD.
CONSULTING ENGINEERS
HASTINGS COUNCIL

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Prepared by: ____________________________
Verified by: ____________________________
# LAKE CATHIE/LAKE INNES

## WATERWAY USERS STUDY

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1. BACKGROUND

The Lake Cathie/Lake Innes waterway is the primary natural feature of the Lake Cathie area. Ever since Major Innes established a homestead in the area in 1832 the lakes have been an important focus of human habitation.

In 1994 Hastings Council undertook an Estuary Management Study and prepared an Estuary Management Plan for Lake Cathie/Lake Innes (WMA, 1994). The study identified a number of different waterway users and conflicting uses. The study recommended further work to clearly identify existing and potential uses of the waterway. The Management Plan also recommended preparation of a waterway users plan which would conserve the ecological and aesthetic values of the estuary, and provide for socially acceptable and ecologically sustainable use of the recreational resource.

This Waterway Users Study meets the requirements of the Estuary Management Plan (EMP) by:

- consulting with various user and control groups such as the local progress association, fishing club, professional fishers, Council and government authorities,
- identifying existing waterway and foreshore uses and demands,
- identifying and assessing the adequacy of existing user facilities and Council services,
- assessing projected demand for facilities and the constraints and opportunities effecting the provision of facilities,
- Preparation of the current stage Interim Draft report examining options for developing appropriate recreational facilities (on a local and regional basis) in conjunction with the Committee,
- assess the economic, social and environmental benefits and costs of the identified options,
- preparation of a draft plan for management of the estuaries recreational resources,
- preparation of an implementation strategy showing likely timings, costs and identifying possible funding sources,
- preparation of a monitoring program to assist manage activities.
2. CONSULTATION

2.1 General

As part of the study the Consultants met with the Lake Cathie/Lake Innes Estuary Management Committee and inspected the site with Council officers. Meetings/interviews were also held with members of other user and control groups including:

- Lake Cathie Progress Association,
- Birpai Local Aboriginal Land Council,
- Lake Cathie Fishing Club,
- Lake Cathie Tidy Towns Committee,
- Hastings River Fishermen's Co-operative,
- disabled services providers,
- identified interested residents,
- identified tourist operators,
- National Parks and Wildlife Service,
- Department of Land and Water Conservation,
- NSW Fisheries,
- NSW Tourism Commission,
- Hastings Council.

The interview process resulted in a wide range of views being expressed about existing uses and possible future uses and management of the estuary. All residents and users agreed that the lower estuary area downstream of the Ocean Drive Bridge was best kept for family oriented swimming, wading and fishing activities, and that the upstream reaches in the Lake Innes Nature Reserve were better preserved for more serious recreational fishers, commercial fishers and bushwalkers. NP&WS have recently produced a Draft Plan of Management for Lake Innes Nature Reserve which makes some provision for such uses.

There was a general belief among long term residents that fishing and prawning were better in the past, that Cathie Creek was deeper, and that the entrance stayed open for longer. The reasons given for the decline in fish stocks and water depths were generally related to commercial fishers over utilising the resources and the effect of the two bridges “stopping the flow of the water” and preventing the entrance from opening fully.

There is a widely held belief among local residents (recent and long term) that while the entrance is open the water quality is better, there are more fish and prawns, and consequently more tourists. The assumptions regarding fish stocks were not supported by regular fishers, particularly commercial fishers, nor the findings of the EMP (WMA, 1994), which reported that fish numbers were largely dependent on seasonal recruitment and fish size was likely to be greatest after the entrance had been closed for a year or more.
2.2 Community Surveys

There have been a number of "surveys" undertaken in recent years, mainly of local residents, which help identify community attitudes to recreational use of the Lakes.

A survey undertaken by the Progress Association in 1996 provided the following information:

- there were 219 responses representing 462 residents of which 58% were retired and 42% were working or students,
- of the nominated short term projects, improving pedestrian access to the beach, and upgrading the foreshore reserves/picnic areas rated very highly. Installing a noticeboard for tourists and constructing a cycleway from Port Macquarie to Laurieton also rated well, in relation to long term goals for the area, keeping Lake Cathie as a quiet village/tourist area rated very highly while controlling tourist activities was not considered important,
- with regards to use of the estuary there was a lot of support for limiting the use of power boats (particularly down stream of Ocean Drive Bridge). There was also a lot of support for providing and managing wildlife corridors. Support for more waterway patrols was split approximately equally between supporters and those who were opposed or undecided,
- in relation to development activities which may affect recreational use of the waterway, there was strong support for dredging of the estuary, widening the two bridges, and for protecting against pollution. The response to restoring Lake Innes to a freshwater system was divided, with half supporting restoration and the remainder undecided or opposed.

Another survey by the owner of the Lake Cathie Tackle Shack had eighteen responses. The survey included residents and a couple of non-residents, most of whom regularly fished in the estuary. The average length of stay at Lake Cathie was over 12 years. The main findings of the survey relating to recreational use were:

- all preferred to fish and swim in the lake when it was open,
- most thought that the length of the bridges was the cause of entrance closures,
- a significant number wanted the bridges lengthened or the estuary dredged to help keep the entrances open,
- a large majority opposed professional netting in the lakes.

Neither survey was designed specifically for determining community attitude to use of the lakes, and so it is not possible to draw firm conclusions about the full range of user options. However, a number of general conclusions can be drawn from the surveys and the interviews:

- there is widespread community support for improving facilities around the foreshores including better access and information,
- there is a desire to keep Lake Cathie as a quiet family orientated retirement/tourist destination with restrictions on power boat use downstream of the Ocean Drive Bridge,
- most residents believe that swimming and hence tourism is substantially better when the ocean entrance is open,
- to ensure the entrance remains open as often and for as long as possible residents would like the channels dredged and the bridges widened.
3. **EXISTING WATERWAY USAGE AND FACILITIES**

For the purpose of assessing existing waterway (and foreshore) usage and facilities the Lake Cathie/Lake Innes estuary has been divided into five zones (see Figure 2):

- north side lower Cathie Creek, downstream of the Ocean Drive Bridge to the ocean entrance,
- south side lower Cathie Creek, downstream of the Ocean Drive Bridge to the ocean entrance,
- upper Cathie Creek, between the bridges and the Drain,
- Lake Innes, upstream of the Drain,
- Lake Cathie, upstream of the Kenwood Drive Bridge.

### 3.1 Usage levels

The lower Cathie Creek area, downstream of the Ocean Drive Bridge, is the most intensively used part of the estuary. Usage is particularly high on weekends and during holiday periods. The main attraction is the sheltered water wading and swimming. The area provides one of the few, and probably the best, sheltered water wading/swimming areas in the Hastings region and because of this, the area has regional significance as a recreational facility.

During the warmer months the principle users are families with small children, although the elderly and people with disabilities are also significant users. Anedotal evidence (pers com. Council Officers) suggests that several hundred people can utilise the area on sunny summer Sundays and public holidays. During the cooler months usage is more evenly divided between families and elderly residents.

The upper estuary areas of Cathie Creek, Lake Innes and Lake Cathie are not nearly as well utilised as recreational resources. These areas are almost entirely within the Lake Innes Nature Reserve and their only significant uses are fishing, prawning, bush walking and bird/nature watching. During the summer holiday period over 30 small boats can reportedly be on the water, mainly in the Cathie Creek area upstream of the Ocean Drive Bridge. Even during winter there can be up to fifteen boats on the estuary, although most of these would be commercial fishers on Lake Innes.

### 3.2 Lower Cathie Creek (North)

#### 3.2.1 Asset Description

The lower Cathie Creek (north) area covers the northern entrance area downstream of the Ocean Drive Bridge, including the northern channels and beaches, as well as the Foreshore Reserve picnic area (see Figure 2 and Photographs 1 to 4).
Specific facilities include:
- over 2 ha of safe swimming area,
- over 200 m of sheltered beach area,
- over 1.5 ha of grassed open space/open forest picnic area,
- access to the ocean beach,
- a deepwater fishing area near the bridge,
- off road car parking for some 35 vehicles in Foreshore Reserve and over 100 spaces along Ocean Drive,
- toilet facilities and several garbage bins,
- a shelter shed with 6 tables,
- 6 picnic tables and chairs, and 5 electric barbecues,
- a playground area with a swing, slippery dip and several rocking horses,
- food outlets within 100 m of most parking areas.

3.2.2 Asset Assessment

The beaches are clean marine sands with sheltered pockets for all but southerly to easterly winds. Under existing conditions, shallow water extends for some distance out from the foreshore along most of Foreshore Reserve beach, making it ideal for small children but less suitable for larger children and adults. The area is not suitable for power boats because of predominant swimming/wading usage and shallow depths.

There is no dune system around the estuary foreshores. Council has recently turfed the foreshore of the Reserve, planting trees and shrubs and installing picnic tables and electric barbeque facilities. These new facilities are fairly close to the foreshore and at a lower level than some of the existing older facilities. It appears likely that this new area will be flooded as the water level rises prior to the next entrance opening. Recreational facilities around the foreshores need to be designed for the naturally large water level variations associated with the intermittently open entrance.

The grassed/open forest picnic areas are well maintained. However, there are no formed pathways in the area. Pedestrian movement is therefore either along the gravel access road, or across the grass and the sand. Significant improvements could be achieved by providing sealed/concrete pathways from the car parking and picnic areas to the beach, the toilets and the nearby shops. This would particularly facilitate access for the elderly and the disabled. Additional seating along the foreshores and near the playground would facilitate use and enjoyment of these areas.

The number of car parking spaces appears to be adequate for current usage rates. Parking in Foreshore Reserve has been formalised with log barriers but the access roads and parking bays are gravel. As a result the area is dusty and unpleasant during dry windy conditions. In the southern portion of the Reserve the parking layout could be improved to better utilise the immediate foreshores and grassed open spaces.
The toilet and picnic facilities are generally in good condition and well maintained. There are enough garbage bins for most occasions and garbage collections appear adequate.

3.3 Lower Cathie Creek (South)

3.3.1 Asset Description

The lower Cathie Creek (south) area includes the entrance channels and beaches on the southern foreshore, as well as Aqua Reserve (see Figure 2 and Photographs 5 to 8). As is common in the lower Cathie Creek area, the principle users are families with small children, although the area is also popular with elderly residents because of its accessibility.

Specific facilities include:
- over 1 ha of safe swimming area,
- some 200 m of sheltered beach area,
- a deepwater fishing area near the bridge and along parts of the foreshore,
- off road car parking for some 10 vehicles in Aqua Reserve and over 20 spaces along Aqua Crescent,
- toilet facilities and change rooms, plus a shelter shed,
- 3 picnic tables and chairs and timber barbeques,
- a small playground area with one swing,
- a sealed foreshore pathway,
- food outlets within 200 m of most of the car parking areas.

3.3.2 Asset Assessment

As with the northern area, the beaches are clean marine sands with sheltered pockets for most wind conditions. Access to the beach, although steeper than on the north side, is via formal gravel or concrete pathways from the car parking and picnic areas. The presence of a concrete pathway along part of the foreshore is particularly attractive to elderly residents and a popular location for casual recreational fishing. This pathway needs to be extended around the small pocket beach near Ocean Drive and a ramp/viewing area provided at the seaward end to facilitate access to the beach and/or a sense of arrival.

Better consideration of the natural variation in water levels needs to be given during the design of recreational facilities. This particularly applies to the level just before opening, which is above the new pathway.

The number of car parking spaces appears to be adequate for current usage rates. Parking along the Reserve has been formalised with log barriers but the parking bays are gravel and there are a number of large potholes.
The toilet and picnic facilities in the Reserve are old but in a fair condition and appear adequately maintained. Additional seating along the foreshore pathway and near the playground/pocket beach would facilitate use and enjoyment of the area. Even though the area is popular for casual and some serious recreational fishing there are no formal fishing facilities such as platforms or cleaning tables.

3.4 Upper Cathie Creek

3.4.1 Asset Description

The upper Cathie Creek area includes the channels, shallows and foreshores of Cathie Creek between the Ocean Drive and Kenwood Drive Bridges and the Drain at the entrance to Lake Innes (see Figure 1). All of the waterways and most of the foreshores are part of the Innes Nature Reserve. A small 1 ha section of the foreshore upstream of the Ocean Drive Bridge, Jabiru Reserve, is Council controlled open space backed by residential development.

Upper Cathie Creek is mainly used by recreational fishers and prawners, or by bushwalkers and bird/nature watchers. The area is also used by professional fishermen to access the Lake Innes fishery. There are three main waterway access sites (see Figure 2 and Photographs 9 to 16):

- in Jabiru Reserve some 50 m upstream of Ocean Drive Bridge,
- off Dirah Street on the edge of the Lake Innes Nature Reserve,
- at the Perch Hole in the Lake Innes Nature Reserve.

The facilities in Jabiru Reserve include a small single lane concrete ramp with informal parking for around 10 vehicles with trailers in the reserve. There is also space for at least 20 vehicles in the street alongside the Reserve. The Reserve has a large number of moderately tall trees, three picnic seats, a timber fire barbeque and a garbage bin. The ramp access road is unsealed and there are no pathways. There is a small dingy storage area at the western end of the Reserve. A paddle boat hire concession operates during the summer and Easter holiday periods.

At the two access sites within the Lake Innes Nature Reserve there are no facilities other than a gravel access road and turning area. Boat launching is via naturally compacted and graded sand banks and parking is in small areas cleared from the bush. Council/NP&WS/local residents provide a garbage cleanup and collection service which helps maintain the areas.

3.4.2 Asset Assessment

The channel along Cathie Creek is shallow and winding. Under the Ocean Drive Bridge there is a 6 m deep scour hole. Downstream of the Kenwood Drive Bridge there is also a deep scour hole. Sand from these holes, and from the ocean entrance area, has formed large shoals adjacent to Jabiru Reserve. Sand scoured from the Drain, which has grown from nothing to a channel 30 m wide and 3 m deep in 50 years, has also filled the holes and channels in the upper reaches of the...
creek. Because of the shoaling problem and the high conservation value of the area, upper Cathie Creek is not suitable for high speed motor boats.

As with the downstream area, facilities in the upper Cathie Creek area have not been designed for use when the estuary water level is nearing its opening level. As a result the ramps and parking/turning areas at all three access sites are submerged at high water levels. This situation makes launching of boats difficult. Raising the approach road at Jabiru Reserve and laying a gravel ramp at the other sites would improve access.

During the peak summer holiday period there can be over twenty vehicles with trailers parked in or near Jabiru Reserve. Under these conditions access to the ramp can be difficult. At low water levels this problem is compounded by a steep drop off at the end of the concrete ramp which makes launching and recovery more difficult.

During the busier summer period commercial fishers generally launch from the Perch Hole ramp to avoid conflicts with recreational users. The Perch Hole is also closer to the main Lake Innes fishing grounds but launching is difficult if estuary water levels are too high.

The Perch Hole and the Dirah Street access sites are also popular prawning sites during the summer holidays. Both commercial and recreational fishers net in this area, a situation which has create conflicts in the past. These activities have also on occasions been associated with heavy alcohol consumption, access damage, bonfires, littering and destruction of by-catch. There is an ongoing problem with four wheel drive vehicles leaving the designated road areas.

3.5 Lake Innes

3.5.1 Asset Description

Lake Innes estuary is entirely within the Lake Innes Nature Reserve. Water levels in the lake vary but are around 1.5 m when the entrance is open. The surface area of the lake can also change by over 100% depending on water level. The lake bed and foreshores are covered with seagrasses, salt marsh and reeds. There are also extensive areas of fringing paperbark swamps. Together these areas provide valuable aquatic/estuarine habitat for fish and birds.

The only significant developments in the area are the ruins of Innes House. These ruins are the remains of the early 19th Century farming/homestead development by Major Innes. They include buildings, structures and machinery all of which are important early European archeology. The area also contains Aboriginal sites.

Use of the area is mainly by commercial fishers and NP&WS environmental officers. The area upstream of the Drain (which connects Lake Innes to Cathie Creek), is the main commercial fishing ground in the estuary. Some recreational fishing and prawning is also undertaken near the Drain.
Ecotourism has been expanding over recent years with day canoe trips up Cathie Creek and bushwalks to the Innes ruins authorised by NP&WS during the holiday period. NP&WS have gradually been improving conditions at the ruins for tourist visits, but as yet there are no landing facilities at the site, no amenities, and the ruins are not considered safe.

3.5.2 Asset Assessment

The entrance to Lake Innes from the Drain is very shallow, a factor which inhibits most boating activity other than commercial fishers who use flat bottom boats, local knowledge and high speed to plane across the shoal. Four wheel drive vehicle access is available to the Lake via the Innes House ruins from the north. The track has at least one locked gate to prevent general public access. A small number of commercial fishers have gate keys allowing them access. These fishers moor their vessels near the ruins in season. Moorings at the ruins are rudimentary although there is a stabilised accessway across the foreshore saltmarsh.

3.6 Lake Cathie

3.6.1 Asset Description

Lake Cathie is very shallow with most of the bed above mean ocean tide level. As a result, when the entrance is open, the "lake" is mainly mud flats surrounded by saltmarsh, reeds and sedge swamps, with fringing paperbark swamps.

3.6.2 Asset Assessment

The area has no significant recreational or commercial uses. Access to the lake via the water is restricted by the narrow, shallow and low passage under the Kenwood Drive Bridge and the very shallow channel into the lake. Access to the lake by land is inhibited by the surrounding wetlands and mud flats. The area is occasionally used by trail bike riders if the mud is sufficiently dry. Because of its isolation the only significant use of the area is as a wetland habitat and wildlife area.
4. WATERWAY USAGE CONSTRAINTS AND OPPORTUNITIES

The following Chapter reviews the major constraints and opportunities to developing waterway usage in the Lake Cathie/Lake Innes estuary (see also Figure 3).

4.1 Recreational Demand

One of the principal factors affecting the provision of waterway user facilities will be the demand generated by any increase in local and regional population, and in tourism. Demand for recreational facilities will depend upon the future size of the local and regional population, and the proportion of these residents utilising the waterway. It will also depend on tourist numbers and recreational trends (such as any changes in domestic summer holiday patterns relating to family oriented sheltered waterfishing holidays).

4.1.1 Population

Based on the 1996 census the Port Macquarie region is growing at a rate of around 3% per year and the Lake Cathie/Bonnie Hills area at a rate of 4%. To accommodate this increase in population the Port Macquarie urban expansion plan has identified the area to the south west of Port Macquarie as a potential development centre. The Laurieton/Bonny Hills area has also been identified for considerable urban expansion.

The immediate Lake Cathie area has not been identified as a major urban growth centre, but some significant increase in population could result from infill development of existing areas. Further, the census shows that the population of the area is aging significantly, from an average of 39 in 1991 to 42 in 1996. The aging trend in the population is likely to increase the numbers of older residents seeking sheltered water swimming conditions.

Based on the projected regional, surrounding area and local development levels, an increase in potential local/regional use in the order of 3% per year would seem reasonable.

4.1.2 Tourism

NSW Tourism Commission figures indicate that family based holiday levels in the Port Macquarie region should increase by about 2% per year. Evidence from Hastings Council based on their marketing strategy indicates that tourism in the area will remain dominated by family based holidays, although the proportion of holidays by couples and groups without children is expected to increase.

Over recent years there has been a strong trend towards shorter and more up market holidays. This is evidenced in the popularity of short resort holidays rather than longer camping or unit style

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holidays. This trend applies to families as well as groups without children. There has also been a rapid trend towards more active adventure type holidays such as canoe trips, scuba diving, game fishing, abseiling, horse riding, etc.

Accommodation in the Lake Cathie area is directed towards the longer stay camping/holiday flat end of the market. This is the area currently showing the least growth potential. The area does have some potential for adventure holidays associated with the Lake Innes Nature Reserve and Innes House but limited use is currently being made of this resource.

Based on the available figures, it appears unlikely that there will be a significant increase in tourist visitations to the Lake Cathie area over the next few years. Therefore, based on the available population and tourism projections, and assuming recreational users of the waterway are divided approximately evenly between local/regional visitors and out of area tourists, the growth rate in users of the Lake Cathie/Lake Innes estuary is only likely to be between 1% and 2% over the coming years.

4.2 Physical Conditions

Conditions in and around the estuary are also very important constraints and opportunities for waterway use. Factors such as water quality, water depths, foreshore access, etc., all influence how, and at what level, the estuary will be utilised.

4.2.1 Water Quality/Entrance Opening

The ocean entrance to the Lake Cathie/Lake Innes estuary is often closed by the ocean beach berm which can build naturally to over 2.5 m above mean sea level. This is a common feature of small NSW estuaries with beach entrances. Because the entrance berm acts as a dam, water levels in the estuary must rise to berm level before a breakout occurs naturally. As a result, water levels in estuaries such as Lake Cathie/Lake Innes, vary over a naturally wide range. This wide range in levels complicates human use and enjoyment of the area. However, it is also an important part of the overall natural and physical environment of the estuary.

When estuary water levels rise above normal tide level, flooding of low lying foreshore areas begins. By the time levels reached 2.5 m, huge areas around Lake Cathie, Lake Innes and Innes Swamp would be flooded, and several properties along Kenwood drive would be threatened. For this reason Council has adopted a policy of opening the entrance under certain conditions up to a water level 1.8 m above mean ocean level (Figure 2 and WMA, 1995). Even at this level low lying areas around the foreshores become inundated causing nuisance flooding.

Further, the estuary is most attractive to recreational users when the entrance is open (Chapter 2). Under these conditions, the water is saline, clear and moving (slowly). After the entrance has been closed for some time the water can become stained by decaying vegetation. Further, the water
level can fall, making the water hyper saline, or more commonly can rise, making the water brackish. Both these conditions have a substantial negative impact on usage. Local accommodation providers also report that some tourists will check prior to confirming their bookings to ensure that the entrance is open (and the water quality is as required).

Council has been opening the entrance at levels less than 1.8 m since the early 1960's. The action of artificially opening the entrance at significantly lower levels than would occur naturally has increased the number of openings, probably reduced fish stocks, increased the volume of sediments entering the estuary from the ocean, and reduced the sand scoured from the entrance during breakout events (WMA, 1994).

The policy of artificially opening the entrance therefore has both positive and a negative impact on waterway and foreshore usage. There are positive impacts in terms of water quality, and foreshore accessibility and utilisation, and negative impacts in terms of fishery production (fish size and numbers), shoaling and water depths. Note, the water quality impacts are largely aesthetic, as there are very few actual human impacts and faecal contamination remains low. The water is always suitable for swimming from a public health perspective.

4.2.2 Water Depth/Levels

Water depths affect the usability of the estuary in a number of ways. Probably the most obvious impact is on navigability. However, water depths also affect the suitability of the lower estuary area for swimming and wading, and high water levels and the large natural water level variation makes the provision of facilities more difficult than would otherwise be the case.

Shoaling in the estuary is a problem, particularly in the lower estuary in the area near the bridges, and both upstream and downstream of the Drain. To provide increased waterway area and depths in the lower estuary Council dredged some 25 000 m$^3$ of sand from area adjacent to Foreshore Reserve in 1994. Subsequent entrance openings have replaced much of this sand. The areas upstream of the bridges and near the Drain are within the Lake Innes Nature Reserve. Maintenance dredging of these areas would be difficult to justify given the environmental sensitivity of the areas.

4.2.3 Foreshore Access

General public vehicle access to the waterway is limited to the lower estuary area and the two Nature Reserve boat ramps. This is because most of the estuarine foreshores are within the Lake Innes Nature Reserve and access is limited. The recently prepared Draft Lake Innes Nature Reserve Plan of Management (NP&WS, 1997) indicates that other than for the Perch Hole access road and the Dirah Street boundary road there are no proposals for general public vehicle access to the waterway through the Reserve.
As discussed in Chapter 3, the lower estuary foreshores are all public open spaces under the control of Council. Public access to these spaces is very good, with adequate open grassed areas, sandy beaches, picnic/barbeque facilities, amenities, etc. Onsite parking is also adequate for normal conditions and sufficient offsite parking is available for peak times. Note however, the standard of this parking is below the level available at other quiet water swimming areas in the region, such as at Settlement Point Park or West Port Park.

Pedestrian access around the estuary is limited by the lack of adequate pathways. Even in the lower estuary area there are very few formed paths. The one partial path along the foreshore of Aqua Reserve is incomplete and is flooded at high water levels. In the Nature Reserve there are a few informal pathways along fire trails or old access ways, but access to the estuary is often blocked by low lying boggy terrain or barriers erected by NP&WS aimed at preventing unauthorised entry to the Innes House ruins.

Boating access is limited to the three boat ramps as discussed in Chapter 3, and the dingy storage area near Jabiru Reserve. Once on the water access to the remainder of the estuary is difficult for all but very shallow draft vessels because of the limited channel depths.

The limited access to all areas other than lower Cathie Creek serves both to limit use of the study area and to preserve its heritage and the natural environment.

4.3 Bridge Impacts

4.3.1 Widening Ocean Drive Bridge

Widening Ocean Drive Bridge been proposed by many residents as a means of increasing waterway usage. The proposition is that by increasing the size of the channel under the bridge the flow of water during breakout would be greater, resulting in deeper entrance channels and a larger entrance. The larger entrance would then increase the time the entrance remains open, improving water quality and so waterway usage.

Modelling of the entrance (WMA, 1994) shows that because the channel under the bridge is very deep, it has very little impact on how fast water flows out of the entrance during a breakout. Widening the bridge would not significantly increase the volume or speed of the flow, and would not increase the size of the ocean entrance, nor the amount of sand scoured from the lower estuary area. Of far greater importance to the size of the entrance (among many other factors) is the volume of water in the estuary when breakout occurs (i.e. the water level just prior to opening), as discussed above.
4.3.2 Widening Kenwood Drive Bridge

Widening the Kenwood Drive Bridge has also been suggested by many residents as a way of increasing the size of the ocean entrance and hence improving waterway usage. Increasing the opening under the bridge would increase flows through the entrance during the critical early breakout period by around 4% (WMA, 1994). It would also increase tidal flows into and out of Lake Cathie when the entrance was open by over 100%, but because of the bed level of the Lake is so high this would have only a minor influence on total tidal flows through the ocean entrance (less than 2%).

Based on the above, widening the bridge would have some affect on entrance opening and closing processes. Quantifying the actual impact of widening the bridge on the size of the entrance would require detailed numerical modelling. However, based on water volume calculations in the Cathie Creek/Lake Cathie area the effect would be similar to increasing the entrance opening level by less than 50 mm. Further, as discussed in the EMP (WMA, 1994) increasing the opening under the bridge would adversely affect flooding along Kenwood Drive.

4.4 Lake Innes Nature Reserve

4.4.1 Nature Reserve Plan of Management

The Lake Innes Nature Reserve surrounds and includes most of the estuary. A Nature Reserve is defined under the NP&W Act as having the highest level of protection of any of the NSW national parks. The purposes of a nature reserve are to:

- care, propagate, preserve and conserve wildlife,
- care, preserve and conserve national environments and natural phenomena,
- allow the study of wildlife, natural environments and natural phenomena,
- promote the appreciation and enjoyment of wildlife, natural environments and natural phenomena.

Nature Reserves differ from other national parks in that the provision of appropriate recreational opportunities is not a major objective.

The Draft Management Plan for the Nature Reserve (NPWS, 1997) does propose as a high priority the maintenance of a system of fire trails throughout the area which would be closed to vehicular traffic but open to walkers. The Plan also proposes to close four wheel drive tracks leading from the Perch Hole road along the estuary.

One of the principal tourist/user attributes of the Nature Reserve are the Innes House ruins. These ruins provide a rare insight into early Australian colonial life, and are a major and valuable asset. Access to Innes House is to be improved under the Draft Management Plan, but only for guided tours.
4.4.2 Adventure Tours

Council and NP&WS both have a policy of encouraging adventure tours. Canoe trips up Cathie Creek to Lake Innes and the Innes ruins have been running on weekends during the school holidays for a couple of years. Indications are that such tours are becoming more popular, and could be an important part of the regional Hastings experience.

Extension of the existing day tours to include overnight camping and wildlife observations or prawning or fishing may be possible.

4.4.3 Closing Lake Innes

Prior to the 1930's Lake Innes was a freshwater lake not part of the estuary system. The Drain which now connects Lake Innes with Cathie Creek was dug in April 1933. Initially the Drain was less than 2 m wide and a metre deep. It is now 30 m wide and 3 m deep.

The Drain did not achieve the desired purpose of lowering water levels in Lake Innes and producing large areas of land for farming. As a result there have been ongoing suggestions that it be returned to a freshwater system.

Over recent years there have been several studies (Creighton, 1983), (WMA, 1994), (NP&WS, 1997) all of which support further investigation into such a move. Returning Lake Innes to a freshwater system would have a major effect on the estuary in terms of its hydrodynamics, sediment dynamics, water quality, biology and ecology. There would also be major effects on waterway usage. It would affect commercial fishing by eliminating the main fishing grounds. It would affect tourism by changing the way the estuary system operated. It could also affect tourism by providing a new tourist feature based on Innes House and the increased bird life the fresh water lake would attract.

4.5 Commercial Activities

4.5.1 Fishery Production

The productivity of the fishery is highly variable, depending on fish and prawn recruitment and growth as well as entrance conditions. However, after tourism, the fishery is currently the only other commercial use of the estuary. Commercial exploitation of the fishery results in up to 20 tonnes of fish and 15 tonnes of prawns being harvested from the estuary in good years. The size of the recreational fish and prawn catch is unknown but is likely to be significant.

There is some debate in the community as to whether more value could be achieved from the fishery if commercial fishing were banned, and the entire fishery was available to recreational users.
Excluding commercial fishing from estuary would undoubtedly increase many times the fish available for recreational anglers. This in turn would increase use of the estuary for recreational fishing.

The question as to whether or not the increase in tourism as a result of improved recreational fishing would balance the economic loss of the commercial fish catch is beyond the scope of this study. Such an assessment would need to include compensation to existing fishers for the economic loss they would suffer. It would also need to accurately assess the value of any increased tourism. Both these problems are impossible to determine without extensive research (and probably legal action).

4.5.2 Mining

Extensive aerial exploration has been undertaken in the Port Macquarie to Laurieton area using a magnetometer which maps the ground boundaries of serpentine rocks. These rocks when weathered provide concentrated accumulations of heavy metals, particularly nickel, cobalt and scandium.

Areas identified as potentially rich in metals include the Innes House area, the low hills between Innes Swamp and Lake Innes and an area south of Lake Innes. Further investigations including extensive drilling and an EIS required prior to any firm mining plans being established.

Drilling investigations would involve the clearing of vegetation on a 100 m square grid over the identified site. Such clearing could have a significant adverse effect on the Nature Reserve and on estuary water quality if erosion of the cleared accessways was not prevented. It could also have adverse impacts by facilitating the introduction of weeds and feral animals.

Assuming the deposits prove viable and all the necessary environmental and planning approvals are obtained, the actual mining operation would require the excavation of some 16 m of material and lowering of the final surface by up to 10 m.

Given that only a small part of the identified area is in close proximity to the Lake Cathie/Lake Innes system, and because of the value and sensitivity of the Lake Innes Nature Reserve, and the likely approval requirements for any mining proposal, the potential for a mining operation to adversely impact on the estuary system appears remote.
5. OPTIONS ASSESSMENT

To facilitate the assessment of a wide range of waterway uses for the Lake Cathie/Lake Innes estuary, three waterway usage options have been prepared. These options covered within reason the potential development options available for the estuary. The options include one based on existing use patterns and progressive improvements to user facilities. The other options range from changes to the existing conditions aimed at minimising human impacts by returning the estuary as far as possible back to pre 1960 (and possibly even pre 1930) conditions, through to changes based on maximising potential waterway usage through human development.

5.1 Option 1

This option has as its basis the acknowledgement that Lake Cathie/Lake Innes is a quiet retirement village area, with significant lower cost family holiday appeal, and a low key emphasis on sheltered water swimming, casual fishing, walking and family picnics. The option therefore concentrates on improving those aspects of waterway usage. The option also assumes continuation of Council's existing entrance opening strategy.

Based on the assessment of waterway and foreshore facilities in Chapter 3, one of the first requirements of this option would be to improve the planning and design of facilities to take into account the variations in water levels up to the maximum water level of 1.8 m above mean ocean level. This work would include the progressive raising of foreshore areas with high usage, to a level above the maximum water level. It would also include the provision of alternative facilities (such as pathways) where existing facilities are inundated, and the modification of existing facilities to better meet high water level conditions.

**Lower Cathie Creek**

A major element of this option would be to acknowledge the regional importance of the lower Cathie Creek area as a sheltered water swimming and picnic area, and to upgrade the existing facilities to meet this requirement. Power boating would continue to be banned from the area and occasional maintenance dredging would be required to counter the effect of the comparatively low entrance opening strategy. Proposed improvements for lower Cathie Creek north would include:

- raising the foreshore levels along Foreshore Reserve,
- reconstructing any facilities covered by landfill,
- redesign and sealing of the Foreshore Reserve car park and along Ocean Drive,
- provision of pathways through Foreshore Reserve linking the beach, the toilets, the playground, the bridge and the shops,
- additional seating and landscaping in Foreshore Reserve particularly along the foreshore and near the playground,
- "Notice board for tourist" construction of vehicle from keith mackie & partners lawrieana

Proposed improvements for lower Cathie Creek south would include:

- raising the picnic area in Aqua Reserve behind the pocket beach near Ocean Drive,
Lake Cathie/Lake Innes Waterway Users Study

- raising the walkway level along the foreshore,
- upgrading and sealing the car parking along Aqua Reserve,
- improvements to the pathways and steps in Aqua Reserve including extensions to the existing concrete pathway around the pocket beach near Ocean Drive,
- additional seating and landscaping along the foreshores of Aqua Reserve particularly near the end of the pathway,
- upgrading of the picnic facilities near the pocket beach/swing including installation of an electric barbeque near the parking area,
- providing easier waterway access ramps and small clearing tables along the Aqua Reserve rock wall (similar to those along the Settlement Point wall).

Upper Cathie Creek

Cathie Creek upstream and downstream of the Ocean Drive Bridge is an important recreational fishing and prawning area for both local and regional residents and tourists. In addition to restricting boat speeds downstream of the Perch Hole proposed improvements would include:
- raising the level of the access road and concrete ramp in Jabiru Reserve,
- erecting a sign at Jabiru Reserve and the Nature Reserve access sites notifying users of the natural occurrence of water level variations,
- upgrading the ramp at the perch Hole by providing a gravel parking area and gravel ramp,
- upgrading and sealing the access road to the concrete ramp in Jabiru Reserve but leaving the remainder of the reserve in a more natural condition,
- future extension of access locations along the Cathie Creek foreshore (possibly with access available only during holiday periods).

Lake Innes and Lake Cathie

To encourage walking and bird/nature watching activities in the Lake Innes and Lake Cathie areas a more formal system of pathways and small boat access points could be developed.
- development of a small landing structure near Innes House to facilitate adventure tourism,
- possible construction of additional pathway around the lakes.

The Lake Innes Nature Reserve Draft Plan of Management does not provide for improved waterway access to those areas of the estuary within the Nature Reserve. The Plan does provide for a fire trail/walkway along the Christmas Bell Plains, but the path is remote from the estuary. A lack of adequate access could lead to informal and unplanned tracks being developed with consequent unnecessary damage to the environment.

The estimated cost of the above works would be (around $150 000/year??) as set out in Appendix A. .......(to be expanded after comments)

5.2 Option 2

This option has been developed to meet the requirements of a section of the community which believe the estuary was in better condition in terms of providing a usable resource before human
development impacts. It is based on returning the estuary as far as possible back to pre 1960 conditions. In the extreme this would include widening the Ocean Drive Bridge, removing the Kenwood Drive Bridge and allowing lake water levels to rise to the natural breakout level up to 0.7 m and possibly over 1.2 m above Council’s current maximum level. An extension of this option back to pre 1930 conditions would include closing Lake Innes to tidal flows and restricting commercial fishing to Cathie Creek.

Under the pre 1960 conditions natural breakout scour would remove much of the existing lower estuary shoaling and encourage longer entrance openings. However, the increased breakout and tidal flows would exacerbate erosion of the Drain, causing increased sediment movement and shoaling in the upper Cathie Creek area. The higher water levels would also inundate large areas of foreshore including several properties along Kenwood Drive, much of Foreshore Reserve and Jabiru Reserve, and the wetlands and fringing paperbark swamps around Lake Cathie, Lake Innes and into Innes Swamp.

Under the pre 1930 conditions, sediment movement in upper Cathie Creek would be reduced but the high level of foreshore inundation would remain. Inundation of foreshore areas would not be a short term phenomenon because the volume of water required to raise the lake level increases as the water spreads out over the floodplain.

The environmental, social and economic cost of the extreme versions of this option would clearly be very high. A more moderate version has therefore been developed with an opening level of say 2.3 m above mean ocean level, (0.5 m above existing maximum level). Under these conditions breakout flows would still be much greater than under existing conditions, but the extent of the works required to preserve the existing waterway amenity would be much less.

The required works would include raising areas of high foreshore use above maximum water level, removing or modifying developments affected by the higher water conditions to better meet these conditions and, providing alternative high level facilities. Specific developments would include:

**Lower Cathie Creek North:**
- raising the foreshore/picnic ground level along Foreshore Reserve,
- constructing a steeper embankment/wall with access steps/ramps between the beach and the picnic area,
- reconstructing any facilities covered by landfill.

**Lower Cathie Creek South:**
- raising the picnic area in Aqua Reserve behind the pocket beach near Ocean Drive,
- providing a higher level walkway and rock bank along the foreshore,
- moving or reconstructing facilities covered by landfill or below high water level.

**Upper Cathie Creek:**
- increasing the size of the opening under the Kenwood Drive Bridge.
• raising the level of the access road and concrete ramp in Jabiru Reserve,
• moving (or demolishing) any facilities below high water level including at least one house (and possibly three) along Kenwood Drive,
• erecting a sign at Jabiru Reserve and the Nature Reserve access sites notifying users of the natural occurrence of water level variations.

Lake Innes and Lake Cathie:
• no action identified, but construction of a low levee to prevent inundation of Innes Swamp may be desirable to prevent habitat changes in that area.

This option does not include modifications to the Ocean Drive Bridge which would be very expensive and have little impact on entrance conditions. The option also does not address the effects of habitat change as a result of the intermittently higher water levels.

To provide ongoing improvements to user facilities a similar set of actions could be undertaken to those as set out in Option 1. These actions include measures such as:
• formalisation and sealing of parking areas,
• provision of pathways,
• additional picnic/barbeque facilities.

The estimated cost of the above works would be (around $300 000/year??) as set out in Appendix A. .......(to be expanded after comments)

5.3 Option 3

This option is based on maximising potential waterway usage. To achieve this objective it would be necessary to maintain the entrance in an open condition as much as possible. To do this regular dredging of the lower Cathie Creek area and the beach berm would be required. It would also be necessary to periodically dredge Cathie Creek upstream of the bridges and the shoals near the Drain.

Both the bridges would be widened, and the area upstream of the bridges could be opened to power boats. An upgraded boat launching facility would be required, at Jabiru Reserve, with improved parking and launching at the Perch Hole.

The environmental, social and economic cost of the above version of this option would clearly be beyond the financial capacity of the community and Council. A more moderate version has therefore been developed which provides for regular dredging of the entrance and the lower Cathie Creek areas prior to the summer holiday period, and widening of the Kenwood Drive Bridge. Widening of the Ocean Drive Bridge would remain as an alternative.

This option would maintain the waterway at a low level, thus avoiding the need for works to raise foreshore facilities above high water. To achieve this objective, some 50,000 m$^3$ of sand would be
dredged from the entrance area each year. To prevent beach erosion this sand would be placed on the ocean beach near the entrance.

Maintenance of a tidal entrance would encourage expansion of the Drain, and more salt tolerant species, such as mangroves, would colonise the foreshores. Seabirds would replace the ducks and swans. The fishery would become more stable (but less productive overall). To provide for the increased recreational users, commercial fishing could be prohibited on the waterway.

To provide ongoing improvements to user facilities a similar set of actions could be undertaken to those as set out in Option 1. These actions include measures such as:

- formalisation and sealing of parking areas,
- provision of pathways,
- additional picnic/barbeque facilities.

The estimated cost of the above works would be *(around $300 000/year??)* as set out in Appendix A with an additional one off cost of *(around $350 000??)* for widening the Ocean Drive Bridge. ........(to be expanded after comments)
6. DRAFT PLAN OF MANAGEMENT

6.1 Summary

6.2 Draft Management Plan

6.3 Implementation Strategy and Monitoring Program
7. REFERENCES

NPWS, 1997  Claussen E
Lake Innes Nature Reserve Draft Plan of Management
NP&WS, June 1997

WMA, 1994  Webb McKeown and Associates
Lake Cathie/Lake Innes Estuary Management Plan
Hastings Council, May 1994

WMA, 1995  Webb McKeown and Associates
Lake Cathie/Lake Innes Entrance Opening Strategy
Environmental Review
Hastings Council, July 1995
FIGURE 1
LOCALITY MAP

LEGEND
- - - LAKE INNES NATURE RESERVE

SCALE

0.4 0.8 1.1 1.6 1.0 km

PACIFIC HIGHWAY
Karkeree Creek
Swamp INNES

Lake Cathie
Dirah St
Creek
Perch Hole
The Drain

CHRISTMAS BELL PLANT
TASMAN
RAINBOW BEACH

HOBART
FIGURE 2
STUDY AREA

LAKE INNES

INNES HOUSE RUINS

LAKE INNES

PERCH HOLE

Cathie Creek

UPPER CATHIE CREEK

Kenwood Drive

Lake Cathie

Dirah St

LOWER CATHIE CK NTH

TASMAN SEA

LOWER CATHIE CK STH

LEGEND

--- LAKE INNES NATURE RESERVE

SCALE

10 20 30 40 50m
Hastings Council
Minutes of the Lake Cathie/Bonny Hills Estuary Management Sub-Committee Meeting held 7 October 1997
at the Lake Cathie Hall

PRESENT

Councillors
Paul O'Connor
Joan Wilson
Jim Roberts
Irene Johnson
Geoff Armstrong
Garry Gilbert (Chairman)
Wayne Richards

Community Representative
Community Representative
Civil Engineer
Biologist
Forester

PMQ Conservation Society
Lake Cathie Progress Association
National Parks & Wildlife Service
Dept of Land & Water Cons
NSW Fisheries

Hastings Fishermen’s Co-operative

Technical Services Manager
Environment Officer

Member for Port Macquarie (Special Guest)

Community Members (see attached list)

APOLOGIES

Resolved

That the apologies received from Brian Kerwick, Allan Taylor and Cam Cochini be accepted.

CONFIRMATION OF MINUTES

Resolved

That the Minutes of the Lake Cathie/Bonny Hills Estuary Management Sub-Committee Meeting held on 5 August 1997 be confirmed.

Page 1 of Minutes of the Hastings River Estuary Management Sub-Committee Meeting 7 October 1997
MATTERS ARISING FROM PREVIOUS MINUTES

There were no matters arising from the minutes of the meeting held on 5 August 1997.

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Item WD 1
Lake Cathie Entrance Opening Strategy

(CT/bf) W.150.35.30

Consensus

1. That Mr Oakeshott be thanked for his interest in the matter of the Lake Cathie Entrance Opening Strategy.

2. That the issues raised by community members be considered at a special meeting of the Sub-Committee, the time and place to be confirmed by the Technical Services Manager.

Sub Committee Comments

A large public gathering attended the Sub-Committee to specifically address this Item. A list of the attendees is separately attached to these minutes. Sub-Committee Chairperson, Councillor Garry Gilbert, welcomed all attendees and the Member for Port Macquarie, Mr Robert Oakeshott. Discussion of the Item commenced by way of an invitation from Garry Gilbert to the community representatives to speak on the issue of the Lake Cathie Opening Strategy. The issues raised were:

- the progress of proposals for the closing of Lake Innes
- the engagement of Webb, McKeown & Associates Pty Ltd to do the Waterway Users Study
- the impacts of Kenwood Drive bridge on the Lake Cathie estuarine processes
- natural opening of Lake Cathie versus physical openings
- the effectiveness of the recently completed rock protection and adjoining beach area work
- availability of State Government assistance
- sedimentation of lake
- options for dredging of the lake and disposal/sale of dredged materials to other sites with funds collected being utilised for future openings and improvement works
- Narrabeen Lakes experiences
- dissemination of information and consultation
In addition to the issues raised above, several questions were put to the Sub-Committee and answers were provided by respective Sub-Committee members.

Following comments from members of the public the Sub-Committee Chairperson invited Mr Oakeshott to address the Sub-Committee and the community representatives. Mr Oakeshott responded and tabled the results of a recent survey and petition containing some 240 plus signatories. This petition identified a number of the above issues as well as the issue of odours, fish kills and impact on tourism.

Following Mr Oakeshott's submission the Sub-Committee Chairperson invited Mr Ian Proctor to make a brief presentation of his concept for entrance training walls on the southern side of the lake entrance combined with a pervious weir upstream of the Kenwood Drive bridge.

The Sub-Committee Chairperson concluded this item and thanked the community attendees for their interest in this matter.

Item WD 2
Lake Cathie/Lake Innes Waterway Users Study

(CT/bf) W.150.35.30

Consensus

That the first draft of the Waterway Users Study prepared by Webb, McKeown & Associates Pty Ltd be circulated to Sub-Committee members for comment and that these comments be reviewed at the special meeting of the Sub-Committee to be held to consider Item No. WD1. The time and place of this meeting is to be confirmed by the Technical Services Manager.

Item WD 3
Lake Cathie Bonny Hills Sewerage Treatment Works Tertiary Treatment

(CK/bf) S.250.70.1, W.150.35.30

Consensus

That the report be received and noted.
Hastings Council
Minutes of the Lake Cathie/Bonny Hills Estuary Management Sub-Committee Meeting held 7 October 1997
at the Lake Cathie Hall

DDE1. Entrance Opening Monitoring Results
(DP/ab) W.150.35.30

Consensus
That the report be received and noted.

Item DDE 2
Lake Cathie/Lake Innes Pollution Impact Investigation
(DP/ab) E.350.70.1

Consensus
That the report be received and noted.

Item DDE 3
Clearing of Vegetation - Ryans Road
(DP/ab) N.150.40

Consensus
That the report be received and noted.

General Business W.150.35.30

1) Tide Gauge Upstream of Ocean Drive Bridge on Western Bank

Community representative, Paul O'Connor, queried the need to remove this tide gauge. The Sub-Committee confirmed that it was agreed to remove this gauge in order to avoid confusion between readings with the telemetric gauge at Ocean Drive bridge.
Consensus

That Cliff Toms follow up the removal of the gauge upstream of the Ocean Drive bridge as previously agreed to by the Sub-Committee.

2) Transfer of Mr S Manton

NSW Fisheries representative, Steve Manton, advised the Sub-Committee that he was due for a transfer to Yamba and would be unlikely to be available for the next meeting of the Sub-Committee. The Chairperson thanked Steve for his past contribution and wished him well in his future at Yamba.

Consensus

That Steve Manton be formally thanked on behalf of Council and the Sub-Committee for his past contributions to the Lake Cathie/Bonny Hills Estuary Management Sub-Committee.

3) Lake Innes Plan of Management

National Parks & Wildlife Service representative, Eric Claussen, tabled a preliminary draft plan of management for Lake Innes and advised the Sub-Committee that it is in order for this document to be circulated to Sub-Committee members.

Consensus

That the draft plan of management for Lake Innes be circulated to Sub-Committee members for comments to be returned to the National Parks & Wildlife Service (attention Eric Claussen).
NEXT MEETING

It was agreed that the next meeting of this Sub-Committee be held on Tuesday 2 December 1997 at the Lake Cathie Hall commencing at 3.30pm.

The meeting concluded at 5.15pm
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SYNOPSIS

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 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, open forests of Melaleuca/Casuarina, Blackbutt/Tallowwood and Flooded Gum/Brushbox. These habitats are distributed in a complex way resulting in high species diversity.

This plan covers the part 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 which played a key role in the development of the region. It contains extensive archaeological resources for studying colonial architecture, gardens and farming techniques.

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 ongoing 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.

It discusses the management of fire and identifies fire advantages, fire management zones 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.

Limited opportunities for low impact recreational use of the nature reserve are also to be provided under this plan of management, in particular basic facilities will be provided in the vicinity of the ruins and the Perch Hole.

Acknowledgments: This plan of management has been prepared by Ranger Eric Claussen of the Port Macquarie District in close consultation with Alison Ramsay of the Field Services Division of the National Parks and Wildlife Service.
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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:

* 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, this plan of management has been placed on public exhibition for comment on the proposals it contains. Any comments received will be referred to the Advisory Council with the plan when their consideration and advice is sought.

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 enquiries on any aspect of the plan, contact the Service's Port Macquarie District Office at 152 Horton St, Port Macquarie or by phone on (065) 84 2203.

**The closing date for comments on this plan is**

........................................

Comments should be forwarded to:

The Planning Officer  
Lake Innes Nature Reserve  
National Parks and Wildlife Service  
PO Box 61  
PORT MACQUARIE 2444

Following the adoption of the plan by the Minister, copies of all representations received will be available for inspection in the library of the Service's Head Office at 43 Bridge street, HURSTVILLE 2220 (telephone: 02 585 6444).
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, some seven years after the world's first National Park was created at Yellowstone in the United States of America.

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 NPW Act 1967, fauna reserves were reclassified as nature reserves. The 1967 Act has 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. It 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 10th 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) containing Innes Ruins was purchased in 1992, but has not yet been formally gazetted as part of the reserve.

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 (6,446ha) north of Cresent Head, Limeburners Creek Nature Reserve (9,123 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 (8,005 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 Threaten Species Conservation (TSC) 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 Lake Innes area was an 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 ‘home farm’, brick clamps and the 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 Lake Innes was not part of the Cathie estuarine system but a separate freshwater lake before it was deliberately drained. 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 species of bird 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 under State Environment Planning Policy No. 14 (see map). 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 (JAMBA/CAMBA) 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 the 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 (No. 509).

* 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 tree species 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 the convict built corduroy road which is a unique structure in Australia.

* Provides outstanding opportunities for the study of Innes Ruins.

* Provides accessible recreational opportunities near a high growth centre and popular tourist destination including bushwalking, photography, birdwatching 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 investigate reverting Lake Innes back to a valuable fresh water habitat;
* to maintain the high diversity of native plant and animal species within the reserve;
* to maintain a viable Koala population within the reserve;
* 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 Bripai 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;
* To provide an opportunity to view and understand the Innes Ruins which complements other historic features in Port Macquarie;
* To maintain the water quality of the lakes and wetlands in the reserve;
* To maintain the Christmas Bells on the Christmas Bell plains.
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 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. The peninsula is a low ridge running north-south and 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 Kooloobung 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 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 subject to mining exploration. Currently exploration for nickel and cobalt is being undertaken. 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.

* To gazette the 410 hectares on the Innes Peninsula as part of Lake Innes Nature 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.

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 1933, as part of a proposed land subdivision, a “drain” 6ft wide and 1ft deep was dug between Lake Innes and Cathie Creek. Outflowing 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 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 have been 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.

The ocean entrance of the system regularly closes. The entrance area is a popular swimming spot and tourist attraction during holiday periods. The Council have a policy of opening the entrance when the water level is 1.8m Australian Height Datum (ADH), this revitalises the water in the entrance and reduces possible localised flooding. Although the opening and entrance are beyond the nature reserve boundaries, the draining can affect the breeding areas of some waterfowl contained within the reserve.

Salt tolerant species and salt water 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.

* The 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

* Investigate the impacts of catchment runoff on fringing wetlands, estuarine sediments and water quality.

* Liaise with Council to establish runoff quality guidelines for residential developments surrounding the nature reserve.

* Ensure that developers construct gross pollutant traps, sediment traps or Council approved alternatives within their estate on drainage lines leading from residential developments.

* Develop a combined opening strategy of the system with Council considering environmental and social constraints, water and salinity levels and time of year.

* Investigate the impact of the new strategy on physical, water quality and biological processes of the estuary.

* The existing water quality monitoring stations will continue to be used to check the level of pollutants in catchment sediments and runoff.

* 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 NPWS will undertake an EIS into the 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 freshwater and Lake Innes, Lake Cathie and Cathie Creek are estuarine systems. Fresh water wetlands within NSW have been depleted to a greater extent than the estuarine communities and are significant. The wetland areas are classified Under SEPP 14 as designated 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 spp). The fringes of the lakes and swamp are dominated by M. quinquenervia swamp sclerophyll forests (Melaleuca Swamps) 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 contains 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. Three NPWS research plots, each 100 square metres, were established to find the optimum fire regime for Christmas Bells. These plots are burnt on a three, six and nine years cycle and are assessed for Christmas Bells. Results show that in order to optimise Christmas Bell flowers the heathland diversity is reduced. Three additional plots will be established to ensure a continual display of Christmas Bells. 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 to South Africa introduced to Australia. This plant rapidly colonises the dunal 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 leading to tussock erosion. Biological control methods with the Bitou Tip Moth have 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 occur on the Innes peninsula under existing forest cover.

*Mysore Thorn*: This introduced 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. It 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, continuing control methods will be required for years to come.

Other weeds include patches of lantana on the peninsula, a small infestation of serrated tussock near the ruins.
Some other remnants of the exotic gardens and orchards associated with the Major Innes’ estate also remain on the peninsula. The most obvious is the bamboo groves near the 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 trees are generally restricted to the area around the ruins. They are of historical horticultural value and any non-invasive plants will be retained, otherwise they will be treated as weeds (such as Mysore Thorn) and removed.

Policies:

* Native plant communities will be protected and research will be encouraged.
* The reserve will be managed to maximise the range of vegetation communities.
* Weeds will be controlled and were possible eliminated with a priority on Mysore Thorn.
* Research into the biological control of weed species will be encouraged.

Actions:

* The Christmas Bell plots will continue to be managed for Christmas Bells. Three additional plots will be created to compliment the existing plots to ensure a regular display.
* A weed control plan for the reserve will be prepared.
* The Mysore Thorn infestation will be contained and eradicated through an ongoing weed control programme.

4.1.4 Native and Introduced Animals

The faunal habitats of the nature reserve are diverse. There are 25 basic vegetation strata containing 117 community 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

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


Species recorded in Lake Innes Nature Reserve which are covered by these agreements include 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 (approximately 600) of Koalas which are in a healthy state. Almost 50% of the land area of this 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* from areas bordering the reserve have been reported. 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 as vulnerable in the TSC 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 local 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.

Actions:

* A feral animal control programme with a priority on foxes and cats will be developed.

* Cattle and other livestock found in the nature reserve will be impounded or removed.

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 be bounded by existing roads, management tracks, natural boundaries or may necessitate new control lines. 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, 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. These management strategies will not automatically be situated on the reserve, rather they should be incorporated into the plans for future residential subdivisions thereby maintaining the integrity of the nature reserve.

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 advantage lines will be developed with the cooperation 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, wide spread 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 the peat soils and remains prone to future fires.

The 41A committee is responsible for the preparation and adoption of a Bushfire Management Plan, consisting of an Operations Plan and a Fuel Management Plan for each council area. A Fire Management Plan for the reserve is being drafted and will be available for public comment. This Fire Management Plan forms part of the input into the Operational and Fuel 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;
• 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 fire advantages and fire management zones to protect the heritage areas for major plant communities and cultural features from un-scheduled fires.
• Develop fire management zones for asset protection and 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.
• Liaise 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” 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 41A 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 coordinated approach to fire management within the nature reserve and on adjoining lands.

* An education program will be implemented to raise community awareness of fire management which concentrates on 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 rationalised.

* 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.

* Manage the Christmas bell Plains 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.

* Develop a fuel management plan which protects the Koala habitat.

* Ensure that Council require fire advantage lines be incorporated into all future neighbouring developments.

* Fire will be used as a management tool to control fuel levels.

**Actions**

* A Fire management Plan for the reserve will be developed.

* Fires will be kept out of the Innes Ruins precinct.

* A fuel management zone will be established north of Lake Cathie village.

* Community Fire Guard training will be undertaken.

* A system of fire trails will be maintained around the Innes Ruins and along the peninsula.

* No fire places will be provided in the reserve and fire will not be allowed for recreational purposes.
4.2 CULTURAL HERITAGE

The region around Lake Innes and the Christmas Bell Plains 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 Hastings valley. Some of these photos have been confirmed as being 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 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 Port Macquarie and the New England regions. Lake Innes House was an important social centre on the edge of settlement. The large colonial mansion was built between 1831-1840. 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 contains 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 of Annabella Boswell’s journal.

The peninsula contains a number of associated elements including outbuildings, 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 outlines management strategies for the site. This will form the basis for the future management of the site. This document will be reviewed and formally adopted. The primary management strategies for the site are as follows:

- The house complex and stables will be conserved and managed as a ruins.
- The fabric of the building will be stabilised.
- The articles of the ICOMOS Burra Charter will apply to all works and activities at the place.
• No new work or activities on the peninsula will obscure any of the historic associations of the place.

• Activities within the viewshed of the ruins will not detract from its evocative historical character, they 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 facilities will be kept out of sight of the ruins. They will be restricted to existing clearings.

• The convict built corduroy road across Innes swamp should be conserved.

• The peninsula will be systematically surveyed for associated sites.

• A program of on-going archaeological investigation, including archaeological excavation, will be established and administered by the NPWS.

• 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 form the house complex will be maintained.

• Items and artefacts removed from the site will be suitably displayed.

In 1993-94 the main building and stable complex underwent stabilisation work including re-pointing of the brickwork, capping the walls and stabilising the doorways and wall sections. Further stabilisation works are required to both protect the fabric of the buildings and also to ensure public safety to the site. 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 the large Flooded Gums which have encroached into the area within the building alignments. These trees can affect the building foundations and 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 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 (1836) is a unique structure in Australia. It traverses Innes Swamp and the road continues across the 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 the 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

* An Aboriginal archaeological survey and assessment 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 Conservation Analysis and Draft Conservation Policy will be the basis for managing the Innes Ruins site.

* Innes Ruins will be managed and maintained in its ruined state.

* On-going, long term archaeological investigation of the Innes Ruins will be undertaken including possible archaeological excavation.

* The convict corduroy road will be investigated and protected.

* There will be no vehicular or pedestrian access 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 will be revised and formally adopted.

* 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 eastern section of the corduroy road will be protected from fire and interpreted.

* The Flooded gums amongst the ruins will be removed.

* All artefacts associated with Innes ruins will be properly housed and cared for.

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 managers 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 below.
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 High 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 ruins and the peninsula 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.

The Discovery programme is developing a full range of appropriate tours and activities. Recently the Innes Ruins have become a special attraction. Regular guided tours have proved popular. Over the past three years 1800 people have visited the site.

The level of visitation to the site 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.

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.

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.

* Encourage environmental education, particularly school groups studying the hydrology of the lake to use the nature reserve.

Actions

* Guided educational tours will be permitted under licence or will be carried out by Service staff through the Discovery programme.

* A range of information including brochures and broadsheets will be provided to help people understand and appreciate Lake Innes Nature Reserve.

* 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 water ways 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 water ways 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 it. An access road from the Perch hole along the creek to Lake Innes will be established if the lake is closed off.

Camping will not be permitted in the 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), it 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. A track leading north from the Perch Hole to
Lake Innes will be established to allow public access to the lake, particularly for recreational fishing.

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 Perch Hole track will be left open to the public.

These tracks could form part of the Googik Heritage Walking Track proposed by the Local Aboriginal Land Council, a coastal walking track linking Laurieton and Port Macquarie. Stage one would link Lake Cathie to Port Macquarie via the Christmas Bell Plains and Kooloonbung Creek. It offers opportunities to interpret the Christmas Bell plots, the Koala corridor and the unique convict built corduroy. The route would be along the existing management tracks and the impact would be minimal. Investigation into the feasibility of this concept will be encouraged. the connection from 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 the Reserve.

* Only basic 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 Googik 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.

* A small car park will be installed at the Perch Hole.

* Providing picnic facilities 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 self composting toilet, water tank and picnic tables will be installed in the clearing near the ruins subject to appropriate environmental investigation.

* Negotiations with the Waterways Authority will be undertaken to institute a four knot speed limit and a 15 hp outboard limit for Lake Innes while it is an estuarine system. Non powered craft or craft with electric motors only will be allowed on Lake Innes after it is closed.

4.3.3. Commercial Opportunities

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

Lake Innes and Cathie Creek is the site of a small scale commercial fishing operation. About 15 licensed fisherman use the lake depending on the season and entrance conditions. These fishermen mesh net for bream, mullet, flathead whiting and taylor. 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 the 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 the NSW Fisheries and the Waterways Authority will take place to determine how best to manage commercial activities on the waterways.
4.3.4 Scientific Research

The purpose of scientific study in Lake Innes Nature Reserve 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 have 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 a compelling 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.

Initially this on-going study aimed to determine how best to manage the Christmas Bell Plains for Christmas Bells. However 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. The present plots together with three additional plots will be managed for Christmas Bells while the remainder of the Christmas Bell Plains are managed for species diversity.

**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 Universities curriculum. A formal arrangement to continue this investigation will be pursued with interested Universities.

**Mysore Thorn Eradication:**
Mysore Thorn was first introduced into Australia at Lake Innes from India. 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. Although the plant has some historical significance its impact on the native vegetation dictate that the infestation must firstly be contained and then eradicated. Interpretive signs at the site will illustrate the historical significance of the plant and explain the eradication programme.

Policies

* All research will be subject to Service policy 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.

* 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; 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 roads which no longer serve a useful purpose for management or are not of historic significance will be closed and rehabilitated.
The old 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 canals serve as useful advantage 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 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 will be allowed through the reserve unless they benefit the management of the reserve.

Actions

* The network of management tracks will be reviewed. Strategic tracks will be maintained, all others will be closed and rehabilitated.

* A rehabilitation plan for the old tip will be developed and implemented.

* Council will be allowed to maintain the flood mitigation channels behind the industrial estate in accordance with the proper environmental investigations.
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 and recreation philosophies, 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 affect 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:

<table>
<thead>
<tr>
<th>Activity</th>
<th>Reference (in plan)</th>
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</thead>
<tbody>
<tr>
<td>An EIS into the closure of Lake Innes will be undertaken</td>
<td>4.1.2</td>
</tr>
<tr>
<td>A weed control plan for reserve will be prepared</td>
<td>4.1.3</td>
</tr>
<tr>
<td>The Mysore Thorn infestation will be contained by continuing the control programme</td>
<td>4.1.3</td>
</tr>
<tr>
<td>A Fire Management Plan will be prepared</td>
<td>4.1.5</td>
</tr>
<tr>
<td>A system of fire trails will be maintained around the Innes Ruins and along the peninsula</td>
<td>4.1.5</td>
</tr>
</tbody>
</table>
The main house structure will be stabilised and made safe for public enjoyment 4.2

Directional signs on the Christmas Bell plains will be developed and installed 4.3.1

Bollards will be installed along the Perch Hole track 4.3.2

Gates will be installed on all fire trails 4.3.2

**MEDIUM PRIORITY**

Three additional Christmas Bell plots will be established to ensure there are on-going displays of flowers 4.1.3

Fencing along the south-western side of lake Innes will be completed in conjunction with the land-holders 4.1.4

A fuel management zone will be established north of Lake Cathie village 4.1.5

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

The flooded gums amongst Innes Ruins will be removed 4.2

Licenses for all guided educational tours will be completed 4.3.1

A self-composting toilet, water tank and picnic tables will be installed near the Innes Ruins 4.3.2

A rehabilitation plan for the old tip will be developed and implemented 4.3.5

**LOW PRIORITY**

The Conservation Analysis will be revised and formally adopted 4.2

Universities will be asked to include the study of Innes ruins in their curriculum 4.2
The fire trail to Home Farm will be re-routed to avoid impact on the remains of the complex. 4.2

the eastern section of the corduroy will be protected from fire and interpreted. 4.2

All artefacts recovered from Innes Ruins will be properly housed. 4.2

Information brochures will be developed. 4.3.1

A small car park and boat ramp will be installed at the Perch hole. 4.3.2
SELECTED REFERENCES


