KATTANG NATURE RESERVE

PLAN OF MANAGEMENT

NSW National Parks and Wildlife Service

Part of the Department of Environment and Conservation (NSW)

August 2005

This plan of management was adopted by the Minister for the Environment on 18 August 2005.

ADDITIONAL INFORMATION

For additional information or enquiries about any aspect of the plan, contact the Service's Hastings Region Office at 152 Horton Street Port Macquarie or by phone on 6584 2203.

ACKNOWLEDGMENTS

This plan of management is based on a draft plan prepared by Amanda Smith, Ranger National Parks and Wildlife Service (NPWS), with the assistance of staff of the Mid North Coast Region NPWS Area and Northern Directorate Planning Group.

Valuable information and comments were provided by NPWS specialists, the Regional Advisory Committee and members of the public.

Cover photograph of Kattang Nature Reserve by Leo Meier.

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FOREWORD

Kattang Nature Reserve covers 58 hectares of coastal land on the mid north coast of New South Wales at Camden Head.

The reserve is one of a number of reserves on the mid north coast of NSW which together protect a range of landforms and related biological features demonstrating the evolution of the coastline between the Manning and the Macleay Rivers.

The primary purpose for dedication of Kattang Nature Reserve was to preserve an area of significant coastal biotic communities and important geomorphological features with high scenic value. It supports a wide range of coastal vegetation communities, including wet and dry heathland, littoral rainforest and headland complexes. It also provides habitat for a diverse range of wildlife, including for threatened species such as the koala and birds protected under international agreements.

The reserve is listed on the Register of the National Estate for its high scenic quality and natural diversity.

A draft plan of management for Kattang Nature Reserve was placed on public exhibition for three months from 4 October 2002 until 3 February 2003. The exhibition of the plan of management attracted 55 submissions that raised 11 issues. All submissions received were carefully considered before adopting this plan of management.

This plan of management aims to maintain the scenic, geological and geomorphological qualities of the reserve, to maintain the high diversity of native plant and animal species, and to promote appreciation and understanding of the natural environment and cultural heritage of the area.

This plan of management establishes the scheme of operations for Kattang Nature Reserve. In accordance with section 73B of the *National Parks and Wildlife Act 1974*, this plan of management is hereby adopted.

Bob Debus
Minister for the Environment

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1. INTRODUCTION

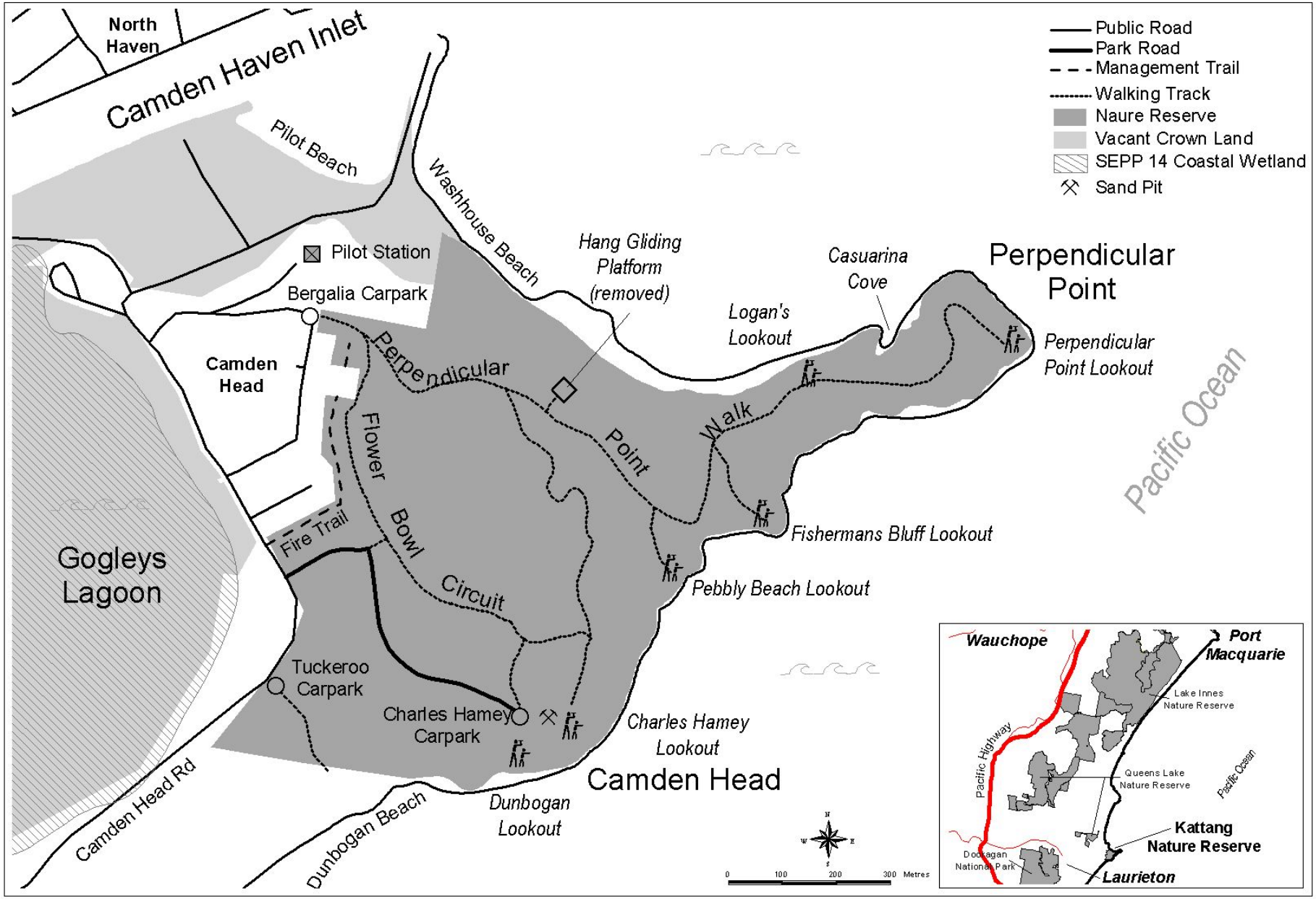
1.1 LOCATION, GAZETTAL AND REGIONAL SETTING

Kattang Nature Reserve (referred to herein as 'the reserve') covers 58 hectares of coastal land on the mid north coast of New South Wales (NSW). It is located at Camden Head, approximately 48km north-east of Taree and 26km south of Port Macquarie. Camden Head is a peninsula of land separated from Dunbogan by a narrow neck of land bounded on one side by the Pacific Ocean and on the other by Gogleys Lagoon. The reserve is bounded by ocean on all but its western side, which adjoins the village of Camden Head (see the map).

The headland was originally proposed as a nature reserve by the 'Save the Headland Action Group' in 1977 who prepared a study and submission to NPWS for its dedication. At that time the area was Crown Land which was used for a range of public recreation activities including camping and vehicle access to popular fishing spots. Logan's lookout, situated half way along the Perpendicular Point walk, is named after Logan McPhearson, who was one of the driving forces behind the dedication of the reserve.

The reserve was dedicated on 23 November, 1983. The name of the reserve is derived from the Aboriginal tribal language group – *Kattang* – who prior to European settlement, are believed to have occupied an area which extended from the Telegraph Point – Port Macquarie region as far south as the Hawkesbury River.

This plan applies both to the land currently reserved as the reserve and to any future additions to the reserve. Where management strategies or works are proposed for additions that are not consistent with the plan, an amendment to the plan will be required.


North Haven
Camden Haven Inlet
Pilot Beach
Washhouse Beach
Pilot Station
Bergalia Carpark
Hang Gliding Platform (removed)
Casuarina Cove
Perpendicular Point
Logan's Lookout
Perpendicular Point Lookout
Camden Head
Perpendicular Point Walk
Flower Bowl Circuit
Fire Trail
Pacific Ocean
Fishermans Bluff Lookout
Gogleys Lagoon
Pebbly Beach Lookout
Tuckeroo Carpark
Charles Hamey Carpark
Charles Hamey Lookout
Camden Head
Camden Head Rd
Dunbogan Beach
Dunbogan Lookout
Public Road
Park Road
Management Trail
Walking Track
Naure Reserve
Vacant Crown Land
SEPP 14 Coastal Wetland
Sand Pit
0 100 200 300 Metres
Wauchope
Port Macquarie
Lake Innes Nature Reserve
Pacific Highway
Queens Lake Nature Reserve
Pacific Ocean
Kattang Nature Reserve
Dooragan National Park
Laurieton

2. MANAGEMENT CONTEXT

2.1 LEGISLATIVE AND POLICY FRAMEWORK

The management of nature reserves in NSW is in the context of the legislative and policy framework, primarily the *National Parks and Wildlife Act 1974* (NPW Act), the *Threatened Species Conservation Act 1995* (TSC Act) and the policies of the National Parks and Wildlife Service (NPWS). The policies arise from the legislative background, the corporate goals of the Service and internationally accepted principles of park management. They relate to nature conservation, Aboriginal and historic heritage conservation, recreation, commercial use, research and communication.

Other legislation, international agreements and charters may also apply to management of the area. In particular, the NSW *Environmental Planning and Assessment Act 1979* requires the assessment and mitigation of environmental impacts of any works proposed in this plan.

The NPWS also has obligations relating to the management of the reserve under international agreements ratified by the Australian Government. These agreements are:

- The Agreement between the Government of Australia and the Government of Japan for the Protection of Migratory Birds and Birds in Danger of Extinction and their Environment (JAMBA); and
- The Agreement between the Peoples Republic of China and the Government of Australia for the Protection of Migratory Birds and their Environment (CAMBA).

The agreements with Japan and China list a number of species found in the reserve and the surrounds. A similar agreement is currently being negotiated with the Russian Government.

2.2 MANAGEMENT PURPOSES AND PRINCIPLES

Nature reserves are reserved under the NPW Act to protect and conserve areas containing outstanding, unique or representative ecosystems, species, communities or natural phenomena.

Under the Act, nature reserves are managed to:

- conserve biodiversity, maintain ecosystem functions, and protect geological and geomorphological features and natural phenomena;
- conserve places, objects, features and landscapes of cultural value;
- promote public appreciation, enjoyment and understanding of the reserve's natural and cultural values; and
- provide for appropriate research and monitoring.

2.3 SPECIFIC OBJECTIVES FOR KATTANG NATURE RESERVE

In addition to the above general objectives, the following specific objectives apply to the management of the reserve:

- to maintain the scenic, geological and geomorphological qualities of the reserve, in particular the prominent cliff faces and headlands including Perpendicular Point and Camden Headland and landforms demonstrating the evolutionary history of the coastline;
- to maintain the high diversity of native plant and animal species within the reserve, including 20 vegetation communities, more than 100 species of birds as well as threatened species such as the koala, little bent-wing bat and common blossom bat;
- to maintain a viable corridor for native plants and animals from the reserve to Gogleys Lagoon, Crowdy Bay National Park and Dooragan National Park;
- to promote and interpret the heath environments in the area commonly referred to as the “Flower Bowl”;
- to manage fire with the local community to protect the natural and cultural features of the reserve as well as adjoining life and property;
- to maintain a viable habitat for the horsetail sheoak (*Casuarina equisetifolia)* and for the vulnerable plant australe toadflax (*Thesium australe);*
- to protect and conserve the rare pockets of littoral rainforest within the reserve;
- to control and manage noxious weeds such as bitou bush and other significant threatening weeds;
- to protect and interpret the Aboriginal culture of the area in association with the Birpai Aboriginal Community and the Bunyah Local Aboriginal Land Council;
- to provide an opportunity for the public to view and understand the natural and cultural values of the area in a natural, coastal setting;
- to provide opportunities for low key, passive recreation and to ensure that recreational pursuits do not compromise the integrity of the reserve or visitor experience; and
- to continue to foster community involvement in the management and protection of the natural and cultural values of the reserve.

3. KEY VALUES AND MANAGEMENT DIRECTIONS

3.1 VALUES OF THE AREA

The reserve is one of a number of small to moderately sized reserves on the mid north coast of NSW which together protect a range of landforms and related biological features demonstrating the evolution of the coastline between the Manning and the Macleay Rivers.

The reserve combines the spectacular scenery of Perpendicular Point, jutting out of the north-eastern corner of the reserve, with sharp vertical cliff faces along its south eastern boundary. These prominent visual features were recognised during a survey of coastal rocky headlands carried out by the National Trust of Australia in 1987. The reserve is listed on the National Estate Register for its high scenic quality and natural diversity.

The primary purpose for dedication of the reserve was to preserve an area of significant coastal biotic communities and important geomorphological features with high scenic value as an area available for scientific research, public education and appreciation (NPWS 1983 – internal report).

The NPWS on investigating the reserve for dedication confirmed the area as having significant conservation value, both locally and on a regional scale, for its relatively undisturbed bushland on a headland complex and as a landscape area of high visual prominence.

The importance of the reserve can be summarised as:

- one of a group of national parks and nature reserves which protect important natural heritage of the mid north coast of NSW;
- a range of landforms which are evidence of past and present coastal processes;
- an area of high scenic quality, providing panoramic views along the coastline and surrounding hinterland;
- habitats which support a diverse range of wildlife communities including threatened plants and animals, and birds protected under international agreements;
- a wide range of coastal vegetation communities including wet and dry heathland, littoral rainforest and headland complexes;
- communities of the rare plant austral toadflax *Thesium australe* which is listed as vulnerable under the TSC Act;
- the most southerly known natural population of the horsetail sheoak *Casuarina equisetifolia* ssp *incana;*
- seasonal coastal food trees for the fruit eating wompoo fruit-dove and the glossy black-cockatoo which feeds extensively on the seeds of various

Allocasuarina and *Casuarina* species. Both birds are listed as vulnerable under the TSC Act;

- surrounding coastal habitat for birds such as the endangered little tern and beach stone curlew as well as, for vulnerable birds such as the pied oystercatcher and osprey;
- habitat for threatened species such as the koala, little bent wing-bat and the common blossom bat;
- outstanding opportunities for the study of coastal processes particularly in relation to geomorphology, marine intertidal environments, coastal vegetation and fauna; and
- opportunities for a range of low key recreational activities such as fishing, bush walking, picnicking, bird watching and photography in a natural setting.

3.2 LANDSCAPE CONTEXT

Natural and cultural heritage and on-going use are strongly inter-related and together form the landscape of an area. Much of the Australian environment has been influenced by past Aboriginal and non-Aboriginal land use practices, and the activities of modern day Australians continue to influence bushland through recreational use, cultural practices, the presence of pest plants and animals and in some cases air and water pollution. The geology, landform, climate and plant and animal communities of the area, plus its location, have determined how it has been used by humans.

Both Aboriginal and non-Aboriginal people place cultural values on natural areas, including aesthetic, social, spiritual, recreational and other values. Cultural values may be attached to the landscape as a whole or to individual components, for example to plant and animal species used by Aboriginal people. This plan of management aims to conserve both natural and cultural values. For reasons of clarity and document usefulness natural and cultural heritage, non-human threats and on-going use are dealt with individually, but their inter-relationships are recognised.

3.3 MANAGEMENT DIRECTIONS

The reserve is to be managed consistent with its status as a nature reserve. It is important that management of the reserve considers the area's significant nature conservation values both locally and on a regional scale as relatively undisturbed bush land on a headland complex and as a landscape of high visual prominence.

Recreation is secondary to the reserve's value for nature conservation and protection of landscape integrity and therefore activities must be passive and ecologically sustainable. A variety of recreational opportunities and facilities are provided in nearby NPWS parks such as Dooragan National Park to the west and Crowdy Bay National Park to the south. Council reserves in the area also provide a range of recreational opportunities.

4. POLICIES AND FRAMEWORK FOR MANAGEMENT

This chapter contains strategies for the management of the reserve. Under each section the values and existing situation are summarised and strategies and actions are proposed.

Where not specifically provided for in this plan, management will be in accordance with the NPW Act and with general NPWS policies.

4.1 NATURAL HERITAGE

4.1.1 Landscape, Geology and Geomorphology[1]

The topography and general geological features of Kattang Nature Reserve range from the coloured and banded precipitous cliff faces of the southern boundary, to joints and faults near the tip of Perpendicular Point that plummet over 40 metres to the sea, to low heath-covered knolls and sheltered sandy depressions.

Perpendicular Point is a significant physical feature of the NSW coastline and projects finger-like into the ocean in an east-west direction. The spectacular scenery of Perpendicular Point and the cliff faces along the south eastern boundary of the reserve are important values and contributed to listing of the reserve on the National Estate Register. A number of historical records mention the northern bight as providing protection to early sailing ships from strong southerly gales due to the extended nature of Perpendicular Point.

The majority of the reserve comprises the headland referred to as Camden Head. Camden Head is flat to gently undulating, with sheer cliff edges. Camden Head is composed of Triassic sediments (laid down approximately 190-225 million years ago). Headlands of Triassic age are not common on the north coast of NSW. Apart from Grants Head several kilometres to the north, others can be found further north at Corindi within the Yuragir National Park, and at Evans Head. By comparison Diamond Head to the south is a geologically younger outcrop of Tertiary volcanic rhyolite, while the headlands at Port Macquarie are an Ophiolitic sequence of cherts, jaspers, dolerites & serpentinites that produce a deep red, silty soil. Hence on a local basis the three headlands (Camden Head, Diamond Head, and those at Port Macquarie) are geologically different, providing diverse vegetation communities on various soils.

Conglomerates form a major part of the lithology of the headland and outcrop towards the eastern end of the plateau and along the shoreline, where interesting colour patterns have resulted from coastal weathering. Progressive

[1] *Triassic Rocks of the Grants Head District and the Post-Permian Deformation of the Southeastern New England Fold Belt by Evan C. Leitch and Malcolm A. Bocking (Journal and Proceedings, Royal Society of New South Wales, Vol. 113. Pp. 89-93, 1980)*
- A Reappraisal of the Lorne Basin by G. W. Pratt and C. Herbert, Nov. 1972. (Rec. Geol. Surv. N.S.W.,15(2), 205-212, 4 figs

periods of sedimentation have formed layers of conglomerate, sandstone and shales. These are seen on the cliffs of the southern aspects of the headland and boulder strewn coastal slopes. As in most sedimentary basins, sediments are progressively finer in the upper layers, with conglomerate as a basal bed, followed by coarse and fine sandstones, shale and mudstone.

Another interesting feature of Camden Head is that the bedrock has been overlain, in part, by Quartenary sand dunes related to wind blown sand from the last glacial period (Pleistocene Period approximately 1 million years ago). It was during this time that the headland, perhaps previously an island, was joined to the mainland. These overlaying dune formations result in different soil fertility and hence a greater diversity of plant species than usual for headlands of the NSW north coast. These sand dunes are presently referred to as the “Flower Bowl”, due to the heath communities providing a profusion of wildflowers during the spring.

The soils of the reserve are highly erodible. Most of the drainage is subterranean due to the permeable sandy topsoil and the trellis drainage pattern developed on the parent rock. Five obvious streams occur within the reserve, mainly flowing in a north-west direction and are mostly intermittent. Evidence of erosion from past and present activities can be seen in the natural weathering along the eastern end of the peninsula in the form of rock faults and joints along exposed conglomerate cliff faces. Human impacts such as 4WD tracks, foot traffic and a sandpit have also contributed to erosion in the area.

The disused sandpit near Charles Hamey carpark on the southern side of the reserve commenced operations in the 1940’s and was operational until 1975. Removal of gravel and sand for road purposes resulted in major disturbance over an area of approximately one-hectare. Loose material was removed to a depth of about 10 metres where bedrock was exposed. The Soil Conservation Service and NPWS on gazettal of the reserve undertook restoration works of the sandpit as part of an ongoing program.

Further restoration works were undertaken at the lower part of the sandpit in June 2000. Stage one of the restoration involved formalising the car park, improving drainage, construction of settling ponds and revegetation of the site. A new lookout (Dunbogan Lookout) was erected on the southern side of the car park overlooking Dunbogan Beach. Stage two of the restoration works will involve rehabilitation of the upper slopes of the sandpit, control of gully erosion, further brush matting and mulching of the settling ponds, improved drainage protection and regulatory sign posting of the site.

Extensive foot traffic and weathering has caused erosion along walking tracks in the reserve, along the track leading to the hang gliding platform and at Pebbly Beach lookout where the cliff face has been exposed and gully erosion is occurring.

Strategies and Actions

- Visitor facilities and management infrastructure will be located and designed to minimise impacts on landscape values. This will be assessed as part of the normal environmental assessment process.

- Walking tracks will be maintained to minimise erosion (refer also 4.4.2 Recreation Opportunities).

- The section of the Perpendicular Point walking track which has been closed and re-located due to erosion will remain closed and will be rehabilitated. Signage will direct visitors to keep off the old track and to follow the existing track to access Casuarina Cove and Perpendicular Point. The reserve will be monitored for informal tracks used by rock fishers and any new tracks will be closed should they occur. Track route markers may be installed on certain tracks to encourage walkers to keep to these tracks and to stop the proliferation of new tracks if necessary.

- The track to the old hang gliding launch site and the surrounding set up/ take off area will be closed and rehabilitated (refer 4.4.2 Recreation Opportunities).

- Bank and gully stabilisation will be undertaken below the lookout at Pebbly Beach.

- Geology and geomorphic processes will be interpreted to visitors as part of guided walks and in information signage (refer 4.4.1 Promotion, Interpretation and Education).

- Stage two of the rehabilitation plan for the old sandpit near Charles Hamey carpark will be completed and signposted to direct visitors to keep out of the regeneration area.

- Gully erosion caused by run-off from the sandpit to Dunbogan Beach will be rehabilitated and appropriately signposted to restrict access.

- Research will be encouraged into the geology and geomorphic processes of the reserve.

4.1.2 Native Plants

For such a small reserve the flora of the headland is unusually diverse in both individual species and structural diversity. Twenty-nine vegetation communities have been identified and mapped (Griffith, Wilson and Dodkin, 1996). Vegetation has been described under the following groups: forest and woodland; shrubland (scrub); heathland; tussock grassland; and sod grassland.

The heath communities occur only on the dune deposits and produce a profusion of wildflowers during the spring. This central heath area is known

locally as the “Flower Bowl” and provides an important food source for nectar feeding birds, mammals and insects. Banksias, in particular old man banksia (*Banksia serrata),* are very common in this area.

Four small patches of dry littoral rainforest dominated by tuckeroo, (*Cupaniopsis anacardioides*) and brush box, (*Lophostemon confertus*) occur at the northern and southern more sheltered aspects of the reserve in well-drained siliceous sands where fires rarely occur. Littoral rainforests have scattered occurrences along most of the north coast. The rainforest in the reserve is depauperate (Williams 2000) and exclusion of fire is important for the survival of this community.

A restoration plan for S.E.P.P. 26 Littoral Rainforests adjacent to the reserve on the eastern shoreline of Gogleys Lagoon and west of Camden Head Road has recorded a high proportion of rainforest plants not known from the reserve (Williams 2000). Williams (2000) states that rainforests at Camden Head are strategically placed within the Hastings coastal habitat corridor. They potentially provide a ‘stepping stone’ for migratory rainforest-dependent wildlife moving between littoral rainforests at Lake Cathie and Port Macquarie, and Crowdy Bay National Park. These movements contribute to the dispersal of genetic material (normally by way of seeds) between individual stands.

The higher ground of the headland is covered by forests and woodlands on very exposed aspects where the soils become shallow and poorly drained. The tall, open to closed forests are dominated by rough-barked apple, (*Angophora floribunda)* with one or both of pink bloodwood (*Eucalyptus intermedia)* and old man banksia (*Banksia serrata)*. Black sheoak, (*Allocasuarina littoralis),* an important food source for the glossy black cockatoo, coast banksia (*B. integrifolia ssp. integrifolia)* and coast tea tree (*Leptospermum laevigatum)* dominate the low to mid-high forests in the reserve.

Broad-leaved paperbark (*Melaleuca quinquenervia)* with associated species of swamp mahogany (*Eucalyptus robusta)* and swamp oak (*Casuarina glauca)* are located along drainage lines and open depressions.

The foredune on the southern side of the reserve primarily consists of hairy spinifex (*Spinifex sericeus)* and coastal wattle *(Acacia sophorae)*.

Perpendicular Point is relatively windswept and barren and vegetated largely by grasses and wind-stunted coast banksia (*Banksia integrifolia* spp*. integrifolia)* and black sheoak *(Allocasuarina littoralis)*. The most southerly known natural population of the horsetail sheoak (C*asuarina equisetifolia* ssp *incana)* also occurs in this area. North of the Camden Haven this community has a scattered distribution in NSW (Griffith et al. 1995; Quint 1982). A major threat to the species is displacement by bitou bush *(Chrysanthemoides monilifera)*. Seeds from horsetail sheoaks in the reserve have been propagated and seedlings planted along the gully above Casuarina Cove by the Friends of Kattang volunteers.

Another important plant species occurring on Perpendicular Point is the semi-parasitic herb austral toadflax (*Thesium australe)* which is listed as vulnerable under the TSC Act 1995 and under the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Austral toadflax occurs in *Themeda* low closed sod grassland on the headland of Perpendicular Point, where it is very exposed to salt-laden onshore winds. State wide, *Themeda* grassland of coastal headlands is considered to be adequately conserved in existing NPWS reserves (Griffith 1992b). On the North Coast, however, significant areas of the community are unreserved, and so regionally the community's status is best described as "fair". The nearest population of *T. australe* to that occurring on Perpendicular Point is at Diamond Head in Crowdy Bay National Park (Griffith 1992b).

The long term survival of the species is dependent on active management of threats and maintenance of its habitat. The greatest concern for coastal populations of *Thesium australe* is invasion by bitou bush and in some cases colonisation by *Banksia integrifolia* (Harre 1999).

The main threat to *T.australe* on Perpendicular Point is habitat displacement by weeds, in particular bitou bush and introduced grass infestations from former vehicle access tracks. Colonisation by *Banksia integrifolia* and coastal wattle (*Acacia sophorae)* also threaten this species. *B. integrifolia* and *A. sophorae* are common and widespread both locally and regionally and may require monitoring and removal from the headland in order to maintain the grassland community.

It has been suggested (Fensham in Harre, 1999) that frequent fire is beneficial to *Thesium australe.* Research undertaken in the reserve between 1995 and 1998 indicated that "a one-off fire in winter did not significantly affect the density of *Thesium australe* at Perpendicular Point" (Cohn 1999). Cohn (1999) in Harre (1999) postulates that other disturbances, such as exposed conditions, may also fulfil the objectives of burning or grazing on coastal headlands in conservation of *T. australe*. This is based on the continued presence of *T. australe* at a number of long-unburnt sites, including Perpendicular Point, which has not been burnt for 34 years.

Fensham (pers comm) in Harre (1999) refers to a *T. australe* survey in the Darling Downs, Queensland and observed that Thesium appeared to benefit from a fire regime of between two and five years.

Cohn (1999) states that at all study sites burning or cutting existing *T. australe* plants did not affect their survival whether the treatment was applied in winter or summer. Gross *et al.* (1995) in Harre (1999) suggested that "it seems to be the relative intensity of threats, rather than their mere presence" which affects the survival of populations.

Other plants of special significance occurring within the reserve include:

- narrow-leaved geebung *(Persoonia virgata)* which is found near its southern limit in the dry-wet heaths and forests of the reserve;

- *Persoonia katerae*, a geebung near its northern limit and found in dry sclerophyll forests; and
- *Lomandra glauca,* found in heath-dry sclerophyll forest and is near its northern limit.

Another interesting feature is the occurrence of an isolated, small population of *Banksia ericifolia* found near the creek line on the northern side of the "Flower Bowl". The *B. ericifolia* population is a remnant of what was once a more substantial stand of vegetation and has almost been lost due to changing fire regimes.

Strategies and Actions

- The reserve will be managed to maintain the diversity of habitats and species.

- Native plant communities will be protected by controlling the spread of introduced plants (refer 4.3.1 Introduced Plants) and maintenance of appropriate fire regimes including exclusion of fire from littoral rainforest (refer 4.3.3 Fire Management).

- The headland will not be burnt for conservation of *T. australe* unless further studies prove that fire is beneficial for the ecology of the plant. However, in a wildfire situation the area could be left to burn if safe to do so and if fire frequency is appropriate (refer 4.3.3 Fire Management).

- The *T. australe* population on the headland will be monitored to determine distribution and threats. Consideration will be given to the need to remove invasive shrub species if threatening the species.

- The grassland communities on the headland will be managed for the protection of *T. australe* (refer 4.3.3 Fire Management).

- Research will be encouraged into the ecology of native plant communities and species, in particular the fire ecology and other requirements of *T. australe*.

- Implement recovery plans for threatened species as they are prepared.

- Continue the program for propagating and regenerating the horsetail sheoak (*Casuarina equisetifolia* ssp *incana)* on the headland and encourage continued community involvement.

- Work with relevant neighbours, conservation groups and others to encourage conservation of remaining vegetation in the vicinity of the reserve and to identify potential wildlife/habitat corridors to link to other native vegetation areas.

- Support the ongoing efforts of Hastings Council, other agencies and volunteers in the restoration of the littoral rainforest adjacent to Gogleys lagoon.

4.1.3 Native Animals

Although the reserve is relatively small it has a considerable diversity of habitats. In addition, the reserve directly adjoins a marine environment of rock platforms, tidal shallows and estuaries.

To date, 154 vertebrate fauna species have been recorded in the reserve, including 8 amphibians, 6 reptiles, 17 mammals and 123 bird species. Ten of these species are listed as either endangered (Schedule 1) or vulnerable (Schedule 2) on the TSC Act.

Some species of birds utilise the reserve as part of their overall feeding range, such as the white breasted sea eagle (*Haliaeetus leucogaster*) and brahminy kite (*Haliastur indus*). Several other species, such as the black-faced monarch (*Monarcha melanopsis*), dollarbird (*Eurystomus orientalis*) and rainbow bee-eater (*Merops ornatus*), are seasonal migrants found in the reserve in spring and summer. The great variety of flowering plants ensures that the reserve attracts flocks of honeyeaters such as the Lewin's honeyeater (*Meliphaga lewinii*), white cheeked honeyeater (*Phylidonyris nigra*) and yellow faced honeyeater (*Lichenostomus chrysops*).

Plants not only provide food sources for bird species but also provide nest and foraging cover. The shrubby understorey and dense grass clumps are particularly important to species such as wrens, thornbills and quail whose nests are constructed low down in tussocks and shrub tangles. Understorey clearing in forests and repeated burning of the ground vegetation can threaten many small bird populations.

A number of the reserve's bird species are listed under the TSC Act. The wompoo fruit-dove (*Ptilinopus magnificus)* is listed as a vulnerable species and has undergone a significant reduction to its population due to the clearing of lowland rainforests upon which it is heavily dependent. The glossy black-cockatoo (*Calyptorhynchus lathami*), another vulnerable species, feeds extensively on the seeds of various *Casuarina* species and suffers from habitat destruction when nesting hollows and feeding trees are cleared for example by agriculture and development.

The endangered little tern (*Sterna albifrons*) was recorded in the reserve by D.R. Milledge in 1978-79. Colonies occur mostly on sand spits, sand islands or sand dunes behind ocean beaches. More than likely the little tern was utilising the surrounding beaches and estuaries. The little tern has not been recorded in the reserve and surrounds since Milledge's report.

The pied oystercatcher (*Haematopus longirostris)* classified as vulnerable, is found on ocean beaches and estuaries scattered around the Australian coast has been recorded on the headland. Like the little tern they lay their eggs in

shallow scrapes on sandy beaches well above the watermark. They also have poor breeding success from interference caused by natural and human related factors.

The endangered beach stone-curlew (*Esacus neglectus*) has also been recorded in the intertidal zone of the reserve. It has similar breeding and feeding habit as the little tern and pied oystercatcher. It is also under threat from habitat destruction and predation from natural and introduced animals.

The osprey (*Pandion haliaetus*) has been recorded within the reserve. It is a vulnerable species due mainly to land clearing and urbanisation, which have greatly reduced the bird's natural habitat. Coastal areas, lake shores and river estuaries are the preferred habitat of the osprey.

The forest type described as broad-leaved paperbark *(Melaleuca quinquenervia)*, swamp mahogany (Eucalyptus robusta) and swamp oak *(Casuarina glauca)* may be potential habitat for the swift parrot (*Lathamus discolor*). The swift parrot is listed as endangered in the TSC Act and the EPBC Act. There have been sightings of the swift parrot near Crowdy Bay National Park in similar habitat.

There are 11 bird species in the reserve and surrounds which are affected by international migratory bird agreements between Australian and Japan (JAMBA) and China and Australia (CAMBA) to protect migratory species and their habitat (refer 2.1 Legislative and Policy Framework). Species affected by these agreements are: the great egret (*Egretta alba*); lesser golden plover (*Pluvialis dominica*); whimbrel (*Numenius phaeopus*); eastern curlew (*Numenius madagascariensis*); bar-tailed godwit (*Limosalapponica*); turnstone (*Arenaria interpres*); grey-tailed tattler (*Tringa brevipes*); caspian tern (*Hydroprogne caspia*); crested tern (*Sterna bergii*); little tern (*Sterna albifrons*); and common tern (*Sterna hirundo*).

The reserve also provides habitat for threatened mammal species such as the koala (*Phascolarctos cinereus*), little bentwing-bat (*Miniopterus australis)* and the common blossom bat (*Syconycteris australis*).

The threatened east-coast freetail bat (*Mormopterus norfolkensis*) has been recorded at the Pilot Station adjacent to the reserve and hence it is likely that its range would also include the reserve.

An important bat cave roosting site occurs in one of the deep crevices on the southern side of the headland. It is a significant site as there are few coastal cliff cave sites known along the NSW coastline. Further research is required to determine the species of bat utilising this cave.

The Australian fur-seal (*Arctocephalus pusillus*), listed as vulnerable under the EPBC Act, and subantarctic fur-seal (*Arctocephalus tropicalis*) have been recorded on the rocky foreshore of the reserve.

A fauna survey was conducted in the reserve in November 1999. Results of the survey and other observations, indicates that while the reserve supports a high diversity of coastal heath birds, a low number and diversity of small ground and arboreal mammals is present within the reserve. Native animals, which would otherwise be expected within the reserve but have not been recorded to date, include the bush rat (*Rattus fuscipes)*, brown antechinus (*Antechinus stuartii)*, New Holland mouse *(Pseudomys novaehollandiae)*, brush tailed possum (*Trichosurus vulpecula)* and sugar glider (*Petaurus breviceps)*.

While information is scant on mammals and other fauna, the northern brown bandicoot (*Isoodon macrourus torosus*) has been confirmed. Agricultural and residential development caused local extinctions over part of the range of the northern brown bandicoot though it manages to survive well in fringe areas such as the reserve.

The tiger quoll (*Dasyurus maculatus*) listed as vulnerable under the EPBC Act, often occurs in coastal habitat but to date has not been recorded within the reserve. Competition for food in the fragmented habitat between the tiger quoll, fox and feral cat may have lead to any tiger quoll populations contracting to larger natural areas such as Crowdy Bay National Park. A more intensive targeted survey would be required to determine the status of the tiger quoll in the reserve.

The Fire Management Plan for the reserve aims to establish fire regimes within the core of the reserve that meet biodiversity conservation thresholds for the various vegetation communities and to support ground cover for native mammals (refer 4.3.3 Fire Management).

As coastal development increases the reserve will become an increasingly important refuge to both local and seasonally migratory wildlife. It is important to maintain the connectivity of the reserve with Crowdy Bay National Park, Dooragan National Park, Lake Cathie and Port Macquarie through vegetation corridors where possible.

Strategies and Actions

- Habitats for native animals will be protected by controlling the spread of introduced plants and animals (refer 4.3.1 Introduced Plants and 4.3.2 Introduced Animals) and appropriate fire regimes (refer 4.3.3. Fire Management).

- Emphasis will be given to protecting the habitats of animals listed under the TSC Act and/or covered by international agreements as well as the EPBC Act including: wompoo fruit-dove; glossy black-cockatoo; little tern; beach stone-curlew; osprey; koala; little bentwing-bat; common blossom bat; great egret; lesser golden plover; whimbrel; eastern curlew; bar-tailed godwit; turnstone; grey-tailed tattler; crested tern; and common tern.

- Implement recovery plans for threatened species as they are prepared. Recovery plans are currently in preparation for the glossy black cockatoo, koala, osprey, beach-stone curlew, spotted-tailed quoll, common blossom bat, little bent wing bat and east coast freetail bat.

- Research into the effects of fire on wildlife will be encouraged.

- Fauna surveys will be encouraged with emphasis on small mammals, reptiles, amphibians, micro-bats and the tiger quoll.

- Further investigations will be undertaken into the bat roosting site on the southern side of the headland to determine the species of bat using the cave and any management actions to protect the bats and their habitat.

- The co-operation of adjoining land-holders, Hastings Council, volunteer organisations and other Government agencies will be sought to improve and maintain wildlife corridors adjoining the reserve.

4.2 CULTURAL HERITAGE

4.2.1 Aboriginal History

Aboriginal communities have an association and connection to the land. The land and water biodiversity values within a whole landscape context are the centre of Aboriginal spirituality and contribute to Aboriginal peoples identity. Aboriginal communities associate natural resources with the use and enjoyment of valued foods and medicines, caring for the land, passing on cultural knowledge and strengthening social bonds. Aboriginal heritage and nature are inseparable from each other and need to be managed in an integrated manner across the landscape.

The reserve is amongst a landscape that is part of the identity, spirituality, connection and resource base of the Birpai Aboriginal people.

Aboriginals of the mid-north coast operated within a series of social groupings. The hearth group, comprising a man, his wife or wives, and their children, formed the basic socio-economic unit and several hearth groups would often co-operate, forming highly flexible ‘bands’ which would coalesce and then disperse as conditions demanded (Godwin, 1990, cited in Collins, 1998). In turn, groups of bands formed land-owning ‘clan’ groups. The size, composition and location of individual bands within the clan estate varied in response to social and economic considerations. In resource-rich coastal areas, clan groups with at least 100 members occupied relatively small territories, the boundaries of which were defined and generally known (Collins, 1998).

There has been much confusion about which traditional tribal groups occupied the Camden Haven area. Tindale (1940; 1974 cited in Collins, 1998) identifies the Ngamba ‘tribe’ as traditional inhabitants of the area, however,

the homeland of the Ngamba has been located by some researchers in the Brewarrina area in north-west NSW. The Ngamba people are believed to have moved to the New England region during disruptive times in the late 1800's. They then moved to the Camden Haven area in the early 1900's, an area which was already occupied by the Birpai.

Creamer (1981) identified the tribal-language group for the Camden Haven area as the Kattang, which, prior to European settlement, is believed to have extended from Telegraph Point, Port Macquarie region to the Hawkesbury River, north of Sydney. Hence, the reserve has taken its name from this tribal language group.

According to Griffith (1992a), the two main seasons, summer and winter, apparently regulated the Ngamba and Birpai tribes' land-use patterns. In summer they lived in the lowlands of their territory near river and sea where they took full advantage of seasonally abundant fish and shellfish, and fruits such as figs. The lowland forests also contained abundant koala, possum, kangaroo, pademelon and wallaby populations. At the close of summer, the Birpai migrated to the mountain lands to hunt game and foul, and gather wild vegetables. The Ngamba people had little in the way of mountain lands into which to migrate during the winter months.

Archaeological surveys show that Aboriginals extensively used coastal areas. When Oxley skirted along the northern shore of Queens Lake (5km west of the reserve) he noted: "saw many large canoes on the lake" and that "the aborigines seem(ed) very numerous".

In the 1800's lime burners, in the absence of any limestone source burnt large quantities of shells and it seems extremely likely that many of the Camden Haven Aboriginal middens were destroyed for their shell content during the course of these early lime burning activities (Collins, 1998).

The types of Aboriginal sites reported within the Camden Haven/ Dunbogan area are: shell middens, open campsites, isolated stone artifacts and scarred trees. There are two known Aboriginal middens located within the reserve and possibly two more on the southern side of the reserve. It is possible that other middens may occur in the reserve which have not yet been located.

Although middens are the most common type of evidence of coastal occupation, it is estimated that up to half of those present in northern NSW, including many still listed on the NPWS register, have been destroyed by sand mining or erosion (Collins, 1998). As a result, undisturbed examples are now relatively rare.

While the NPWS has legal responsibility for the protection of Aboriginal sites, the NPWS acknowledges the right of local Aboriginal people to be part of the decisions about their own heritage. Consultation has traditionally occurred with local Aboriginal people through Local Aboriginal Land Councils and contact with traditional owners. The reserve falls within the Bunyah Local Aboriginal Land Council (LALC).

Strategies and Actions

- The Bunyah LALC, Birpai Aboriginal Community, local Aboriginal elders, custodians and other relevant representatives will be consulted in the management of Aboriginal sites on the reserve.

- The Bunyah LALC will be approached to participate in an archaeological survey of the reserve, in particular to locate the two possible midden sites on the southern side of the headland to determine the significance of these (and other) sites and appropriate management actions.

- Prior to any works, a survey for Aboriginal sites involving Sites Officers from the Bunyah LALC will be undertaken. Where sites or places of cultural significance are found actions will be implemented to ensure protection of sites in consultation with representatives of the Aboriginal community.

- All midden sites will be included in the heritage zones of the Kattang Fire Management Plan and will be protected from wildfire.

- Interpretation of Aboriginal sites and cultural heritage in the reserve will be approved by the Bunyah LALC and Birpai people.

- Further research into the Aboriginal heritage of the reserve will be encouraged.

4.2.2 Non-indigenous Heritage

The first European record of the area was by Captain James Cook who named the most eastern promontory 'Perpendicular Point' in 1770.

On October 15th 1818, Surveyor-General John Oxley named the Camden Haven River in honour of Charles Pratt, 1st Earl Camden (Camden Haven Historical Society, 1991).

Oxley noted the diversity and abundance of fauna and flora. His journal notes highlight the excellent stands of blackbutt, stringy bark, turpentine and forest oak. He refers to large numbers of water fowl and kangaroos, and notes the presence of a sizeable Aboriginal population. His journal stated "the higher lands abound with good timber, the points nearest the sea being covered with *Banksia integrifolia* of large dimensions fit for any kind of boat timber".

Settlement of the Camden Haven occurred in a piecemeal fashion through the 1820's and 1830's as an outpost of the more structured penal settlement of Port Macquarie. Between 1820 and 1860 Camden Haven area was important in order to intercept convicts who escaped from Port Macquarie. The towering headland of Perpendicular Point sheltered the area from strong winds and provided a haven for vessels during storms. The area was also visited by limeburners, cedar getters and graziers.

The first permanent European settler occupied land at Laurieton (Peach Grove) in 1872. By 1890 the Camden Haven had come to be regarded as one of the strongholds of the northern timber trade, giving employment to “a small army of puntsmen, snaggers, rivermen, lumberers, coasting seamen, sawmill hands, wharf labourers, engineers, teamsters, splitters and shinglers” (Sharp, 1890 in Patterson Britton and Partners, 1999).

The reserve has experienced a range of historical uses including cattle grazing and camping, and there was an extensive network of trails and vehicle tracks throughout the area. In 1831 the reserve area was gazetted as Crown Land for recreation, camping and access. The reserve exists now as a protected area largely as a result of the efforts of the local community in 1977, working together, under the auspices of a “Save the Headland” organisation. Logan’s Lookout was named after Logan McPherson, who was one of the driving forces behind the dedication of the reserve.

Adjacent to the reserve, overlooking the Camden Haven Inlet, Pilot and Washhouse Beaches, is the Camden Head Pilot Station. The land was originally reserved for the Pilot Station on 18 October 1890. It was commissioned in 1907 and was operational until 31 October 1975. A dwelling, garage, boathouse and signal shed remain as evidence of its operation. The site was used to improve navigation by recording the dangers to navigation and to construct breakwaters. The Camden Head Pilot Station is registered by the National Trust and is listed on Hasting Council’s Local Environmental Plan. The Pilot Station is presently managed by the Camden Haven Adult and Community Education (CHACE) as a centre for writing, community cultural development and environmental education. It is likely that the reserve will play a major role for environmental studies and as artistic inspiration for activities undertaken at the Pilot Station.

Strategies and Actions

- A history of occupation and use of the reserve and surrounding area will be compiled in consultation with the CHACE committee, Camden Haven Historical Society and other relevant local community groups.

- NPWS will liaise with the management of the pilot station in regard to joint interpretation of the reserve and Pilot Station.

- A heritage interpretive and educational strategy will be developed for Aboriginal and non-indigenous heritage, including information on Logan McPhearson and the history behind the dedication of the reserve (refer 4.4.1 Promotion, Interpretation and Education).

4.3 PARK PROTECTION

4.3.1 Introduced Plants

A survey of weeds species in 1996 identified 35 weed species occurring within the reserve (Griffith, Wilson and Dodkin, 1996). A further seven weed species in the reserve have since been identified. Bitou bush *(Chrysanthemoides monilifera*), lantana (*Lantana camara*) and asparagus fern (*Asparagus sprengeri*) are all recorded in the reserve and are considered to be the three worst weeds on the NSW coastline (DLWC, 2001). Other noxious weed species recorded in the reserve include giant Parramatta grass *(Sporobolus sp.)* and prickly pear *(Opuntia sp).*

Bitou bush is a noxious weed introduced to Australia from South Africa. This plant rapidly colonises the dunes and adjacent areas to the exclusion of all native species. It can form clumps, which change the velocity of the wind causing it to accelerate either side of the plant thus leading to tussock erosion. Biological control using the bitou tip moth has been trialed on the south side of Perpendicular Point near Pebbly Beach. Other biological control agents have been released in nearby areas such as Crowdy Bay National Park and Sea Acres Nature Reserve.

Under Schedule 3 of the TSC Act bitou bush has been listed as a key threatening process and NPWS has recently prepared a draft threat abatement plan for bitou bush.

There has been a long term effort by community volunteer groups to control the infestations of bitou bush in the reserve, including the Camden Haven Protection Society, Friends of Kattang supported by government schemes such as Coastcare and Greencorps. Other groups such as the National Parks Association, the Camden Haven Garden Club, Scouting Association and Seventh Day Adventists and the LEAP scheme have also contributed. NPWS and NSW Agriculture weed programs have also been ongoing.

Lantana is an environmental weed also common to farming areas, roadsides and gullies. Lantana is the most widely distributed weed in parks and reserves in the NPWS Mid North Coast Region. It is a highly invasive weed, particularly in areas of previous disturbance. Prior to the dedication of the reserve a network of vehicle tracks disturbed the native vegetation over the headland, which enabled the infestation of weeds such as lantana to occur. Lantana has since established itself within the reserve, effectively competing against native plants.

Other environmental weeds such as giant parramatta grass, giant paspalum and prickly pear occur within the reserve and threaten to colonise at the expense of native plants. Many weeds originate as ornamental garden plants disposed as refuse, spread by native fauna or by wind and water.

The dumping of garden refuse, particularly along the western boundary of the reserve adjacent to the residential area, has been a major concern in the past

because of the introduction of weeds which can harbour pests, destroy native bushland and reduce habitat for native fauna. Apart from introducing weeds, garden refuse can also threaten life and property in the event of wildfire by creating a potential fire hazard. However, there is currently a co-operative approach with neighbours whereby garden refuse is being appropriately disposed. Weeds from previous dumpings still exist along the western boundary behind the residential area.

A Pest Management Strategy for the Mid North Coast Region has been developed. This strategy identifies the major pest populations and priorities for control of pests within NPWS parks and reserves in the Mid North Coast Region over the period 2001-2004. A Regional Weed Strategy for bitou bush has also been identified as a priority.

Strategies and Actions

- A pest strategy for the reserve will be prepared which will give priority to control of noxious weeds and weeds threatening rare plants on the headland, for example bitou bush and its threat to *T. australe*.

- Mapping and monitoring weed infestations in the reserve will occur as part of the pest strategy for the reserve.

- Weeds will be controlled and where possible eliminated.

- Bitou bush in the reserve will be contained and if possible eliminated through an ongoing weed control program and in accordance with the threat abatement plan. Options may include hand removal; aerial spraying and direct application of chemicals; and biological control.

- NPWS will continue to encourage the support of volunteer organisations in the containment of weeds, in particular bitou bush.

- A community education program to prevent the dumping of garden refuse and spread of exotics in the reserve will be ongoing in the local area.

- The success of biological control trials for weeds at Crowdy Bay National Park and Sea Acres Nature Reserve will be monitored and if successful the NPWS will investigate their use in the reserve.

- Weed control programs occurring adjacent to the reserve such as those existing at the Pilot Station and Gogleys Lagoon, will be encouraged.

- Aerial spraying of bitou bush will be undertaken in inaccessible locations in the reserve, in conjunction with pre and post vegetation and fauna monitoring for any negative impacts.

- Research into biological controls for weed species will be encouraged.

4.3.2 Introduced Animals

Feral animals such as foxes and cats threaten native animals through predation and competition for food. The close proximity of the reserve to a residential area increases the likelihood of domestic cats occurring within the reserve. Domestic dogs taken into the reserve by visitors or wandering into the reserve also threaten native fauna through predation and by leaving a predator scent in the area. Bait, gutted fish remains and other food scraps can attract pest predators to the reserve.

Fox populations occur in high numbers along the urban/semi rural fringes of major towns and villages. Foxes are a major concern in the reserve and over the years there has been an increase in fox and den sightings. Other introduced animals recorded within the reserve are the house mouse (*Mus musculus*) and black rat (*Rattus rattus*).

No trapping or baiting programs have been undertaken to date, however a control program for cats and foxes will be developed for the reserve as part of the Regional Fox Management Strategy and Feral Cat Management Strategy which will follow on from the Mid North Coast Pest Management Strategy 2001.

The Regional Fox and Cat Management strategies will consider: trials of various control techniques; liaison with volunteer groups; community education programs; endangered fauna recovery plans; liaison with recovery teams; fire management plans; consultation with other government agencies; training of staff on control techniques; and attendance at workshops and conferences on the management of feral animals. Control programs may include: trapping; biological control; 1080 baiting; den fumigation (foxes); and community education programs.

Strategies and Actions

- Domestic animals will not be allowed within the reserve. Improved signage will be provided at main access points, in particular signage at Charles Hamey carpark to advise visitors of restrictions on domestic animals.

- A feral animal control program will be developed, with priority on the control of foxes and cats.

- Education programs will be undertaken in the Camden Head local community about feral animal control programs and the impact of feral and domestic pets on local wildlife (refer 4.4.1 Promotion, Interpretation and Education).

4.3.3 Fire Management

Fire is a natural feature of the environment and is essential to the survival of some plant and animal communities. Appropriate fire management is essential to avoid the extinction of native plant and animal species.

Management must aim to achieve both long-term conservation of native plant and animal communities and ongoing protection of life and property within and adjacent to the park.

Fire history

Between 1976-2002 there have been five wild fires in the reserve. Apart from the 1976/77 fire, these fires have been of low intensity and usually associated with arson where the fire ignition points have been related to walking tracks and nearby roads. The majority of these ignitions occurred close to the reserve's western boundary. The last wild fire occurred in 1997/98 near Bergalia car park in the northwestern corner.

Fires within the reserve have been difficult to contain due to the lack of fire access advantages such as roads (other than a fire trail along the western boundary of the reserve and the road to Charles Hamey carpark). Hence, wild fires have the potential to spread rapidly and burn large areas of the reserve.

Ecological requirements

Critical fire regime thresholds for major groupings of plant communities in the reserve are identified in Appendix 1. Fire regimes beyond these thresholds will result in the decline of plant species and will cause changes in structure and vegetation cover adverse to animal species.

Accordingly, the management of fire should aim to provide a pattern of fires of high, moderate and low intensity, frequency and extent. Extinction of native plants and animals are most likely to occur when fire regimes are of a fixed frequency, intensity and extent.

Inappropriate fire frequencies and intensities not only impact on native plants and animals but also encourages the spread of noxious and environmental weeds such as bitou bush. Pest animal densities within the reserve can also be encouraged if the general fire regime is too frequent. This may in turn impact on wildlife, in particular threatened fauna within the reserve through habitat displacement and predation.

Fire Management Plan

A fire management plan has been prepared for the reserve. This identifies the bushfire threat, requirements for the conservation of native plants and animals, the protection of cultural sites such as Aboriginal middens and the need to manage the urban/bushland interface along the western boundary of the reserve.

The plan is consistent with the Hastings District Bush Fire Risk Management Plan developed by the Hastings District Bush Fire Management Committee. The NPWS is an active member of this committee.

Strategies and Actions

- Recreational fires (i.e. open fireplaces and wood fire barbecues) will not be permitted in the reserve.

- Slashing will be undertaken to maintain a fire protection zone along the western boundary of the reserve behind the houses. Fire will be used to control fuel levels in the area immediately east of the slashed zone and elsewhere as necessary.

- Fire will be managed to maintain species diversity in the reserve (refer Appendix 1). Mosaic burning will be used to preserve vegetation communities and habitats. The pattern of the mosaic burning will be on compartments using existing roads, internal walking tracks and naturally occurring fire lines such as rocky platforms. Where necessary, low intensity fires will be used to reduce the impact of wildfire on arboreal mammals.

- Fire will be excluded from littoral rainforest and dune vegetation.

- The headland will not be actively burnt for managing *T. australe* unless further studies show that fire is beneficial for the ecology of the plant. However, wildfires occurring in the vicinity of *T. australe* populations could be allowed to burn within frequency threshold and if safe to do so.

- Further research will be undertaken or encouraged into the fire ecology of *T. australe*.

- Wildfires within the reserve will be managed to avoid an unacceptable fire regime and to protect adjacent life and properties.

- Weed control measures will be undertaken in conjunction with fire management in the reserve. Intensive bitou bush control follow-up will be implemented where fire is used to maintain species diversity and following any wildfires (refer also 4.3.1 Introduced Plants).

- The existing network of roads, fire management trails and walking tracks in the reserve will be maintained and used as fire advantage zones where considered necessary.

- The cleared fire protection zone along the western boundary of the reserve will be available for fire and management access only. General public vehicular access will not be permitted along the clearing to private property. NPWS will liaise with neighbours to ensure that the western fire trail and boundary is kept clear of vehicles, rubbish and other unauthorised uses.

- Liaison will be maintained with local Bush Fire Brigades, local government agencies and neighbours to ensure a coordinated approach to fire

management within the reserve and on adjoining lands. This will include the development of co-operative fire management strategies.

- The NPWS will encourage community involvement in the "Community Fire Guard" training programs in Camden Head village, in particular for residents adjoining the reserve to assist the community in protecting their assets from wildfire.

- NPWS will encourage the ongoing efforts of community groups such as the Friends of Kattang, the Camden Haven Protection Society and the National Parks Association in assisting in minimising weed infestation following fire.

- An education program will be implemented to raise community awareness of the importance of establishing an ecologically acceptable fire regime for the reserve (refer also 4.4.1 Promotion, Interpretation and Education).

- Further research will be encouraged or undertaken into fire behaviour, fire hazard and risk assessment and the impact of fire on the biodiversity represented within the nature reserve. This will include research on the vertebrate and invertebrate animal populations of the reserve and endangered and threatened plant populations.

4.4 USE OF THE AREA

The scenic beauty and natural diversity of the reserve provides opportunities for nature based recreation in a natural setting. Other uses of the reserve include promotion of the conservation of natural and cultural heritage, environmental education, scientific research and management operations by NPWS and other authorities.

This plan seeks to ensure that activities in the reserve are managed consistent with the NPW Act, as well as NPWS policies and management objectives outlined in this plan, in particular, ensuring that use is consistent with the primary objective to protect the natural and cultural values of the reserve.

4.4.1 Promotion, Interpretation and Education

The reserve is ideal for environmental education because of its close proximity to a number of towns and villages along the mid north coast including Taree, Port Macquarie and Laurieton. It also has easy access for visitors passing through the area. The diversity of plants, animals and habitats within the reserve and surrounding area offers extensive opportunities to study the coastal environment.

A visitor information brochure has been produced which provides basic information on the reserve's natural and cultural values, recreation opportunities, walking tracks, lookouts and general access.

A visitor survey (Hardwick 1995) found that reserve users felt the natural state of the reserve met their needs and current use of the reserve was environmentally sustainable. There was no demand for development of the reserve or a change in its current usage. Some visitors did, however, suggest that the public profile of the reserve should be raised to attract visitors living beyond the immediate locality.

Development of the Pilot Station could increase awareness of the reserve (refer 4.2.2 Non-indigenous Heritage). Visitor numbers to the reserve are likely to increase in response to this project and population growth of the area. It is therefore necessary to ensure that interpretative and promotion facilities such as directional signage, park management signs and on-site information are developed and maintained in a manner which encourages appropriate visitor behaviour as well as an understanding of the values of the reserve and management operations.

Strategies and Actions

- An interpretation and educational strategy will be developed consistent with the management objectives of the nature reserve as provided in this plan.

- The reserve will be promoted as an area for the study of coastal plants, geological and geomorphological formations and cultural heritage.

- Environmental education groups, particularly school groups and those attending the Pilot Station programs, will be encouraged to use the reserve for environmental education. Guided educational tours will require consent from NPWS.

- NPWS will investigate opportunities for linking interpretive programs such as *Discovery Ranger* tours to the proposed Pilot Station environmental programs (refer also 4.2.2 Non-indigenous Heritage).

- A public awareness program involving signage, brochures and enforcement will be undertaken for priority problem areas including: unauthorised use of bicycles on walking tracks; illegal use of 4WDs on the northern end of Dunbogan Beach; littering at Perpendicular Point headland; and domestic animals in the reserve.

- Signage will be installed in the reserve encouraging visitors to stay on the walking track network.

4.4.2 Recreational Opportunities

The reserve, including Perpendicular Point, the rocky foreshores and surrounding beaches have been used since the 1930's for local recreation including fishing, camping, picnicking, and sightseeing.

The headland remains popular for recreation and the high scenic quality and natural diversity of the reserve lends itself to passive recreational pursuits such as bushwalking, photography, bird watching, whale watching, sightseeing and nature studies.

Fishing is a popular activity along the rock platforms and beaches near Perpendicular Point and Camden Head, however, fishing line and bait litter can impact on the reserves wildlife. A number of fishing rod holders have been illegally cemented into the rock platforms near Casuarina Cove.

The reserve is close to the villages and towns of Camden Head, Dunbogan, Laurieton, North Haven and Port Macquarie and attracts large numbers of visitors during holiday periods. The population of the surrounding area is growing and hence there will be greater visitor pressures on the reserve. The surrounding towns, villages and national parks offer a range of recreation opportunities (as well as facilities) including boating, picnicking, camping, fishing, swimming, surfing and bush walking. Accommodation for visitors to the mid-north coast includes motels, holiday cottages and caravan parks in the adjoining coastal villages and regional centres.

Visitor facilities and recreation opportunities can contribute to appreciation and enjoyment of the reserve. However, they have the potential to impact on the values of the reserve from on-site impacts (e.g. clearing, effluent disposal, soil erosion etc for facilities) and off site impacts (e.g. litter and landscape intrusion). It is important that recreational use of the reserve presents minimum or no threat to the values of the reserve and be ecologically sustainable. Visitor facilities also incur an ongoing maintenance cost to NPWS and need to be considered in the context of providing an appropriate level of visitor access consistent with the primary objective to protect the natural and cultural values of the reserve.

(a) General

An objective of this plan is to manage the reserve as a nature reserve suitable for low key, passive visitor use. Facilities present in the reserve include an access road, car parks, lookouts, signage, seating and walking tracks. These facilities are complemented by other more developed opportunities provided in the adjacent council reserve and other national parks and reserves in the area, including Dooragan National Park, Crowdy Bay National Park and Sea Acres Nature Reserve.

It is also important that the visual amenity of the reserve is not compromised hence any maintenance, signage, walking track improvements etc should consider the visual impact that may occur from views within the reserve as well as, from further afield.

Strategies and Actions

- No new facilities will be provided in the reserve, other than the formal extension of the walking track and installation of a viewing platform on

Perpendicular Point and interpretive signage at appropriate locations (refer below and section 4.4.1 Promotion, Interpretation and Education).

- Facilities such as toilets, picnic tables, campsites, garbage bins, fireplaces and water supply will not be provided in the reserve.

- Existing facilities will be maintained for a low key level of visitor use.

- Fishing rod holders and where possible associated cement footings will be removed from the reserve.

- Adventure activities, such as abseiling, rock climbing, hang gliding and paragliding will not be permitted (refer (e) hang gliding).

- The impact of visitor use will be monitored and if necessary areas within the reserve will be permanently or temporarily closed or otherwise restricted if unacceptable damage is found to be occurring to natural or cultural values.

- Any structures such as signage, fencing, bollarding and track maintenance will consider the visual amenity of the reserve.

- Competitive events will not be allowed in the reserve.

(b) Walking tracks

A loop-walking track circuits the “Flower Bowl” in the centre of the reserve with side trails to additional points of interest, such as Perpendicular Point (see the map). Erosion control works have recently been undertaken on sections of the Flower Bowl walking track. Access to the walking track is from the parking area north of the reserve at Bergalia Crescent or the Charles Hamey carpark in the south. The track has a number of lookouts providing panoramic views south to Diamond Head (Crowdy Bay National Park), north to Port Macquarie, west to North Brother Mountain (Dooragan National Park), the Camden Haven estuary and along the rugged cliff faces of the reserve.

The existing walking track system is badly eroded in places resulting in siltation to surrounding vegetation and creeks as well as exposing tree roots. Due to the sandy nature of the soils tracks are prone to erosion from weathering processes and foot traffic. In some locations vegetation along the track edge are dying from tree root exposure.

The walking track at Tuckeroo car park provides access to Dunbogan beach. This track cuts through an exposed and eroded sand dune.

A number of unauthorised walking tracks have developed from the residential area along the western side of the reserve and on the headland through fragile coastal vegetation leading to rock platforms below.

At Perpendicular Point, the walking track has been extended and a lookout has been constructed. Previously there were a number of informal tracks that traversed this area to the cliff face through the Themeda grassland (where *T. australe* occurs). The upgraded walking track will encourage people to stay on the track and minimise any impacts to *T. australe* from possible trampling. Perpendicular Point has a number of dangerous drop-offs and the new lookout will help manage visitor safety in this location.

The section of the Perpendicular Point walking track near Casuarina Cove, is closed and fenced due to erosion. Visitors trying to gain access to Casuarina Cove are by-passing the fence and accessing the rock platforms via this eroded track or through headland vegetation creating a number of ad-hoc foot trails.

There are a number of informal tracks in the reserve that are used mainly by fishers to access rock platforms and beaches for fishing. Some of these tracks are eroding and in need of repair works.

Strategies and Actions

- The walking tracks shown on the map will be maintained in accordance with the principles of the NPWS Walking Track Manual. A walking track maintenance and rationalisation plan will be developed and implemented for the network of walking tracks shown on the map. This will include:
    - the installation of low decking or boardwalks across drainage lines where required;
    - track resurfacing with appropriate gravel substance only;
    - stabilisation of the Tuckeroo car park to Dunbogan Beach access track pending an alternative track to the beach being constructed by Council;
    - closure and rehabilitation of the tracks leading to the hang gliding platform, Casuarina Cove and all other unauthorised walking tracks within the reserve; and
    - track signage where required e.g. at Charles Hamey carpark and at the access to Casuarina Cove.

- Walking track maintenance will ensure special consideration for: adequate drainage, the use of inert substances for track resurfacing, keeping track width to a maximum of 1.2 metres and brush clearing (pruning) to be sensitive to the integrity of the specific location.

- Track route markers may be installed on some tracks to minimise the proliferation of informal tracks to beaches and rock platforms. Tracks that are significantly eroded will be closed and rehabilitated.

(c) Vehicle access

Prior to gazettal as a nature reserve a number of 4WD vehicle tracks were developed mainly to access fishing sites on the peninsula and for scenic viewing. These tracks have since been closed and rehabilitated, although

remnants of sections of the tracks remain and weeds such as bitou bush have established in some areas.

Poor drainage at Charles Hamey carpark has led to erosion of the watercourse extending from the car park to the northern end of Dunbogan Beach and the access road to the car park (Hameys Road) requires upgrading.

Tuckeroo car park (and walking track access to Dunbogan Beach) is situated on the southern side of Camden Head. It is a popular spot for beach fishing, swimming and surfing. Unauthorised 4WD use occurs along the northern section of Dunbogan Beach where vehicle access is prohibited by Council and NPWS. Theft from vehicles parked at the Tuckeroo car park is also a problem and many visitors choose to park their vehicles on the Camden Head Road and walk to the Dunbogan beach via the access road and walking track.

Strategies and Actions

- Public vehicles will only be permitted on the designated park road (see the map).

- The Charles Hamey carpark and access road will be upgraded and erosion control works will be undertaken along the creek line extending from the carpark below the lookout platform.

- The Tuckeroo car park will be closed and rehabilitated subject to Hastings Council providing alternative parking along Camden Head Road.

- 4WD regulation signage will be installed in appropriate areas, including Dunbogan Beach.

- NPWS will liaise with Hastings Council rangers about policing unauthorised 4WD access to the northern end of Dunbogan Beach.

(d) Emergency access

Perpendicular Point is a popular fishing destination especially along the rock platforms surrounding the headland. This type of environment can become dangerous during bad weather conditions and in the past a number of rescues have been carried out where fisherman have been washed out to sea. An emergency rescue buoy has been installed on the rock platform near Casuarina Cove by the local rescue authority. Access to these locations by rescue authorities is either by foot, boat or helicopter.

Local fire authorities have periodically used the reserve for cliff rescue training.

Strategies and Actions

- Local fire authorities carrying out training courses will require consent from NPWS.

- NPWS will consult with local rescue authorities to determine more effective means for emergency access within the reserve such as quad bikes.

(e) Hang gliding

Recreational and commercial hang gliding previously occurred in the reserve on a sandy knoll at the northern side of the headland above Washhouse Beach. Due to the steep gradient and sandy nature of this location the access track to the hang gliding platform and the area surrounding the platform has become badly eroded. The hang gliding platform also poses safety issues to the public as well as having impacts on the landscape values of the area. The structure is visible from Perpendicular Point, Logan's Lookout and Washhouse Beach. The access track and hang gliding platform is also located adjacent to the littoral rainforest, which is a rare and sensitive plant community. The vegetation below the hang gliding platform has also been occasionally trimmed in the past to improve air flow conditions for gliding.

Hang gliders also occasionally used the old lookout site on the southern side of the reserve near the sandpit. This area has been closed for rehabilitation, however, pilots and sightseers have been climbing the barrier fences and traversing through the regeneration area to reach the old lookout site.

There are a number of alternative locations for hang gliding in the region, both on Crown and private lands. NPWS provides formal opportunities for hang gliding at Dooragan National Park 5kms to the west. This site is internationally recognised as one of Australia's best hang gliding locations.

Hang gliding and the provision of hang gliding facilities such as platforms is inconsistent with the management objectives of the reserve and this plan.

Strategies and Actions

- Hang gliding will not be permitted within the reserve.

- The hang gliding platform above Washhouse Beach will be removed, the access track will be closed, and the area rehabilitated.

(f) Paragliding

Paragliding is becoming increasingly popular in the reserve. It is a recent adventure sport to the reserve that has not been authorised. The main location for this activity is near Casuarina Cove on Perpendicular Point and is accessed by the existing walking track. The impacts associated with this activity includes damage to vegetation from accessing the launch site. Paragliding is inconsistent with the management objectives of the reserve and this plan.

Strategies and Actions

- Paragliding will not be permitted within the reserve.

(g) Horse riding

Horse riding has not historically occurred in the reserve. Although the NPWS regards horse riding as an acceptable form of recreation in some areas, horse riding is not permitted in nature reserves under general NPWS policies.

Strategies and Actions

- Horse riding will not be permitted in the reserve.

(h) Cycling

Cycling on the walking tracks can be dangerous, can impact on walkers safety and enjoyment of the reserve, and can contribute to track erosion. There is evidence of unauthorised cycling along the walking tracks in the reserve.

Strategies and Actions

- Cycling will only be permitted on public roads. Cycling will not be permitted on management trails or walking tracks.

- Signage about cycling restrictions will be installed at the entrance to the walking track at Charles Hamey carpark and Bergalia carpark (refer 4.4.1 Promotion, Interpretation and Education).

(i) Lookouts

There are a number of lookouts in the reserve (see the map). Charles Hamey Lookout is situated on the southern side of the reserve on Camden Head and offers stunning views south of Dunbogan Beach through to Diamond Head in Crowdy Bay National Park. It is accessible from the walking track leading up from Charles Hamey carpark and from the Flower Bowl circuit.

Dunbogan Lookout is situated at Charles Hamey carpark below Charles Hamey Lookout. It is easily accessible for visitors who wish to drive to the car park for viewing the magnificent scenery south of the reserve, overlooking Gogleys Lagoon towards North Brother Mountain (Dooragan National Park) and surrounds. It also provides access for people with disabilities.

Logan's Lookout is situated half way along the Perpendicular Point walking track. It was named after Logan McPhearson who was one of the driving forces behind the dedication of the reserve (refer to section 1.1 Location, Gazettal and Regional Setting). This lookout offers extensive views north over North Haven through to Bonny Hills and Port Macquarie and overlooks the rocky shoreline below.

Fishermans Bluff and Pebbly Beach Lookouts are accessible from side trails leading off the Perpendicular Point walking track. They offer magnificent views south along Dunbogan Beach to Crowdy Head and of the vertical cliffs on the southern side of the reserve. The cliff face in the vicinity of the lookout above Pebbly Beach is eroding, and requires stabilisation (refer also 4.1.1).

The walking track to Perpendicular Point has been extended and includes a lookout.

Lookouts are the focus for many visitors to the reserve and offer opportunities for on site interpretation. In the past interpretive signs at lookouts within the reserve have been vandalised.

Strategies and Actions

- Interpretive signs will be provided at strategic lookouts (refer also 4.4.1 Promotion, Interpretation and Education).

- Appropriate directional signage indicating the location of the lookouts within the reserve will be installed (refer also 4.4.1 Promotion, Interpretation and Education).

4.4.3 Research

Research can improve understanding of the area's natural and cultural heritage values and the processes affecting them. The outcomes of research can also establish the requirements for the management of particular species, communities or sites.

Recent research undertaken in the reserve has included vegetation surveys and fauna surveys. Specific studies include:

Vegetation Mapping and Inventory of Kattang Nature Reserve: A preliminary report on the vegetation of the reserve was carried out in 1996. Plant communities were identified from air photos and selective field sampling, and then mapped and digitised. A checklist of vascular plants including exotic species was also compiled. The digitised information, mapping and plant list for the reserve has been undertaken however, the final report has not yet been completed.

Bird list for Kattang Nature Reserve: In 1978-79 an avifauna survey was carried out by the Australian Museum. Eighty-two species were recorded for the headland. Since then further bird species have been added to this list and 136 species have been recorded to date.

Fauna Survey: A fauna survey was carried out in the reserve in November 1999 by NPWS. Small mammals, bats and amphibians were targeted during the survey as past records indicated these groups were poorly represented. A number of threatened species were identified however, the survey did not

find small native terrestrial mammals which would be expected to occur within the reserve.

Thesium australe: *T. australe* most commonly occurs in grassland dominated by *T. australis* and open woodlands. *T.australe* is listed as vulnerable under Schedule 2 of the TSC Act. Scientific research to understand the role of fire in the ecology of *T. australe* was undertaken between May 1995 and December 1996 at Look at Me Now Headland (NSW north coast) and Perpendicular Point (Kattang Nature Reserve), and at Old Bar Park (NSW central coast) between December 1996 and 1998.

Strategies and Actions

- All research will be subject to NPWS policies and procedures for the granting of permits, conduct of research and the production of results.

- Research permits will only be granted if it has the potential to facilitate better management of the reserve and does not conflict with the objectives and policies in this plan of management.

- NPWS will finalise the report on the reserve's vegetation.

- Encourage species data collection by birdwatchers, other groups or individuals and enter records in the NPWS NSW Wildlife Atlas database.

- Data and findings from research studies and surveys will be utilised in reserve management where appropriate.

- A prospectus will be prepared as a guide to preferred research projects in the reserve. Priority topics will be those of direct relevance to management and include:

    1. Habitat requirement for threatened species;
    2. Biological control of introduced plants;
    3. Biological control of introduced animals;
    4. Survey of Aboriginal sites;
    5. The ecological significance of fire in the reserve;
    6. Small mammal surveys;
    7. Micro-bat survey;
    8. Reptile and amphibian survey;
    9. Survey and management of *T. australe*;
    10. Research into the fire ecology of *T. australe*; and
    11. Research topics identified in recovery plans and threat abatement plans.

4.4.4 Non reserve uses

(a) Effluent Pipeline
An effluent pipeline was installed in the early 1970's by the Public Works Department at the southern side of the headland and predates gazettal of the reserve. The outlet for the pipeline is at the rocky cliff line above the northern end of Dunbogan Beach. Hastings Council has recently upgraded the treatment works and this has improved the quality of the output. Council will continue to monitor the outfall and are planning to improve the flow characteristics by extending the pipeline out to sea.

(b) Trig Site
The trig site above the sandpit and adjacent to Charles Hamey lookout has been heavily cleared in the past and has resulted in infestations of bitou bush and lantana. This area has been targeted for weed eradication and restoration. The 'Friends of Kattang' have already undertaken bitou removal however follow up work is required (refer 4.1.3 Introduced Plants).

Strategies and Actions

- No new non-NPWS infrastructure will be allowed in the reserve unless it benefits the management of the reserve.

- NPWS will liaise with Hastings Council about any future proposals to upgrade the effluent pipeline and with the Department of Land and Water Conservation about any future clearing of the trig site to ensure minimal environmental impact.

- Under the provisions of section 153 of the NPW Act the NPWS will liaise with Hastings Council to grant an authority for the effluent pipeline where it traverses the reserve.

- Works to remove bitou bush and lantana and to rehabilitate the trig site will be completed (refer to section 4.1.3 Introduced Plants).

4.4.5 Management Operations

The reserve is administered by the Hastings Area of the NSW NPWS. The area office and workshop is located at Port Macquarie.

Management of the reserve requires maintaining a system of access using walking tracks, the western fire trail and the Charles Hamey carpark access road.

Though it would be beneficial for management to include the intertidal zone, the intertidal zone is currently outside the reserve boundary.

Adjacent to the reserve is an area of Vacant Crown Land (VCL) near Gogleys lagoon and east of the Pilot Station adjoining Bergalia car park. This area

has natural and cultural values including wetlands, littoral rainforest and Aboriginal sites which would be a valuable addition to the reserve.

Strategies and Actions

- Maintain the western fire trail and Charles Hamey carpark access road for management access. Public vehicles will not be permitted on the western fire trail. No additional management trails will be constructed.

- Pursue options to dedicate the intertidal zone as an addition to the nature reserve.

- NPWS will investigate opportunities to include areas of VCL into the reserve where they have conservation values or for management purposes subject to consultation with relevant managing agencies.

5. PLAN IMPLEMENTATION

The plan of management is part of a system of management developed by the NPWS. The system includes the NPW Act, management policies, established conservation programs, and strategic planning at corporate, regional and district levels.

The orderly implementation of this plan will be undertaken within the annual programs of the NPWS Mid North Coast Region. Priorities, determined in the context of regional and Directorate strategic planning, will be subject to the availability of necessary staff and funds and to any special requirements of the Director-General or Minister.

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

Section 81 of the NPW Act requires that this plan shall be carried out and given effect to, and that no operations shall be undertaken in relation to the nature reserve unless they are in accordance with the plan. However, if after adequate investigation, operations not included in the plan are found to be justified, this plan may be amended in accordance with section 73B of the Act.

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

Section	Management Strategies (summary)	Priority
4.1.1 Landscape, Geology and Geomorphology	• Minimise impact of works on landscape values	High
	• Rehabilitate closed section of Perpendicular Point walking track, monitor for new tracks and erect signage	High
	• Close and rehabilitate hang gliding access	High
	• Undertake stabilisation works at Pebbly Beach lookout	Medium
	• Interpret geology and geomorphic processes	Low
	• Complete stage two rehabilitation of the sand pit	High
	• Undertake gully erosion control at Dunbogan beach	High
	• Encourage research	Ongoing
4.1.2 Native Plants	• Maintain diversity of habitats and species	High
	• Control spread of introduced species and maintain appropriate fire regimes	High
	• Manage for conservation of *T. australe*	High
	• Encourage research and implement recovery plans as prepared	Ongoing
	• Continue program for propagating and regenerating the horsetail sheoak	High
	• Work with neighbours and others to encourage the conservation of native vegetation and wildlife corridors in the vicinity of the reserve	Ongoing
	• Support ongoing efforts of Hastings Council and others in restoration of littoral rainforest adjacent to Gogleys lagoon.	Ongoing
	• Work with neighbours and others to encourage conservation of native vegetation and wildlife corridors in the vicinity of the reserve	Ongoing

4.1.3 Native Animals	• Control introduced plants and animals and implement appropriate fire regimes	High
	• Protect habitats of animals listed under the TSC Act and/or covered by international agreements and implement recovery plans	High
	• Encourage research into the effects of wildfire on wildlife	Ongoing
	• Encourage fauna surveys	Ongoing
	• Investigate bat roosting site	Medium
	• Seek co-operation of adjoining land-holders, Hastings Council, volunteer organisations and other Government agencies about wildlife corridors	Medium
4.2.1 Aboriginal History	• Consult with Bunyah Aboriginal Land Council, Birpai Aboriginal elders, custodians and other relevant representatives about cultural management	High
	• Undertake an archaeological survey	Medium
	• Ensure sites protection prior to undertaking any works	High
	• Protect middens from wildfire	High
	• Encourage Bunyah Aboriginal Land Council and Birpai Aboriginal groups or individuals to undertake interpretation of cultural heritage	Medium
	• Encourage further research	Ongoing
4.2.2 Non-indigenous Heritage	• Compile history of area in consultation with the CHACE committee and the Camden Haven Historical Society.	Medium
	• Work with the CHACE committee toward a cooperative relationship between the Pilot Station and the reserve.	Medium
	• Develop an interpretive and educational strategy	Medium
4.3.1 Introduced Plants	• Prepare a pest strategy	High
	• Map and monitor weed distribution	High
	• Prepare a Regional Weed Strategy	High
	• Control bitou bush in accordance with the threat abatement plan for bitou bush	High
	• Encourage support of volunteer organisations in the containment of weeds	Ongoing
	• Continue community education program	Ongoing
	• Investigate biological control trials for weeds	Medium
	• Encourage weed control programs adjacent to the reserve	High
	• Encourage research into biological controls	Ongoing
	• Undertake aerial spraying of bitou bush in inaccessible locations, and undertake pre and post monitoring of vegetation and fauna	High
4.3.2 Introduced Animals	• Prohibit domestic and other introduced animals	Ongoing
	• Develop strategy for control of foxes and cats	High
	• Undertake education programs	High
4.3.4 Fire Management	• Prohibit recreational fires	Ongoing
	• Use fire to control fuel levels and to maintain species diversity	High
	• Exclude fire from littoral rainforest and dune vegetation.	
	• Undertake or encourage research into the fire ecology of *T.australe*.	Ongoing
	• Protect life and property adjoining the reserve from fire	Ongoing
	• Undertake weed control measures when undertaking fire management	High
	• Maintain fire radiation zones & fire advantages e.g fire trails	High
	• Liaise with local bush fire brigades, local government agencies and neighbours to ensure a coordinated approach	High
	• Encourage community involvement in the “Community Fire Guard” training programs and raise community awareness of fire management	High
	• Undertake/encourage research into fire behaviour, fire hazard	

	and risk assessment and the impact of fire on the biodiversity	High
4.4.1 Promotion, Interpretation and Education	• Develop an interpretation and educational strategy	Medium
	• Promote as an area for the study of coastal plants, geological and geomorphological formations and cultural heritage	Medium
	• Encourage use of the reserve for environmental education	Medium
	• Ensure guided educational tours are licensed	Ongoing
	• Investigate opportunities for linking NPWS interpretive programs to the proposed Pilot Station environmental programs	Medium
	• Undertake public awareness program for appropriate use of the reserve	Medium
4.4.2 Recreational Opportunities	• Maintain facilities for low key level of visitor use.	Ongoing
	• Remove unauthorised fishing rod holders	High
	• Prohibit adventure activities and competitive events	Ongoing
(a) General	• Monitor impacts of visitor use.	Medium
(b) Walking tracks	• Maintain walking tracks shown on the map	Ongoing
	• Develop a walking track maintenance and rationalisation plan in accordance with this plan.	Medium
(c) Vehicle access	• Prohibit public vehicle access on management trails	High
	• Upgrade Charles Hamey carpark and access road	High
	• Close Tuckeroo car park subject to providing alternative parking.	High
	• Install 4WD regulation signage and liaise with Council about policing	High
(d) Emergency access	• Consult with local rescue authorities about emergency access	Medium
	• Require consent for non NPWS fire/rescue training courses	Ongoing
(e) Hang gliding	• Prohibit hang gliding	Ongoing
	• Remove hang gliding platform above Washhouse Beach	High
(f) Para gliding	• Prohibit paragliding within the reserve	Ongoing
(g) Horse riding	• Prohibit horse riding in the reserve	Ongoing
(h) Cycling	• Permit cycling on public roads only and install signage	Ongoing
(i) Lookouts	• Provide directional signage and interpretive signs at lookouts	Medium
	• Install viewing platform Perpendicular Point	High
4.4.3 Research	• Require permits for research	Ongoing
	• Encourage species data collection by bird watchers and others	Ongoing
	• Incorporate research findings into management	Ongoing
	• Prepare a prospectus to guide research projects	Medium
4.4.4 Non reserve uses	• Prohibit non-NPWS infrastructure	Ongoing
	• Liaise with Hastings Council about any upgrade of effluent pipeline	Ongoing
	• NPWS will liaise with Hastings Council to grant an authority for the effluent pipeline where it traverses the reserve.	High
	• Complete removal of bitou bush and lantana and rehabilitate trig site	High
4.4.5 Management Operations	• Maintain the existing western fire trail and Charles Hamey carpark access road for management vehicle access	Ongoing
	• Locate park infrastructure off park whenever possible	Ongoing
	• Pursue options for the intertidal zone to be added to the nature reserve	High
	• Pursue VCL additions to the reserve	Medium

APPENDIX 1 Critical Fire Regimes for Major Plant Communities in Kattang Nature Reserve

Littoral rainforest: This community has not been subjected to fire. This situation should be maintained to ensure the conservation of this forest type.

Forest and woodland communities: The majority of forest and woodland communities have not been burnt beyond appropriate thresholds. The maintenance of low fuel levels in the property protection zone may reduce species diversity in that zone but will assist in protection of the remainder of the communities some of which have experience fire frequency of a concern for the long term viability of plant species. Appropriate thresholds to maintain this community suggests that a decline in species is predicted if more than one fire occurs every fifty years.

Shrubland/heath complex: This vegetation community has experienced the level of fire frequency necessary to maintain species diversity. The fire regime guidelines suggest the "shrubland-heath complex" community is best suited to a fire frequency of no more than two fires in a row with intervals of eight years. Although it may be desirable to burn these communities in the near future to maintain diversity, the problem of bitou bush invasion following fire is thought to be of greater concern in specific areas. Unless intensive bitou bush control follow-up is implemented the deliberate use of fire in these species assemblages is not desirable. The control of bitou bush in the reserve is undertaken by NPWS field staff, Camden Haven Protection Society, Friends of Kattang and a number of volunteers in the community. In the past, bush regeneration activities in the reserve have been funded by the Commonwealth Government's Coastcare Program and Greencorps.

The headland and sod grassland complexes: these communities have received a low fire frequency, to the extent that *Banksia integrifolia* is replacing much of the sod grassland and invading the headland complexes. Again bitou bush control follow-up must be implemented if fire is to be deliberately used to promote diversity in these complexes. Any fire used in these complexes must be of low intensity in the vicinity of the stands of *Allocasuarina equisetifolia*.

Fire will not actively be used for the management of *Thesium australe* unless further studies on fire ecology of this plant proves otherwise. However, in advent of a wildfire in the vicinity of *T. australe* and frequency is appropriate then the wildfire can be allowed to burn if safe to do so. Follow up work on weed removal in particular bitou bush will be necessary after fires.

The foredune areas are heavily infested with bitou bush. Bitou Bush is a weed of national significance and is a priority for management. Fire has been used in the past in an attempt to control bitou bush. Fire in dune areas is a risk to sensitive native vegetation and can lead to dune destabilisation and weed invasion. NPWS will not use fire as a control method for weed species in dune areas. Bitou control in these areas is a prerequisite to any other management for species diversity.

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