WAMBINA NATURE RESERVE
PLAN OF MANAGEMENT

NSW National Parks and Wildlife Service

July 2003

This plan of management was adopted by the Minister for the Environment on 30th July 2003.

Acknowledgments: This plan of management is based on a draft plan prepared by Rangers David Kelly and Phil Lamrock of the Central Coast and Hunter Range Regional Office of the National Parks and Wildlife Service.

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Photograph of Wambina Nature Reserve by Joel Winter.

NSW National Parks and Wildlife Service

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FOREWORD

Wambina Nature Reserve is located at Matcham on the Central Coast of New South Wales, approximately 10 kilometres east-north-east of Gosford. The area was gazetted on the 21 May 1997 and currently protects 53.65 hectares at the headwaters of Erina Creek catchment.

Wambina Nature Reserve protects a variety of habitats from ridges of open forest to deep rainforest gullies. These habitats in turn support a diverse range of flora and fauna including species of ecological significance on a local, regional and state-wide scale.

Twelve animal species found in the reserve are listed as Vulnerable (Schedule 2) under the Threatened Species Conservation Act 1995, including a nursery and mating colony of the Grey-headed Flying-fox. In addition, twelve plant species identified within the reserve are of special conservation significance.

Wambina Nature Reserve provides opportunities for environmental education and scientific research, particularly into the ecology of rainforests and flying-foxes. The reserve will be managed to protect and where necessary improve the natural environment and to maintain habitat for flying-foxes.

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

Bob Debus
Minister for the Environment

CONTENTS

1. INTRODUCTION

The *National Parks and Wildlife Act 1974* requires that a plan of management be prepared for each nature reserve. A plan of management is a legal document that outlines how the area will be managed in the years ahead. The procedure for the adoption of a plan of management is specified in the Act and involves the following stages:

- The Director-General gives notice that a plan of management has been prepared.
- The plan is placed on public exhibition for at least one month and during this period any person may make representations about the plan.
- The plan and copies of all the representations are referred to the National Parks and Wildlife Advisory Council for consideration.
- The Director-General submits the plan of management together with any comments and suggestions of the Council to the Minister for the Environment.
- The Minister may adopt the plan with or without amendment after considering the comments of the Advisory Council or may refer the plan back to the Director-General and Council for further consideration and advice.

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

A draft plan of management for Wambina Nature Reserve was placed on public exhibition for a period of three months from September 2001 until December 2001. The exhibition of the draft plan attracted ten submissions which raised eight issues. All submissions received were considered by the Advisory Council and the Minister before adopting this plan.

This plan of management covers Wambina Nature Reserve and all other lands which may be acquired as additions to the reserve.

The planning process leading to the development of this plan has involved the collection and use of information, which for reasons of document size has not been included in the plan. Additional information or inquiries on the management of Wambina Nature Reserve can be obtained from the National Parks and Wildlife Service's Central Coast / Hunter Range Regional Office at 207 Albany St North, Gosford (telephone (02) 4324 4911).

2. MANAGEMENT CONTEXT

2.1 NATURE RESERVES IN NSW

2.1.1 Nature Reserves

Nature reserves are reserved under the National Parks and Wildlife 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.

Nature reserves differ from national parks which include as a major objective the provision of opportunities for outdoor recreation. The value of nature reserves lies in their role as refuge areas where natural processes, phenomena and wildlife can be studied, maintained and conserved.

2.2 WAMBINA NATURE RESERVE

2.2.1 Location and Regional Context

Wambina Nature Reserve is located at Matcham on the Central Coast of New South Wales, approximately 10 kilometres east-north-east of Gosford.

Wambina Nature Reserve was gazetted on the 21 May 1997 and currently protects 53.65 hectares at the headwaters of Erina Creek catchment (refer map, page 3).

Wambina Nature Reserve lies entirely within Gosford Local Government Area. The reserve comprises lands which have been transferred to the National Parks & Wildlife Service (NPWS) by Gosford City Council. These lands formed part of Council's Coastal Open Space System (COSS) adopted in 1984. Under this system, certain lands with significant conservation values are purchased or otherwise acquired by Gosford City Council and dedicated to the public.

Wambina Nature Reserve is one of a group of reserves located on the Matcham - Holgate Range, locally known as the "Ridgeway". Together with Wamberal Lagoon Nature Reserve, Katandra Reserve and other lands protected under the COSS, Wambina Nature Reserve forms an important conservation reserve within the City of Gosford. Adjacent COSS lands have been identified for consideration for future addition to Wambina Nature Reserve.

2.2.2 Significance of Wambina Nature Reserve

Wambina Nature Reserve protects part of the relatively intact catchment of Upper Erina Creek and a variety of habitats from ridges of open forest to deep rainforest gullies. These habitats in turn support a diverse range of plants and animals including species of ecological significance on a local, regional and state-wide scale.

The reserve provides an important link for faunal movement. It is one of a series of reserves and parks stretching along coastal New South Wales, which provide habitat for a range of migratory and nomadic animals. It is also provides a link to other reserves on the Central Coast, such as Katandra and Rumbalara, which are managed by Gosford City Council.

The vegetation communities of Wambina Nature Reserve include warm temperate rainforest with sub tropical elements; and open forests of Blackbutt *Eucalyptus pilularis,* Spotted Gum *Corymbia maculata* and Sydney Blue Gum *Eucalyptus saligna* (Payne 1992). These vegetation communities are inadequately conserved in permanent reserves in the Gosford-Lake Macquarie region (Benson 1986).

The rainforest of the reserve while typical of other rainforest sites found throughout the Central Coast, is of high long-term conservation significance to the region because of its size, species richness and protection from outside disturbance when compared to other similar rainforest sites.

Twelve plant species identified within Wambina Nature Reserve are of special conservation significance. Two of these species, the Giant Watergum *Syzygium francisii* and Native Ginger *Alpinia arundelliana* occur in the gullies of the reserve and are at the southern limits of their distribution. The bottlebrush *Callistemon shiressii* is considered to be rare and the Christmas Orchid *Calanthe triplicata* is considered to be a restricted species. Although fairly widespread, *Tetrastigma nitens* is not common, existing in isolated patches of subtropical, dry and littoral rainforest with a southern limit near Gosford. Other species such as Blackbutt *E. pilularis,* Spotted Gum *C. maculata* and the Small-leaved Fig *Ficus obliqua*, provide important seasonal food resources for the fauna of the area (Payne 1992).

One hundred and sixty nine animal species have been recorded within the reserve comprised of 110 bird, 35 mammal, 13 reptile and 11 amphibian species. Twelve species are listed as Vulnerable (Schedule 2) under the Threatened Species Conservation Act 1995 (see 4.1.3).

The mammal diversity in Wambina Nature Reserve is notable with 29 species of native ground and arboreal mammals being recorded within the area. The most abundant mammal, the Grey-headed Flying-fox *Pteropus poliocephalus* is generally present in the reserve from October to June. The number of individuals in the colony fluctuates with reports indicating that up to 80,000 individuals may roost in the rainforest gullies of the reserve at any one time. The colony has local, regional and statewide significance both as a nursery and mating colony. It is a major link with other nearby flying fox colonies (including colonies at Belmont, Gordon, Mandalong and Toukley) and with those located along the eastern coast of Australia (Parry-Jones & Augee 1992). Flying foxes are important in pollination and seed dispersal of rainforest species and pollination of native hardwood species.

Eight species of mammals are listed as Vulnerable (Schedule 2) under the Threatened Species Conservation Act 1995. These include the Little Bent-wing Bat *Miniopterus australis,* Common Bent-wing Bat *M. schreibersii*, Yellow-bellied Glider *Petaurus australis*, Squirrel Glider *P. norfolkensis*, Yellow-bellied Sheathtail-bat *Saccolaimus flaviventris*, and the Greater Broad-nosed Bat *Scoteanax rueppellii*. Additionally there have been recent unconfirmed sightings of the Long-nosed Potoroo *Potorous tridactylus.* The Platypus *Ornithorhynchus anatinus* although not having been recorded within the reserve has been recently noted in the lower sections of Erina Creek below the reserve boundary.

Four bird species listed as Vulnerable (Schedule 2) under the Threatened Species Conservation Act 1995 have been recorded within the reserve, three of which are nocturnal owl species. These include the Barking Owl *Ninox connivens*, Powerful Owl *Ninox strenua* and the Sooty Owl *Tyto tenebricosa*. The Masked Owl *Tyto novaehollandiae* has also been sighted on the Matcham Range and is likely to occur within the reserve. In addition, the Glossy Black-Cockatoo *Calyptorhynchus lathami* has been observed in the open forests of Spotted Gum *C. maculata* and probably utilises the reserve as part of a greater home range.

A number of species of high conservation significance occur within the reserve, including the White-bellied Sea-Eagle *Haliaeetus leucogaster,* Fawn Footed Melomy *Melomys cervinipes* and Southern Angle-headed Dragon *Hypsilurus spinipes* the latter of which both reach their southern limit of distribution within Wambina Nature Reserve.

Wambina Nature Reserve provides opportunities for environmental education and scientific research, particularly in the ecology of rainforests and flying foxes because of its accessibility from the University of Newcastle (Central Coast Campus), Rumbalara Environmental Education Centre, Central Coast Community College and TAFE Colleges.

3. OBJECTIVES OF MANAGEMENT

3.1 GENERAL OBJECTIVES

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

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

3.2 SPECIFIC OBJECTIVES FOR WAMBINA NATURE RESERVE

In addition to the above general objectives Wambina Nature Reserve will be managed to:

- protect and where necessary improve the ecological condition and functioning of Wambina Nature Reserve so as to conserve species richness of native plants and animals;
- protect the grey-headed flying-fox colony site by minimising disturbance to the area;
- protect and enhance the catchment of the reserve; and
- promote community education and understanding of the value of the reserve, the importance of the rainforest communities and the flying fox colony.

3.3 OVERALL STRATEGY

To give effect to achieving these objectives of management, the following strategies will also apply to the management of Wambina Nature Reserve. The Service will:

- control the spread of, and where possible reduce and/or remove, populations of introduced plant and animal species within the reserve and rehabilitate areas affected by erosion, past clearing and frequent burning;
- encourage appropriate land use planning and management practices by neighbours and land management authorities and support the establishment of off-park conservation initiatives such as Voluntary Conservation Agreements on adjoining lands as resources permit;
- emphasise within the local community, particularly with neighbours of the nature reserve, the importance and purpose of management programs relating to the protection of the natural values of the reserve and the control of fire, weeds and feral animals;

- support Gosford City Councils' Coastal Open Space System in order to promote habitat continuity and ensure a viable reserve system; and

- liaise closely with Gosford City Council on management issues related to the nature reserve in order to facilitate a more coordinated and integrated management approach within the local area.

4. POLICIES AND FRAMEWORK FOR MANAGEMENT

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

- Natural and Cultural Landscapes; and

- Use of the Reserve.

The policies established in this plan of management provide the framework for management of the nature reserve.

The actions identified are those to which priority will be given in the foreseeable future. Unless otherwise stated in this plan of management, management of Wambina Nature Reserve will be consistent with the National Parks and Wildlife Act and with the objectives and policies set out in the plan.

4.1 NATURAL AND CULTURAL LANDSCAPES

4.1.1 Geology, Landform and Soils

Wambina Nature Reserve lies within the Sydney Basin biogeographic region (Thackway and Cresswell 1995). This region draws its name from the Sydney Basin geological area that stretches from the Hunter Valley in the north, south to Batemans Bay and includes the Central Tablelands west of Sydney.

On a local scale, the reserve lies within the Erina Hills physiographic region and is dominated by Narrabeen Sandstones belonging to the Watagan and Erina soil landscapes (Murphy 1993). The crests and ridges of the reserve are convex and narrow with steep hillslopes containing sandstone boulders. Cliffs and scarps, usually less than 10m, are occasionally present. The gullies are steep, especially along creek lines where gradients often exceed 45 degrees.

The Watagan Soil Landscapes are characterised by rolling to very steep hills on fine-grained Narrabeen Group sediments (Terrigal Formations of the Gosford sub-group), with local relief ranging from 50-220 m and slopes greater than 25%. These slopes contrast strongly to the steep rugged sandstone cliffs and benches of the Hawkesbury Sandstones found on other ranges south and west of the area (Payne 1992).

Closely associated with the Watagan soil landscapes are the Erina soil landscapes, which may be found at the foothills and gently inclined crests and ridges. Local relief is usually restricted to less than 60 m with slope gradients below 25% (Murphy 1993).

The rock outcrops are typically comprised of shales and sandstones. These sandstones are quartz-rich, similar to those found on the Hawkesbury Sandstone sequence, but with calcite or siderite as the cementing agent. Silts, and shales with feldspars, devitrified volcanics, siliceous and shaly cherts, comprise the interbedded lenses.

Soils of the reserve are very complex and range from shallow lithosols / silaceous sands and yellow earths on coarse sandstones, to moderately deep yellow podzolics on the footslopes. Topsoils in the catchment tend to be black sandy loams, loosely compacted and up to sixty (60) cm deep. Their texture is coarse and has been

derived from overlying sandstone boulders which outcrop over the surface of the range.

Both the Watagan and Erina soil landscapes are susceptible to localised mass movement and / or seasonal waterlogging, and present a high to extreme erosion hazard. However, where good vegetative cover is present, little appreciable hazards exist. The landscapes must therefore be managed according to such limitations (Murphy 1993).

The Matcham – Holgate Range forms an important land unit primarily conserved for its conservation and scenic value within the City of Gosford.

Policies

- Erosion is recognised as a naturally occurring process in Wambina Nature Reserve. Where erosion has been accelerated by human activity or is threatening significant habitats or other values, appropriate control measures will be undertaken.

- All works will be designed and undertaken in a manner which minimises soil erosion.

- The Service will continue to support the principles of total catchment management and will liaise with local government, other authorities and the local catchment management board to protect the catchments located within the reserve.

- Neighbouring development proposals and activities will be monitored for potential threats to catchments within the reserve.

- Further studies in comparative water quality throughout the reserve will be encouraged.

- Access to sensitive areas will be identified, and restrictions implemented where necessary to minimise erosion.

Actions

- Locations of accelerated erosion will be identified; the cause of the erosion determined and the sites managed to minimise erosion.

- Close liaison will be undertaken with Gosford City Council on issues related to the management and maintenance of the Road Reserves of Wambina Road and Booralie Roads.

- An initial upgrade of the tracks and trails within the reserve will be conducted in accordance with the NPWS Guidelines for Park Facilities Manual, followed by periodical maintenance when required.

- Inappropriate tracks and trails leading into the rainforest and steep open forest will be closed and rehabilitated (refer Section 4.2.3 – Management Operations).

4.1.2 Native Vegetation and Introduced Plants

Native species

Wambina Nature Reserve lies within the Central Coast botanical division which includes all lands between Lake Macquarie and the Shoalhaven River, and west to the upper Blue Mountains (Anderson 1961).

Wambina Nature Reserve represents a relatively unmodified example of a variety of habitats found throughout the Matcham-Holgate Range. Three vegetation units have been identified within the reserve by Payne (1992) and include open forests of Blackbutt *Eucalyptus pilularis* and Spotted Gum *Corymbia maculata* and warm temperate rainforest with sub tropical elements.

The open forests are dominated by Blackbutt *E. pilularis* and Sydney Blue Gum *E. saligna* on gentle slopes and valley floors, and by Spotted Gum *C. maculata*, Red Bloodwood *C. gummifera*, White Mahogany *E. acmenoides* and Northern Grey Ironbark *E. siderophloia* on the high steeper slopes and ridge tops. Common understorey shrubs include *Rhodamnia rubescens, Oxylobium ilicifolia, Cassine australis, Notolaea longifolia* and *Notolaea venosa,* with vines such as *Morinda jasminoides, Cissus antarctica* and *Dioscorea transversa.* These open forest communities are inadequately conserved in the Gosford-Lake Macquarie area (Benson 1986).

Rainforest in the reserve is dominated by Cheese Tree *Glochidion ferdinandi*, Maiden's Blush *Sloanea australis*, Coachwood *Ceratopetalum apetalum*, two large Small-leaved Figs *Ficus obliqua*, Bangalow Palm *Archontophoenix cunninghamia* and Cabbage Tree Palm *Livistona australis*. The understorey is typical rainforest with a large variety of ferns, creepers and vines.

The rainforest of the reserve while typical of other rainforest sites found throughout the Central Coast, is of high long-term conservation significance to the region because of its size, species richness and protection from outside disturbance when compared to other similar rainforest sites. The rainforest covers 21.7 hectares (approximately 40%) of the reserve in which a total of 133 plant species comprising of 24 pteridophytes, 1 gymnosperm and 108 angiosperms have been recorded. Only 15 rainforest gullies in the Gosford / Wyong area are 10 hectares or greater and only 7 greater than 20 hectares (Payne 1990).

Within the north-eastern section of the reserve, Erina Ck branches out into a particularly large pristine area of rainforest. This area consists of a mature structural density (stems per hectare) equivalent to the best stands of rainforest in the region.

Whilst the gullies of the reserve are floristically less diverse than the gullies located in the lower Hunter Range, they are as structurally complex. The common presence of tree ferns, palms, climbing ferns, epiphytes, lianas, strangler figs and species with mesophyllous leaves increases the structural complexity of the forest. The vegetation therefore contains characteristics of a sub-tropical rainforest within a warm temperate rainforest regime.

Vegetation in gullies, drainage lines and on south easterly facing aspects is similar to gully rainforest but differs mainly in the canopy tree composition.

Twelve plant species identified to date within Wambina Nature Reserve are of special conservation significance (Benson & Howell 1994). Three of these species, the Giant Watergum *Syzygium francisii,* Native Ginger *Alpinia arundelliana* and *Tetrastigma nitens*, which occur in the gullies of the reserve, are at the southern limits of their

distribution. The bottlebrush *Callistemon shiressii* is considered to be rare and the Christmas Orchid *Calanthe triplicata* is considered to be a restricted species. Other species such as Blackbutt *E. pilularis,* Spotted Gum *Corymbia maculata* and the Small-leaved Fig *Ficus obliqua*, provide important seasonal food resources for the fauna of the area (Payne 1992).

Currently there are no vulnerable or endangered plant species or populations, critical habitat or endangered communities listed under the *Threatened Species Conservation Act 1995* occurring within the reserve.

Introduced species, their impact and control

An introduced species is defined in this plan as any plant or animal species not native to the Wambina Nature Reserve. Introduced species within the reserve and on adjoining land are of concern because of the potential to have detrimental effects on ecological values.

Middleton (1998) and Total Earth Care (1999) have identified 37 species of weeds within the reserve. A site assessment prepared for the reserve further prioritises the significance of each weed species intrusion based on NPWS prioritising criteria.

The majority of weed species occurring in Wambina Nature Reserve are generally associated with pastures and are confined to areas subjected to past clearing. Apart from typical edge intrusion there are no serious occurrences of weed invasion into the gully rainforest.

The Matcham-Holgate Landcare Group has been active in the reserve since its establishment, removing many introduced species from the reserve on a regular basis in accordance with a pest management strategy developed by the Central Coast / Hunter Range Region.

The *Noxious Weeds Act 1993* places an obligation upon the Service to control noxious weeds on areas that it manages to the extent necessary to prevent such weeds spreading to adjoining lands. Crofton Weed *Ageratina adenophora* and Pampas Grass *Cortaderia selloana* are listed as noxious weeds within the Gosford City Local Government Area. Other significant weed species within the reserve are Bitou Bush *Chrysanthemoides monilifera,* Lantana *Lantana camara,* Large-leaved Privet *Ligustrum lucidum,* Small-leaved Privet *L. sinense* and Blackberry *Rubus fruticosus.*

Policies

- Native vegetation will be managed in order to:
    - maintain floristic and structural diversity;
    - protect threatened or significant species and communities;
    - maximise habitat values for native animal species; and
    - encourage regeneration of areas previously cleared or grazed.

- The occurrence of weeds in the reserve will be monitored and, where practicable, controlled. Preference will be given to techniques having minimal environmental impact and which do not disturb flying fox populations.

- Priority for control of introduced plants will be given to those which:
    - are declared noxious;
    - are the subject of a national emergency control program;
    - must be controlled to allow another high priority management program to be effective;
    - are a threat to biodiversity;
    - are a threat to a population of threatened species;
    - are damaging cultural heritage;
    - affect neighbouring lands;
    - have a high capacity for dispersal;
    - are likely to spread along access routes;
    - are new isolated occurrences;
    - constitute a fire hazard;
    - the community has identified as a high priority for action;
    - require continued management to maintain benefits gained from previous control programs;
    - a window of opportunity occurs (e.g. an effective biological control agent available);
    - have limited distribution, but known to be an important problem in other reserves, or in other states or overseas; and / or
    - have a new weed infestation within a water catchment.

- Weed control will include the systematic removal of weeds to allow natural regeneration to occur and encourage regeneration of areas previously cleared or grazed.

- Revegetation will use local soils and plants propagated from local genetic stock.

Actions

- A survey of threatened plant species of the nature reserve will be undertaken and where required species recovery plans will be prepared and implemented.

- A program for weed control will be prepared based on the policies set out above. Specific works priorities will be identified annually as part of the program. The program will identify priority species and areas, and locations requiring revegetation.

- The cooperation of adjacent landholders will be sought in developing programs to control the invasion and spread of non-native plants within the reserve.

- Community involvement in bush regeneration will be promoted within the reserve.

4.1.3 Native and Introduced Animals

Wambina Nature Reserve represents one of a series of reserves utilised by nomadic and migratory birds and mammals. An important consideration relating to the management of native animals in Wambina Nature Reserve is the maintenance or establishment of corridors for nomadic species and recognition of the needs of migratory species (Payne 1992).

Wambina Nature Reserve has been the subject of many surveys over the past ten years and as such a comprehensive species inventory has been compiled. As of July 1999, 169 species have been recorded within the reserve, including 110 birds, 35 mammals, 13 reptiles and 11 amphibians. Of these, 11 species are listed as Vulnerable (Schedule 2) under the *Threatened Species Conservation Act 1995*.

Birds

One hundred and ten species of birds have been recorded in Wambina Nature Reserve. Morris (1991) suggests that of the species listed, at least 24 specifically inhabit the Matcham-Holgate Range whilst many more could be stated to specifically inhabit the area based on sightings and journal records.

Four bird species listed as Vulnerable (Schedule 2) under the Threatened Species Conservation Act have been recorded within the reserve. These include the Barking Owl *Ninox connivens*, Powerful Owl *Ninox strenua*, Sooty Owl *Tyto tenebricosa* and the Glossy Black-Cockatoo *Calyptorhynchus lathami*.

In addition to the three owl species mentioned above, several other species of nocturnal birds of prey have been recorded within the reserve. These include the Australian Owlet-nightjar *Aegotheles cristatus*, Southern Boobook *Ninox noveaseelandiae*, and Tawny Frogmouth *Podargus strigoides*. The Masked Owl *Tyto novaehollandiae* has also been sighted on the Matcham Range and probably utilises Wambina Nature Reserve.

Other species of high conservation significance include the White-bellied Sea-Eagle *Haliaeetus leucogaster* which utilises the forests for nesting and breeding while frugivorous pigeons such as the Wonga Pigeon *Leucosarcia melanoleuca* rely on the reserve for food resources. The White-throated Needletail *Hirundapus caudacutus* visits the area annually as a trans-equatorial migrant arriving in Australia around October, and departing for the northern hemisphere in April.

Mammals

The mammal diversity in Wambina Nature Reserve is notable with 29 species of native ground and arboreal mammals being recorded within the area. Of these, 13 belong to the order *Chiroptera* (bats) and 9 to the order *Diprotodontia* (possums, gliders and macropods).

Seven species of mammals are listed as Vulnerable (Schedule 2) under the Threatened Species Conservation Act 1995. These include the Little Bent-wing Bat *Miniopterus australis,* Common Bent-wing Bat *M. schreibersii*, Yellow-bellied Glider *Petaurus australis*, Squirrel Glider *P. norfolcensis*, Yellow-bellied Sheathtail-bat *Saccolaimus flaviventris*, and the Greater Broad-nosed Bat *Scoteanax rueppellii*. Additionally there have been recent unconfirmed sightings of the Long-nosed Potoroo *Potorous tridactylus.* The Fawn Footed Melomy *Melomys cervinipes* is also considered to be of significance with its southern known limit existing within the reserve.

The most abundant mammal, the Grey-headed Flying-fox *Pteropus poliocephalus* is generally present in the reserve from October to June depending on the flowering of food resources such as Spotted Gum *C. maculata* and Swamp Mahogany *E. robusta*, though some individuals may also be found there outside of this period. The number of individuals in the colony fluctuates, again dependent upon available food resources, with reports indicating that up to 80,000 individuals may roost in the rainforest gullies of the reserve at any one time.

The species has now been listed as Vulnerable on Schedule 2 of the Threatened Species Conservation Act due to the rate of its population decline over the last ten years and the Wambina colony has local, regional and statewide significance both as a nursery and mating colony. It is a major link with other nearby flying fox colonies (including colonies at Belmont, Gordon, Mandalong and Toukley) and with those located along the eastern coast of Australia (Parry-Jones and Augee 1992). Flying foxes are important in pollination and seed dispersal of rainforest species and pollination of native hardwood species.

Other more common mammal species found in the reserve include the Common Brush-tail Possum *Trichosurus vulpecula*, Common Ring-tail Possum *Pseudocheirus peregrinus*, Sugar Glider *Petaurus breviceps* and Greater Glider *Petauroides volans*. In addition, recent surveys indicate a high relative abundance of Bush Rat *Rattus fuscipes* and Brown Antechinus *Antechinus stuartii*. Both the Swamp Wallaby *Wallabia bicolor* and the Northern Brown Bandicoot *Isoodon macrourus* have also been observed at the rainforest edge.

Reptiles and Amphibians

The reserve contains at least 13 species of reptiles including the Yellow-faced Whip-snake *Demansia psammophis*, Eastern Water Dragon *Physignathus lesueurii*, Lace Monitor *Varanus varius* and Southern Leaf-tailed Gecko *Phyllurus platurus*. Of high conservation significance is the Southern Angle-headed Dragon *Hypsilurus spinipes* which is thought to reach its southern limit of distribution at Wambina Nature Reserve.

Eleven amphibian species have been recorded within the reserve and include the Tusked Frog *Adelotus brevis*, Brown-striped Frog *Limnodynastes peronii* and Lesueur's Frog *Litoria lesueurii*. The timing of previous surveys, however, has not been adequate to obtain a comprehensive inventory of amphibian species.

Introduced species and threatening processes

Threatening processes to native animals include predation and competition from feral animals, recreational activity in sensitive areas, inappropriate fire regimes, development along the reserve boundary and high populations of pets just outside the reserve.

A number of introduced animals have been recorded in Wambina Nature Reserve including the European Red Fox *Vulpes vulpes*, Cat *Felis catus*, Dog *Canis domesticus*, Common Myna *Acridotheres tristis*, Common Starling *Sturnus vulgaris* and Rabbit *Oryctolagus cuniculus*. Of these species the European Red Fox is listed under the Threatened Species Conservation Act as a key threatening process.

All introduced animals pose a threat to biodiversity by predating and/or competing directly with/upon native populations. Some species of introduced animals may also exacerbate weed problems by spreading or introducing seeds. Artificially high populations of predators such as domestic dogs and cats are becoming an increasing management problem with increasing records of predation on native animals at the time of preparation of this document.

Policies

- Conservation of native animals will concentrate on the maintenance of natural processes and protection of habitat.
- Where threatening processes can be identified from on or off park, programs to mitigate these will be undertaken with priority given to those which affect threatened species.
- Introduced animals will be controlled and, where practicable, eliminated from the reserve. Preference will be given to control techniques which have minimal environmental impact.
- Priority for control of introduced animals will be given to those which:
    - are declared noxious;
    - are the subject of a national emergency control program;
    - are a threat to a population of threatened species;
    - must be controlled to allow another high priority management program;
    - are a threat to biodiversity;
    - are likely to spread disease;
    - do or may affect neighbouring lands;
    - are damaging cultural heritage.
- The flying fox colony will remain protected and no attempts will be made to relocate flying foxes to another area or other part of Wambina Nature Reserve due to conflicts arising from their presence.
- Changes to rainforest vegetation as a result of flying fox activity will be monitored.
- In accordance with the Service's boundary fencing policy, fencing of the reserve boundaries will be encouraged in consultation with neighbours.

Actions

- Scientific research into the occurrence and distribution of native animals in Wambina Nature Reserve will be encouraged. Surveys of native animals, particularly of reptiles and amphibians, will be undertaken with investigations timed during peak activity or to detect breeding individuals. Research into mammals, particularly flying foxes will be encouraged. The results of this research will be incorporated into future management programs.
- Access to sensitive habitat will be restricted. Areas will be identified and maintained to protect both vegetation and native animals including flying fox populations.
- Development proposals or activities on neighbouring lands will be assessed for possible impacts on Wambina Nature Reserve or potential additions to the reserve. Liaison will be maintained with Gosford City Council to minimise impacts on the reserve.
- An introduced animal control plan will be prepared for Wambina Nature Reserve setting out techniques and programs, including monitoring of the

effectiveness of control programs. Pending preparation of the plan, priority will be given to fox and rabbit control in the reserve.

4 1.4 Cultural Heritage

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

Aboriginal Heritage

Prior to European settlement, the Aboriginal people who lived in the area within which Wambina Nature Reserve is now located were part of the *Guringai* community.

The *Guringai* inhabited the coast between Port Jackson and somewhere north of Wyong where they met the *Awabakal* (Threlkeld in Gunson 1974; Mann 1885). The *Darkingung* occupied land to the north of the Hawkesbury River and to the west of Mooney Mooney Creek (cf. Kohen 1986; Smith 1983). The *Guringai* had a close and cordial relationship with the *Darkingung* including reciprocal visits between tribes, trade and sharing feasts in either area depending upon season (Vinnicombe 1980).

Aboriginal occupation on the Ridgeway / Matcham-Holgate Range is evident in the form of Aboriginal sites including rock engravings, axe grinding groove sites and other archaeological material. To date only three Aboriginal axe - spear grinding groove sites have been recorded within the reserve. An additional site consisting of an open artefact scatter has been located adjacent to the reserve. Due to the density of the vegetation, site detection is difficult and the potential for further archaeological material in the area is considered to be high.

Today, Wambina Nature Reserve lies within the area of the Darkinjung Aboriginal Land Council. Close liaison is maintained with the Land Council in regard to the management of Aboriginal values.

Policies

- All Aboriginal sites will be protected from disturbance or damage by human activities.
- All Aboriginal sites and other cultural features will be recorded as they are located.
- The Darkinjung Local Aboriginal Land Council and other relevant Aboriginal community organisations will be consulted and actively involved in all aspects of management of Aboriginal sites and values in the reserve.
- Any works with the potential to impact on Aboriginal sites will be preceded by an archaeological assessment.

Actions

- The register of Aboriginal sites will be maintained and updated.
- The impact of visitor use on Aboriginal sites will be monitored.

European History

European occupation of the Matcham area first occurred in the 1820s. Land was cleared for cattle grazing and the cultivation of small crops such as beans, peas, tomatoes and citrus (Gosford District Historical Research Association 1981).

Selective logging was also undertaken. The hardwood and rainforests of the area contained species such as Turpentine *Syncarpia glomulifera*, Ironbark *E. siderophloia*, White Mahogany *E. acmenioides*, Sydney Blue Gum *E. saligna*, Spotted Gum *C. maculata*, Blackbutt *E. pilularis*, Coachwood *Ceratopetalum apetalum*, White Beech *Gmelina leichardtii*, Red Ash *Alphitonia excelsa* and Red Cedar *Toona ciliata*. The timber was variously used for pit props in the Newcastle coal mines, local ship building, railway sleepers, fence posts and for furniture (Payne 1992).

Wambina Nature Reserve forms part of the original 2,560 acres of land granted to Charles Horatio Nelson Matcham in 1828 on his arrival in Australia. Matcham's property was willed to his nephew and was finally sold to F. Measures of Niagara Park who subdivided the estate in 1910.

The south-western section of Wambina Nature Reserve, (Pt 13 DP 169325 now DP 262006), located adjacent to the Wambina Road and Booralie Road intersection, was owned by Clarence Denning who sold the property to the Pine family who struggled for many years with small crops and citrus. Foundations of the house and the roof of a shed are still visible just north of the Wambina Road entry and a number of internal fence lines running along old portion boundaries remain in a dilapidated state.

At this time the area to the south of Wambina Road, known as "Burroughs Wellcome", began operation in the commercial farming of digitalis for pharmaceutical purposes.

In 1964 the south-western section of Wambina Nature Reserve was sold to Hillangrove Stud who operated a dairy and pig-breeding farm which extended to Tumbi Road, Wamberal. Upon purchase, the owners of Hillangrove Stud proceeded with clearing the lower slopes and the area adjoining the headwaters of Erina Creek. After a strong appeal by three conservationists, clearing ceased.

In 1968 this section was sold to Baron Dashwood of England who gave a verbal undertaking not to further clear the land.

In 1981 Hillangrove Stud was subdivided and as part of the approval a public reserve was dedicated to Gosford City Council. The reserve proceeded to the Coastal Open Space System reserves and was finally gazetted on the 21 May 1997 as Wambina Nature Reserve.

Evidence of past land use remaining on the reserve includes the foundations of a house, a collapsed shed, fences and cleared areas.

Policies

- The provisions of the Burra Charter (ICOMOS 1988) for the conservation of places of cultural significance will guide management of historic places within Wambina Nature Reserve.

- Any works with the potential to impact on cultural sites will be preceded by an archaeological assessment.

- Historic features will be fully recorded.

Actions

- The evidence of past European land uses will be recorded.
- The remnants of the house and shed will be made safe.
- Those fences not required for control of domestic animals will not be maintained. Wire will be removed while wooden fence posts will remain *in situ*.

4.1.5 Fire Management

Fire has great capacity to directly affect the conservation of species, habitats and the maintenance of biodiversity. Appropriate fire regimes are necessary to conserve habitats and populations of species. Conversely, inappropriate use of fire can damage habitats and cause local depletion or extinction of species.

The correct management of fire is essential to avoid the extinction of native plant and animal species. Both the long and short term effects of fire on native plant and animal species, including the biota of the surface and sub-surface soil zone, is largely dependent upon four factors; the frequency of fire, the intensity of fire, the spatial distribution of burnt areas and seasonality.

The natural fire regime of Wambina Nature Reserve is unknown, however fire frequency is considered to be low by virtue of its vegetation. The greater area of the reserve is characterised by moist, mesophyllic species. Further, fire history records indicate that the last fire to occur within any part of Wambina Nature Reserve was in 1979. According to these records, this fire only spread through approximately 5 ha of the north-eastern section of the reserve.

Likely additions to the reserve consist of dry sclerophyll forests primarily in ridge top positions and are subject to a greater fire risk. The majority of the assets surrounding the reserve consist of rural – residential properties.

The primary objectives for fire management of the National Parks & Wildlife Service are:

- to prevent the occurrence of human caused unplanned fires on the reserve;
- to suppress unplanned fires occurring on the reserve;
- to minimise the potential for spread of wildfires on, from or into the reserve;
- to protect persons and property from bushfires occurring on the reserve or immediately adjacent to the reserve;
- to manage bushfires to avoid the extinction of native species; and
- to protect Aboriginal sites, historic places and culturally significant features from damage by bushfires.

Protection of Life and Property

In consultation with Gosford City Bush Fire Management Committee, the Service undertakes planning for the protection of life and property, community assets and values and natural and cultural heritage.

Part of this planning process involves the identification of management zones both on and off each reserve. The management of each zone is guided by its own set of fire management objectives and strategies.

A description of the zonation and appropriate management strategies are contained within the Gosford City Bush Fire Management Committee's *Operations Plan* and *Bush Fire Risk Management Plan*

A preliminary draft fire management plan specific to Wambina Nature Reserve and Wamberal Lagoon Nature Reserve has been developed. The plan identifies the bushfire threat, identifies requirements for the conservation of native plants and animals, and provides the basis for management strategies and prescriptions.

Maintenance of Species Habitat and Diversity

Contemporary ecological research in fire prone ecosystems has established broad principles about the fire regimes needed to avoid the extinction of species and thus conserve biodiversity:

- Groups of plant and animal species which constitute an ecosystem respond similarly to fire according to the characteristics of their life-history. It is not necessary to specify fire regimes for the conservation of every species. Rather fire regimes for groups of species or an ecosystem are required to be developed.

- Animals and plants are interrelated. Plants form an important component of habitat for animals. Fire management must consider this important interaction.

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

Scientific understanding of the fire requirements for plant communities is generally more advanced than for animal communities, although recent published research demonstrates that the conservation of many animal species also depends upon a mix of fire regimes including occasional high intensity fires.

The following guidelines define fire regime thresholds for the major vegetation communities represented in Wambina Nature Reserve, providing a basis for the programming of prescribed burns and suppression strategies.

Current research indicates that plant species decline is possible if the following fire regime thresholds are exceeded:

<u>Gully rainforest</u>

- Any fire is likely to lead to a decline in plant species.

Open-forest (S & E facing aspects, gullies and drainage lines)

- More than 2 successive intervals between fire of less than 20 years.
- Two or more high intensity fires with a complete scorch of the canopy within a period of one hundred years.
- No high intensity fire within a period of one to two hundred years.

Open-forest

- More than 2 successive intervals between fire of less than 5 years.
- No fire for more than 30 years.

Inappropriate fire regimes have been implicated in the retreat of rainforests on the Central Coast (Payne 1993; Payne in press). In addition, fire is likely to have a negative impact on the flying-fox community, and fire disturbance may advantage introduced species with increases in the rates of predation by foxes, cats and wild dogs (Catling 1991).

Policies

- Fire management in Wambina Nature Reserve will aim to:
    - protect human life and property both within and adjacent to the park;
    - maintain species habitat and diversity, avoid local extinctions of native plant and animal species, protect rainforest communities and enhance the conservation of threatened native plant and animal species;
    - protect scenic landscape and catchment values; and
    - protect structures, objects or places of cultural heritage significance.
- Liaison will continue to be maintained and co-operative strategies developed with the Rural Fire Service, local government and neighbours to ensure coordination of fire management in the nature reserve and on adjoining lands.
- Until the fire regime thresholds for the major plant communities identified above have been achieved, wherever practical wildfires within Wambina Nature Reserve will be suppressed as soon as possible.
- Once the thresholds have been achieved, fire suppression may be carried out in line with the above fire regime thresholds and prescribed fire may used to achieve the desired fire regime thresholds.
- No prescribed burns will be undertaken in Wambina Nature Reserve for asset protection purposes.
- The level of community understanding of the role and management of fire within Service areas will be promoted.
- The cooperation of all relevant authorities, neighbours and visitors will be sought in controlling the occurrence and extent of wildfires.
- A fire management information system will be maintained to assist in the identification of bushfire zones, fire hazardous areas, trends in fire occurrence, assets at risk and sensitive environments, ecosystems and species.

- Wherever practicable, management trails used for fire management and other purposes will be maintained by slashing or trittering. Trails may be relocated or realigned where necessary for fire management and erosion control purposes.

- No new trails will be constructed except where necessary for wildfire suppression. All new trails constructed will be closed and rehabilitated as soon as possible following the fire.

- Research into fire behaviour, fire hazard and risk assessment, and the impact of fire on the reserve's plant and animal communities will be encouraged.

Actions

- Co-operative plans for the protection of surrounding property from fire will continue to be developed and implemented in consultation with the Gosford Bush Fire Management Committee, Rural Fire Brigades and neighbours.

- An education program will be implemented to raise community awareness of fire management within Wambina Nature Reserve.

4.2 USE OF THE AREA

Wambina Nature Reserve will be managed to ensure that its use, whether by the general public, special interest groups, the Service or other authorities is consistent with the Act and the objectives of this plan of management.

Uses that may be consistent with the management of nature reserves include:

- education and interpretation of the area, the Service and the conservation of the natural and cultural heritage;

- research; and

- management operations by the Service and other authorities.

The extents to which these categories of use are appropriate to Wambina Nature Reserve are indicated in the following sections.

4.2.1 Environmental Education

The primary purposes of nature reserves are the conservation of wildlife, natural and cultural environments and environmental education including scientific research. Recreational opportunities are provided within the nearby Katandra Reserve and other COSS lands within the Matcham-Holgate Range.

Visitation to Wambina Nature Reserve is low and is mainly limited to local residents and managers. It is estimated that the reserve has between 500 – 1000 visits each year.

Walkers and mountain bike riders may access the reserve from the single formed public access trail off Wambina Road. A trail from Oak Road leading to the north of the reserve is for emergency vehicle access only.

Wambina Nature Reserve was gazetted on the 21 May 1997. Prior to its gazettal the

reserve was managed by Gosford City Council, which has prohibited motorbikes, horses and dogs in the area since 1992. These activities are not permitted within the reserve and are inconsistent with the objectives of the reserve.

Wambina Nature Reserve contains a variety of habitats that are sensitive to disturbance from inappropriate or excessive use. The reserve does however provide limited opportunities for bushwalking in natural areas. Walkers may use the road reserves currently managed by Gosford City Council and the track which runs along the ridge in a south-westerly direction separating the two catchments of the reserve (shown on the map, page 3).

There are no other recreational facilities such as camping or picnic areas within the reserve. No camping will be permitted and no new facilities except signage will be provided.

It is an objective of this plan of management to encourage educational programs into the values and the management of rainforest and flying foxes, in conjunction with local educational, research and community organisations. Groups such as Rumbalara Environmental Education Centre, the University of Newcastle, Matcham-Holgate Landcare, Wambina Flying Fox Centre and Wildlife ARC already participate in educational programs on the reserve.

Guided walks are undertaken in the reserve as part of the Service's Discovery Program which promotes the natural and cultural heritage values of the reserve and public awareness of the Service's conservation responsibilities. No commercial recreation activities are licensed in the reserve.

Policies

- Public use of Wambina Nature Reserve will be limited to low impact day use which promotes appreciation and enjoyment of the reserve and is consistent with the objectives of this plan of management.

- Walking and bicycle riding will be permitted on management trails within the reserve. Use of minimum impact bushwalking codes and safe practices will be required.

- Motor vehicles, motor cycles, horse riding and camping will continue to be prohibited in the nature reserve.

- Any organised activities within the nature reserve will require permission of the Regional Manager. Conditions of use may include:

    - limits on group sizes and frequency of use to minimise environmental impacts; and
    - program leaders will be required to have adequate qualifications and experience.

- Interpretation of the reserve will emphasise:

    - the biodiversity of the reserve;
    - the inter-relationships between animals and plants, particularly the importance of flying foxes in the distribution of rainforest plant species;
    - the value of the reserve for environmental education and scientific research; and
    - appropriate public use.

- All domestic animals will be prohibited from the reserve.

- The Service will not actively promote visitation to Wambina Nature Reserve and will encourage other organisations to follow the same policy.

Actions

- A brochure will be developed for Wambina Nature Reserve emphasising biodiversity, inter-relationships between animals and plants, the value of the reserve for education and scientific research and appropriate use of the area.

- A video will be developed which provides information to assist in the protection of flying foxes and their habitat.

- The impacts of bush walking and bicycle riding in the nature reserve will be monitored and these activities may be temporarily or permanently excluded from all or part of the reserve if negative impacts are indicated.

- The boundaries of the reserve will be clearly marked and signs indicating the name of the reserve and appropriate uses will be erected adjacent to public roads and entrances to the reserve and elsewhere as necessary.

4.2.2 Research

The purpose of scientific study in Wambina Nature Reserve is to improve the understanding of the natural features and the ecological processes. Research will also establish the requirements for the management of particular species. Data and findings from research studies and surveys will be utilised in reserve management.

Research into the native plants and animals of the reserve, their management requirements, methods to control introduced species and the impacts of park users is essential to the development of appropriate management practices.

There have been a number of studies conducted in Wambina Nature Reserve in recent years. The range of information covered includes both flora and fauna, with many studies specifically targeting rare flora species and communities. The Service has completed comprehensive fauna surveys of the area as a part of the Comprehensive Regional Assessments. The National Parks and Wildlife Service, however, does not presently have the resources to undertake long term monitoring or research in Wambina Nature Reserve and relies on work undertaken by accredited institutions.

Policies

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

- Research applications will only be approved where the research:

    - has the potential to facilitate the better management of the reserve; or the conservation of individual species; and
    - does not conflict with the objectives of reserve management and cannot be reasonably undertaken elsewhere.

- Researchers will be restricted to specific routes within the reserve.

Actions

- A prospectus will be prepared as a guide to preferred research projects in the reserve. Priority will be given to research and monitoring programs into:
    - the ecology of the reserve;
    - significant and threatened species;
    - key threatening processes including introduced species and the impact of visitors;
    - pollution, degradation and rehabilitation of creek lines; and
    - cultural heritage.
- Liaison will be maintained with researchers to obtain as much mutual information and assistance as possible. The results of research will be provided to the managers of the area.

4.2.3 Management Operations

Management operations refer to the operational activities of the NSW National Parks and Wildlife Service and others within Wambina Nature Reserve. The reserve is part of the Central Coast and Hunter Range Region of the National Parks and Wildlife Service. Administration and planning takes place out of the Regional Office at Gosford, while Girrakool Depot located within Brisbane Water National Park is used as a base for undertaking works in the reserve.

The primary function of the nature reserve is for the protection of natural and cultural heritage, however, a number of utilities which existed prior to the dedication of the area remain today.

A power-line easement cuts across the boundary in the northern section of the reserve in the vicinity of Triple Springs.

The management trail system is shown on the map (page 3). Parts of the management trail system are located on road reserves managed by Gosford City Council. Access to these trails is currently through private property.

Policies

- All management trails and structures will be maintained according to Service guidelines (NPWS Guidelines For Park Facilities 1995).
- The Service will seek to reduce the impact of, and if possible eliminate, the power lines and other utilities within the nature reserve. To this end such occupancies will be kept under regular review and where warranted the facility will be relocated and/or closed and the site rehabilitated.
- Vehicle use of management tracks and trails will be restricted authorised management purposes.

Actions

- The Service will pursue the closure and transfer of part of the Road Reserves of Wambina and Booralie Roads with Gosford City Council as a matter of priority.

- The Service will liaise closely with neighbours in regard to management access requirements.
- The Service will install access barriers at appropriate locations to prevent illegal access into the reserve of horses and trail bikes.
- An agreement will be developed to guide management of the powerline easement in the northern section of the reserve.

5. PLAN IMPLEMENTATION

This plan of management is part of the system of management developed by the National Parks and Wildlife Service. The system includes the National Parks and Wildlife Act, the Service's Corporate Plan, associated strategies and management policies. It also includes directorate and regional operational planning.

The orderly implementation of this plan of management will be undertaken within the annual programs of the Service's Central Coast and Hunter Range Region. Priorities will be determined during the development of these programs and will be subject to regional priorities, the availability of funding and staff and to any specific requirements of the Director-General or the Minister.

Regional programs are subject to on-going review within which works and any other activities carried out in Wambina Nature Reserve will be evaluated in relation to objectives laid down in this plan.

The environmental impact of all development proposals will be assessed in accordance with established environmental assessment procedures.

In accordance with Section 81 of the National Parks and Wildlife Act this plan shall be carried out and given effect to and no operations shall be undertaken in relation to Wambina Nature Reserve unless those operations are in accordance with the plan of management. If after adequate investigation operations not included in the plan are found to be justified, the plan may be amended in accordance with Section 75 of the Act.

The management proposals outlined in the plan have been prioritised as shown in the following table:

Activities	Reference in plan	Priority	Timeframe	Performance indicator
• Support Gosford City Council's Coastal Open Space System in order to promote habitat continuity and ensure a viable reserve system.	3.2	High	3 – 5 years	Attend COSS meetings.
• Identify locations of accelerated erosion, determine their cause and manage appropriately.	4.1.1	High	> 5 years	Conduct annual erosion audit, measure sample points on an annual basis
• Pursue the closure and transfer of part of the Road Reserves of Wambina and Booralie Roads with Gosford City Council.	4.1.1	High	0 – 3 years	Closure and transfer of Wambina and Booralie Road Reserves.
• Close and rehabilitate inappropriate tracks and trails.	4.1.1	High	0 – 3 years	Identify inappropriate tracks and trails.
• Prepare a program for weed control and identify priority species and areas.	4.1.2	High	0 – 3 years	Complete pest species site assessment and site strategy.
• Promote community involvement in bush regeneration within the reserve.	4.1.2	High	> 5 years 0 – 3 years Ongoing	Complete and implement community relations strategy. Integrate community bush regeneration program with pest species strategy. Attend LandCare days
• Assess development applications on neighbouring lands.	4.1.3	High	Ongoing	Provide comments to Sydney Zone on all DAs adjacent to Wambina NR.
• Identify and protect areas of sensitive habitat.		High	0 – 3 years	Restrict access

Activities	Reference in plan	Priority	Timeframe	Performance indicator
• Prepare and implement an introduced animal species control plan.	4.1.3	High	0 – 3 years	Complete introduced animal control plan and integrate into pest species strategy
• Maintain and update the Aboriginal sites register.	4.1.4	High	> 5 years	All located sites are recorded and monitored.
• Monitor the impact of visitor use on Aboriginal sites.	4.1.4	High	Ongoing	
• Record cultural heritage sites.	4.1.4	High	0 - 3 years	Complete site reports
• Make historic features safe	4.1.4	High	0 – 3 years	
• Develop cooperative fire protection strategies.	4.1.5	High	0 – 3 years	Complete reserve fire management plan
• Clearly mark and sign the boundaries of the reserve indicating the name of the reserve and appropriate uses.	4.2.1	High	0 – 3 years	Install signs as per NPWS Signage manual.
• Negotiate with Gosford City Council and private property owners legal access arrangements to the reserve for management purposes and fencing of common boundaries.	4.2.3	High	0 – 5 years	Legal access to reserve is provided and problem areas are fenced.
• Install access barriers at appropriate locations to prevent illegal access into the reserve of horses and trail bikes.	4.2.3	High	0 – 5 years	Barriers installed and illegal access prevented.
• Formalise an agreement for the powerline easement in the northern section of the reserve.	4.2.3	High	0 – 5 years	Formalise easement agreement.
• Upgrade and maintain tracks and trails used for management.	4.1.1 / 4.1.5	Medium	Ongoing	Tracks and trails meet SCS standards.

Activities	Reference in plan	Priority	Timeframe	Performance indicator
• Undertake threatened plant species survey.	4.1.2	Medium	3 – 5 years	Record threatened species on Wildlife Atlas of NSW
• Seek co-operation with adjacent landholders in developing programs to control the invasion and spread of non-native plants within the reserve.	4.1.2	Medium	Ongoing	Complete and implement community relations strategy.
• Undertake fauna species survey	4.1.3	Medium	3 – 5 years	Record species on Wildlife Atlas of NSW
• Record historic features.	4.1.4	Medium	3 – 5 years	Record features on historic sites register.
• Prepare a fire management plan for the reserve.	4.1.5	Medium	3 – 5 years	Complete reserve fire management plan
• Develop a fire education program.	4.1.5	Medium	3 – 5 years	Complete reserve fire management plan
• Develop a brochure for Wambina Nature Reserve emphasising the value of the reserve and appropriate use of the area.	4.2.1	Medium	3 – 5 years	Complete brochure
• Develop a video that provides information to assist in the protection of flying foxes and their habitat.	4.2.1	Medium	3 – 5 years	Complete production of video
• Monitor impacts of bushwalking and bicycle riding.	4.2.1	Medium	Ongoing	Conduct annual erosion audit, measure sample points on an annual basis
• Prepare a prospectus as a guide to preferred research projects in the reserve.	4.2.2	Medium	3 – 5 years	Prepare prospectus.
• Liaise with researchers to obtain as much mutual information and assistance as possible.	4.2.2	Medium	Ongoing	Integrate prospectus.

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