

**NADGEE NATURE RESERVE
PLAN OF MANAGEMENT**

**NSW National Parks and Wildlife Service
June 2003**

This plan of management was adopted by the Minister for the Environment on 16 June 2003.

Acknowledgments

This plan of management was prepared by Lyn Evans of the Far South Coast Region of the NSW National Parks and Wildlife Service, with assistance from specialists in Southern Directorate and Head Office.

The plan was developed in consultation with members of the local community and other interested individuals and organisations. The Service gratefully acknowledges the information and ideas contributed by these people. In particular, useful comment was provided by members of the former Eden District Advisory Committee and the Far South Coast Regional Advisory Committee.

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FOREWORD

Nadgee Nature Reserve is located on the far south coast of NSW between Wonboyn Lake and the Victorian border and has an area of 20,671 hectares. It comprises coastal range, coastal plain, estuaries, beaches, cliffs, dunes and other coastal landforms.

The reserve contains a complex variety of plant communities, including four types of rainforest and one of the four large areas of heathland on the NSW south coast. It protects a concentration of threatened and biogeographically significant native plant and animal species. There are six rare plant species, a large number of restricted species and 24 plant species that reach their southern limit of distribution in the reserve. Thirty-seven species of threatened native animals have been recorded. The reserve is an outstanding area for scientific research.

Many Aboriginal sites have been recorded in the reserve, providing a detailed record of Aboriginal occupation of this part of the coast. There are also several historic places associated with former agricultural and other uses.

The reserve will be managed to protect its natural and cultural values, with emphasis on maintenance of habitat diversity and conservation of populations of rare and threatened species. Historic and Aboriginal sites will be protected from disturbance, educational programs and approved scientific research will continue to be encouraged.

The scenery of the reserve is outstanding and its naturalness and sense of isolation contribute to making the reserve a rare and special area. It contains the only declared coastal wilderness area in NSW and the most isolated beaches and undisturbed estuaries in NSW. The wilderness area will be managed to protect its natural heritage and value for solitude and self-reliant recreation by such measures as minimising vehicle tracks and limiting the amount of use.

Low key visitor use will continue to be permitted at existing sites in the northern part of the reserve. These provide opportunities for walking, picnicking, beach and lake-oriented recreational activities.

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

BOB DEBUS
MINISTER FOR THE ENVIRONMENT

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1. INTRODUCTION

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

This plan of management was exhibited in 2001. The procedures for the adoption of a plan of management for a nature reserve at that time were:

- * Where a plan of management has been prepared, the Director-General is required to refer the plan to the National Parks and Wildlife Advisory Council for its consideration and advice.
- * The Director-General then submits the plan to the Minister, together with any comments or suggestions of the Advisory Council.
- * The Minister may adopt the plan without alteration or with such alterations as the Minister may think fit, or may refer it back to the Director-General and Council for further consideration.

Although not a requirement under the Act at that time, this plan of management was placed on public exhibition from December 2000 until April 2001. All comments received were carefully considered by the National Parks and Wildlife Advisory Council and the Minister for the Environment before adoption of this plan of management.

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

The planning process leading to the development of this plan involved the collection of a large amount of information, which for reasons of document size, has not been included in the plan. For additional information or enquiries on Nadgee Nature Reserve or this plan of management, contact the Service's Far South Coast Region Office, corner Merimbula and Sapphire Coast Drives, Merimbula or by phone at (02) 6495 5001.

2. MANAGEMENT CONTEXT

2.1 NATURE RESERVES, WILDERNESS AREAS, BIOSPHERE RESERVES, AND REGIONAL FOREST AGREEMENTS

2.1.1 Nature Reserves in New South Wales

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

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 are valuable refuge areas, where natural processes, phenomena and wildlife can be studied. They differ from national parks which include as a major objective the provision of appropriate recreation opportunities.

2.1.2 Wilderness Areas

That part of Nadgee Nature Reserve south of Newtons Beach was declared the Nadgee Wilderness in 1994. The wilderness was increased in 1997 by the inclusion of the whole of the Merrica River catchment with the exception of the access corridor to the management infrastructure at Merrica River crossing (see map, centre pages). Its current area is approximately 18,880 ha.

Wilderness areas are declared under the *Wilderness Act 1987*. They are large natural areas of land that, together with their native plant and animal communities, are essentially unchanged by human activity. It is recognised that even in the most untouched landscapes there is evidence of human impact, such as airborne pollution or introduced species. Areas classified as wilderness, however, are amongst the least modified and undisturbed landscapes that we have left.

Wilderness areas are necessary for the long term protection of biological diversity and serve as scientific reference areas. An important purpose of wilderness areas is to provide opportunities for solitude and appropriate self-reliant recreation. Protection of natural values, however, has priority over providing for recreational use of wilderness areas.

2.1 3 Biosphere Reserves

Nadgee Nature Reserve and the adjoining Croajingalong National Park in Victoria form the Croajingalong Biosphere Reserve, dedicated in 1977.

Biosphere reserves are multiple function conservation areas designated under the UNESCO Man and the Biosphere program. They are representative of important ecosystems and contain both natural areas (core areas) which are protected sites for conserving biological diversity, where monitoring of minimally disturbed ecosystems and non destructive research can take place, and actively managed areas (buffer and transition areas) which have been modified by human activity. The latter areas are used for cooperative activities compatible with sound ecological practices including environmental education, recreation, ecotourism and research, and are areas where the local community and management agencies work together to manage and sustainably develop the area's resources. Each biosphere reserve remains under the control of the country in which it is located and is managed by appropriate national authorities. The primary goals of the biosphere reserve program (UNESCO 1966) are:

- to conserve for present and future use the diversity and integrity of plant and animal communities within natural ecosystems and to safeguard the genetic diversity on which continuing evolution depends;
 - to provide areas for ecological and environmental research, especially baseline studies both within and adjacent to the biosphere reserves;
 - to provide facilities for education and training; and
- to foster sustainable economic and human development.

2.1.4 Regional Forest Agreements

Regional Forest Agreements are one of the principle means of implementing the National Forest Policy Statement of 1992. Under this Statement Commonwealth, State and Territory governments agreed to work towards a shared vision for Australia's forests. This aimed to maintain native forest estate, manage it in an ecologically sustainable manner and develop sustainable forest-based industries. The Statement provided for joint comprehensive assessments of the natural, cultural, economic and social values of forests. These assessments formed the basis for negotiation of Regional Forest Agreements that provide, amongst other things, for Ecologically Sustainable Forest Management (see section 4.3.3).

The Eden Comprehensive Regional Assessment (Eden CRA) region totalled 800,000 ha extending from Bermagui and Nimmitabel to the Victorian border. The Eden Regional Forest Agreement of 1999 (Eden RFA) covered the Eden CRA region and was the first of four such agreements completed for the eastern forests of NSW. The process leading up to the RFA provided for major additions to the reserve system in the Eden Region, including additions to Nadgee Nature Reserve.

2.2 NADGEE NATURE RESERVE

2.2.1 Location, Dedication and Regional Setting

Nadgee Nature Reserve is located on the far south coast of NSW between Wonboyn Lake and the Victorian border. It is a long triangular area of land stretching 28 km north-south and 18 km at its widest from west to east.

The major part of the area, 11,430 ha, was initially gazetted as a faunal reserve in 1957 under the Fauna Protection Act. It was dedicated as a nature reserve in 1967 and subsequent additions have brought the area to 20,671 ha.

Nadgee is in an isolated location, being bordered by Croajingalong National Park to the south in Victoria, Nadgee State Forest to the west and Wonboyn Lake and the village of Wonboyn to the north.

The far south coast includes extensive areas of State Forest in the coastal hinterland and escarpment. Agricultural areas are located in the river valleys north of the reserve, particularly near Bega. The very attractive coastline and water-based recreation opportunities of the district draw large numbers of tourists during the summer, particularly to coastal towns such as Merimbula, Pambula, Eden and Wonboyn, and to Mallacoota in Victoria.

Nadgee is one of several conservation reserves that protect large sections of the far south coast of NSW. The others are Ben Boyd National Park which adjoins Nadgee, and Bournda, Mimosa Rocks, Wallaga Lake and Eurobodalla National Parks further north.

2.2.2 Importance of Nadgee Nature Reserve

The important features of Nadgee Nature Reserve are outlined below.

Geomorphological and landscape values

The reserve contains a considerable variety of coastal landforms including dissected low tablelands, plateau remnants, coastal plain, estuaries and coastal lagoons, cliffs, shore platforms, sea caves, beaches and extensive dunes. The landform variety and lack of disturbance have resulted in a particularly beautiful, and in places spectacular, coastal landscape. The coastline is of national significance for its diversity of geology and geomorphological features and evidence of past and present processes (Ecology Australia 1998).

The catchments of all creeks and rivers are contained wholly in the reserve except for a small area near the junction of Newtons Road and Storkys Fire Trail. For this reason water quality is very high and the estuaries of Nadgee River, Nadgee Lake and Little Creek are among the few undisturbed and unpolluted estuaries in NSW. These undisturbed catchments are highly valuable as reference areas for assessing water quality (Ecology Australia 1998).

An area of sand dunes at the northern end of the reserve near Wonboyn is one of the most extensive, least disturbed and best developed remaining areas of parallel dune ridge terrain on the NSW coast (Dent, 1966). This area is identified as of national significance as an outstanding example of a major barrier infill sequence which illustrates Holocene coastal evolution (Ecology Australia 1998). The dunes are of considerable scientific interest and educational value.

Extensive sand dunes are also located in the Cape Howe area at the southern end of the reserve. This area encompasses a complex, dynamic landscape where there are substantial and ongoing changes in coastal and dune morphology. One of the major environmental changes on the Australian continent occurs in the area. At Cape Howe, as the coastal alignment changes from a broadly north-south to an east-west alignment, the balance of coastal processes shifts from wave dominated (Disaster Bay to Nadgee Lake) to a wind dominated regime (Endeavour Moor to

Lake Wau Wauka in Victoria). This is reflected in the differing geomorphology of the coastal shorelines (Ecology Australia 1998).

Biological Values

Nadgee features a complex variety of plant communities in a small area including four types of rainforest, tall open forest, several types of open forest, woodland, coastal scrub, coastal and upland heath and freshwater and estuarine wetland communities.

The reserve contains a concentration of rare and biogeographically significant plant species. Six plant species occurring in Nadgee are significant in a national context, including one endangered species listed in Schedule 1 of the *Threatened Species Conservation Act 1995* (*Lepidium hyssopifolium*) and four rare plant species (Briggs and Leigh 1995). The other species of national significance is *Eucalyptus ignorabilis*, listed as poorly known in Briggs and Leigh (1995). Nadgee Nature Reserve provides secure reservation for a further 54 species considered of conservation significance within the region and an additional 2 species whose status in the reserve is unconfirmed (Keith and Ashby, 1992; Keith, Miles & Mackenzie 1999, D. Keith pers. com.). Refer to section 4.1.2 for details.

The reserve appears to lie on a biogeographical boundary relating to the overlap between summer and winter dominant rainfall (Gilmour 1983). A large number of plant species reach their southern limit of distribution in the Eden region, including 24 species in Nadgee Nature Reserve (Keith & Ashby 1992 & Keith, Miles and Mackenzie 1999). Refer to section 4.1.2.

The reserve supports 11 vegetation types considered by Ecology Australia (NPWS Report, 1998) to be rare or vulnerable in a regional and national context. These are Coastal Wetland, Coastal Saltmarsh, Cool temperate Rainforest, Warm Temperate Rainforest, Coastal Lowland Heath, Mt Nadgee Heath, Button Grass Sedgeland, Xanthorrhoea Plain, Estuarine Wetland, Coastal Barrier Woodland and Beach Strand Grassland. A further 3 ecosystems were identified as regionally significant in the Eden CRA – Eden Dry Shrub Forest, Lowland Dry Shrub Forest/Woodland and Timbillica Low Dry Shrub Forest (Keith and Bedward 1999).

The heathland of Nadgee is one of only four large areas on the south coast of NSW, the others being at Barren Grounds Nature Reserve, Jervis Bay and the Tianjara-Little Forest Plateau in Morton National Park.

The plant community diversity within the southern coastal area of the reserve is exceptionally high and, together with the coastal section of the adjacent Cape Howe wilderness in Victoria, has been recognised as significant in a national context (Ecology Australia 1998).

The plant diversity in the south western corner of the park is also very high. Sequences of warm and cool temperate hinterland and coastal rainforest, moist eucalypt forests and rare oldgrowth dry eucalypt forests in this area provide habitat for rare and threatened fauna and were identified as a significant refugia (Eden RFA 1999). The mature and oldgrowth eucalypt forests protected in Nadgee are particularly important refuges for aboreal mammals. These forests and woodlands are also an integral component of the undisturbed character of the Nadgee, Little River and Table Creek catchments of the reserve.

Nadgee has a diverse native animal population, with 48 species of native mammals, 216 bird species, 28 reptile species and 16 amphibian species.

The reserve provides fauna habitats which are secure and which have been relatively undisturbed in terms of habitat loss and fragmentation as a result of human activities such as logging, grazing and recreation. The reserve also contains relatively low levels of introduced plants and animals. Fauna habitats and populations have thus remained relatively unaffected by the potentially high impacts of these threatening processes (Ecology Australia 1998). In addition, the low recreation pressure and strictly managed public access in Nadgee compared to other coastal reserves enables management for maximum habitat value and biodiversity.

A large number (37 species) of threatened native animals have been recorded. Refer to section 4.1.3 for details. Surveys have indicated that suitable habitat exists, which could support the Long-footed Potoroo *Potorous longipes* (Saxon per com 2000).

The Nadgee heathland is particularly important for conservation of the threatened Ground Parrot (*Pezoporus wallicus*) and Eastern Bristlebird (*Dasyornis brachypterus*). The habitat of these species has been greatly reduced outside reserves and they are now limited to a small number of isolated populations.

Nadgee is one of three strongholds for the threatened Striated Fieldwren (*Calamanthus fuliginosus*) in NSW (Gosper and Baker 1996).

Several of the sea caves contain important invertebrate communities dependent on bat guano. At Merrica Beach cave there is significant interaction between the guano community and the marine seawrack-dependent littoral community (Eberhard 1997).

Several Dingo *Canis lupus dingo* families are present in the reserve. Because of the isolation of Nadgee the dingoes have been subject to little disturbance and therefore provide a valuable opportunity for research into their biology and behaviour.

The reserve has been identified as having the potential to contain catchments with exclusively native fish populations. Estuaries are an integral part of the life history of many fish species and the relatively undisturbed estuaries of Nadgee Nature Reserve are important for the maintenance of populations of many native fish species (Ecology Australia 1998).

The intertidal rock platforms adjacent to Nadgee have a rich, well developed littoral fauna and Nadgee Point/Black Head has been identified by the National Trust as having the most diverse biota of any headland in NSW south of Narooma (National Trust of Australia 1982).

As well as being adjacent to Ben Boyd and Croajingolong National Parks, Nadgee is connected via extensive areas of state forest to Mount Imlay and South East Forest National Parks on the ranges and escarpment. These areas in turn are connected to Wadbilliga and Deua National Parks and to other parks and public land as far north as Sydney. This interconnection greatly enhances the habitat value of each area and assists the maintenance of biodiversity.

Value for Scientific Research

Nadgee Nature Reserve has been a site of scientific research since 1953. The reserve is highly significant as a site for descriptive research on the biological and physical processes of south-eastern Australia and as a control site providing a comparison against more disturbed environments (Ecology Australia 1998). In particular, Nadgee is important as a long term scientific reference area against the intensively logged state forests of the district.

The reserve is an outstanding area for biological and ecological research because of its diverse range of environments, the presence of several entire catchments within the reserve, its size and isolation from rural and urban land use influences and human interference.

A large amount of information has been collected in the reserve over a long period. This is valuable as base data for further research and in building up a more complete understanding of the area's ecology.

Aboriginal Values

The reserve contains a variety of Aboriginal sites, including some extensive middens in sand dunes. Many of the midden deposits are rich in archaeological material. Sites within coastal reserves are valuable because of the degree of disturbance by development and recreational use elsewhere on the coastline. The Wonboyn and Cape Howe dune systems have particularly high Aboriginal cultural value, with potential for establishing a sequence of land use changes in response to changing coastal environments and for dating the rates of dune formation.

Wilderness Value

The majority of the reserve is classified as the Nadgee Wilderness. This is the only coastal wilderness area in NSW and the only declared NSW wilderness defined by whole catchments. Its value is extended by management of adjacent land in Croajingalong National Park (Vic) as the Cape Howe wilderness. Nadgee wilderness and the Cape Howe wilderness together comprise the largest essentially unmodified coastal area in south-eastern Australia.

Nadgee River is one of only two NSW coastal rivers identified as wild for their full length (Environment Australia Wild Rivers project). The other is the Esk River in northern NSW.

Cape Howe Beach is the most isolated beach in NSW.

Recreation and Educational Values

The beautiful landscape, naturalness and sense of isolation contribute to making the reserve a rare and special area for recreation. Opportunities for wilderness walking and the relatively low numbers of visitors are unique on the NSW coastline.

Low impact recreational opportunities in Nadgee complement the mainly car-based opportunities available in Ben Boyd and other heavily used national parks on the south coast and in Victoria.

The Wonboyn dunes and other parts of the reserve are used for educational excursions. The reserve also provides opportunities for the general community to learn about the environment and conservation.

Social and Economic Values

Nadgee Nature Reserve is one of the major attractions in the area for tourists who make a significantly contribution to the economy of Wonboyn. Nadgee is also used regularly by local people for recreation.

Summary Statement of Significance

Nadgee Nature Reserve is of significance at a national level because:

- it has a large number of rare and threatened plant and animal species, rare plant communities and species at the limits of their distribution occur in the reserve;
- it has the only coastal wilderness area in NSW, one of only two coastal rivers identified as wild and scenic for their full length, and the most isolated beach in NSW;
- it is an outstanding area for biological and ecological research and a scientific reference area; and
- it is one of the most significant long-term sites for ecological monitoring in Australia; and
- the Eucalypt forests at Nadgee form part of the outstanding species-rich Eucalypt forests in the Eden Region.

Nadgee Nature Reserve is also of state and regional significance because:

- it protects a wide variety of coastal landforms, vegetation types and habitats in a region which is subject to extensive disturbance by logging, agricultural use and development;
- it is linked to other extensive natural areas, contributing to maintenance of biodiversity and the viability of natural systems within the reserve and the region;
- water quality is extremely high and the reserve contains some of the few undisturbed and unpolluted estuaries in NSW;
- it contains the most extensive, best developed and least disturbed area of dune ridge terrain on the NSW coast;
- a variety of undisturbed Aboriginal sites and cultural values are contained within the reserve;
- the beautiful natural coastal landscape and sense of isolation give the reserve a special inspirational and recreational value; and
- it is one of the major attractions in the area for tourists.

3. OBJECTIVES OF MANAGEMENT

3.1 GENERAL OBJECTIVES FOR NATURE RESERVES

The following general objectives, derived from the National Parks and Wildlife Act, relate to the management of nature reserves in New South Wales:

- * protection and preservation of scenic and natural features, including significant geological and geomorphological features;
- * conservation of wildlife, including maintenance of biodiversity and populations of threatened species;
- * maintenance of natural processes;
- * preservation of catchment values;
- * preservation of Aboriginal sites in consultation with the Aboriginal community;
- * conservation of non-Aboriginal historic features;
- * provision of opportunities for appropriate use; and
- * encouragement of scientific and educational enquiry into environmental features and processes.

3.2 GENERAL OBJECTIVES FOR WILDERNESS AREAS

The following general objective, derived from the Wilderness Act, apply to the management of wilderness areas in NSW:

- restoration (if applicable) and protection of the unmodified state of the area and its plant and animal communities, while managing cultural heritage in a manner appropriate to its significance;
- preservation of the capacity of the area to evolve in the absence of significant human interference; and
- provision of opportunities for solitude and appropriate self-reliant recreation.

3.3 SPECIFIC OBJECTIVES FOR NADGEE NATURE RESERVE

In addition to the above general objectives, the management of Nadgee Nature Reserve will be subject to the following specific objectives:

- * protection of the reserve as a largely undisturbed sample of the landforms and plant and animal communities of the far south coast;
- * maintenance of populations of the rare, threatened and biogeographically significant plant and animal species which occur in the reserve, and protection of rare vegetation types;
- * protection of high water quality in the estuaries and elsewhere within the reserve;

- * provision of opportunities for appropriate scientific research;
- * provision of opportunities for low key day use in the northern section of the Nature Reserve and for self reliant recreation under permit in the Wilderness Area; and
- * promotion of community awareness of the significant conservation values of the reserve.

3.4 OVERALL STRATEGY

Nadgee Nature Reserve will be managed primarily to protect its high ecological, scientific and wilderness values by:

- control of introduced plant and animal species;
- management of fire to maintain biodiversity and promote old growth;
- encouragement of scientific research by provision of appropriate access and accommodation;
- placing limits on the numbers of visitors within the wilderness area through a permit system;
- continued provision of low key recreation opportunities at existing sites at the northern end of the reserve; and
- on-going cooperative management with Parks Victoria.

Programs for management of threatened fauna, fire, introduced species, erosion and other issues will apply within the wilderness area as for other parts of the nature reserve. Because of the emphasis on protecting the wilderness in an unmodified state, however, particular care will be taken to ensure that management programs are designed to avoid damage to natural values.

Sympathetic management of the adjacent Cape Howe Wilderness in Croajingolong National Park is important for protection of Nadgee's wilderness values. Cooperative arrangements for management of fire, threatened species and public use of both areas have been negotiated.

4. POLICIES AND FRAMEWORK FOR MANAGEMENT

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

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

The policies established in this plan of management will provide the framework for the management of Nadgee Nature Reserve over the next five to ten years. Progress in implementation of the plan will be reviewed annually.

Where not specifically provided for in this plan, management of Nadgee Nature Reserve will be in accordance with the National Parks and Wildlife Act and with general National Parks and Wildlife Service Policies.

4.1 NATURAL HERITAGE

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

4.1.1 Geology, Geomorphology, Landscape and Soils

Nadgee Nature Reserve consists primarily of late Devonian Merimbula Group sediments of sandstones, conglomerate, siltstones and shales laid down in riverine and marine environments 350 million years ago.

The Merimbula Group also outcrops in Ben Boyd National Park and parts of other parks along the Budawang Synclinorium, which extends from Bega to Yalwal, west of Nowra. In Nadgee the bedding is almost horizontal while in Ben Boyd and further north along the Synclinorium the beds are frequently heavily folded and steeply dipping.

The Merimbula Group rests unconformably on the Ordovician (400 million years old) Mallacoota Beds or on Middle Devonian Gabo Island Granite. The Mallacoota Beds consist of sandstone, shale, quartzite and slate and have been tightly folded. They are exposed in the valley floors of the Merrica River and Old Battery Creek. Gabo Island Granite outcrops along the Howe Range at the southern end of the reserve.

Coastal ranges (Table Ridge, Howe Range and part of the Nadgee Range) form the visual backdrop of much of the reserve, rising to over 500 m high at Mount Nadgee. The ranges fall steeply to a narrow coastal plain drained by several creeks, and to the Merrica River catchment within the reserve on the western side.

Resistant sandstone of the Merimbula Group alternating with the more erodible shale has resulted in rugged topography and the formation of cliffs and scree slopes along the Table Range.

The coastline consists of a broken cliffline, rock platforms, sand and boulder beaches, sand barriers, estuaries and coastal lagoons with tidal and overwash features. Between Wonboyn Beach and Jane Spiers Beach the cliffs are up to 35m high.

The estuaries have formed on the Merrica River, Wirra Birra Creek, Little Creek, Nadgee River and at Nadgee Lake. They are Pleistocene deepened valleys which are now filled with sand, apart from the Merrica River estuary which lies in a gorge. The reserve is bounded at its northern end by Wonboyn Lake which separates it from Ben Boyd National Park

Several Tertiary (up to 65 million years old) basalt intrusions occur along the coastline. Sea caves, chasms and bridges have formed as a result of erosion of the dykes.

Areas of Tertiary sand, gravel and alluvium occur along the coast and Table Ridge.

The area of mobile sand dunes at Cape Howe form part of a very extensive dune area in adjacent Croajingolong National Park in Victoria. The dunes are encroaching onto adjacent parts of the reserve. The unvegetated dunes are thought to have resulted from an actively receding coastline and to be a natural evolutionary feature. Past grazing and burning may, however, have contributed to destabilisation of the dunes.

The Wonboyn dune barrier system is comprised of at least 60 low, parallel beach ridges with minimal transgressive dunes and forms the northern section of the reserve between Wonboyn Lake and the ocean. It connects a small headland, Bay Cliff (which is a former island) to the mainland. This barrier sequence is entirely of Holocene Age (the last 10,000 years).

The dune areas are vulnerable to disturbance from recreational and other use. Ground water in the Wonboyn dune area has been proposed as a water source for the village of Wonboyn. This would have a significant impact on the vegetation, habitat values and stability of this area and is not an appropriate use of the area.

Because of the exposed position of the reserve, the beach dunes and estuary mouths are particularly vulnerable to erosion if the vegetation cover is disturbed.

The soils of the reserve are generally poor, being sandy to gravelly, acidic and highly erodible. Some areas of more fertile soils have built up by alluvial deposition adjacent to creeks.

Some erosion is occurring along management tracks (dealt with in section 4.3.3) and routes regularly used by walkers, particularly within the wilderness area.

The Service is an active member of the Far South Coast Catchment Management Committee and the Wonboyn Lake Management Committee. The latter is preparing an estuary management plan for Wonboyn Lake and River that will set out strategies for protection and management of the natural and cultural heritage values of the estuary.

Policies

- * The Wonboyn, Cape Howe and other sand dune areas will be managed to minimise human and other disturbance.
- * Action will not be taken to stabilise the Cape Howe dunes.
- * Extraction of town water supplies from the ground water of the Wonboyn sand dune system will not be permitted.

- * All works carried out in the reserve will be designed and undertaken so as to minimise soil erosion and prevent water pollution.
- * The Service will continue to participate in the Far South Coast Catchment Management Committee and the Wonboyn Lake Management Committee and will work with other organisations such as Landcare groups where relevant.

Action

- * Erosion control works will be carried out on areas affected by walking use.

4.1.2 Native and Introduced Plants

The great diversity of vegetation types in Nadgee reflects the variation in topography, local climate, soils and fire history. Over 40 different vegetation associations have been identified and 700 plant species have been recorded in the reserve. The variety of associations and communities within each vegetation type complicates management because of the need to maintain this variety.

Several vegetation surveys have been undertaken in the reserve, each of which used different classification systems. The descriptions below combine information from reports by Gilmour (1983), Kendall (1998), Ecology Australia (1998) and Keith and Bedward (1999).

Rainforest

Mixed cool temperate/warm temperate rainforest occurs in gullies below the Table and Howe ranges in the catchments of Nadgee River, Little Creek and Table Creek, and in gullies falling to the south and crossing the border into Victoria. This tends towards cool temperate rainforest near Mount Victoria in the upper catchment of Harrisons Creek which flows into Victoria. Cool temperate rainforest is dominated by Pinkwood *Eucryphia moorei*, with Prickly Tree Fern *Cyathea leichhardtiana* being common in the tree fern layer. In the mixed cool temperate/warm temperate rainforest Lilly Pilly *Acmena smithii* and Pinkwood are dominant while Sweet Pittosporum *Pittosporum undulatum*, Bolwarra *Eupomatia laurina*, Bower Wattle *Acacia subporosa*, Musk Daisy Bush *Olearia argophylla*, Blanket Leaf *Bedfordia arborescens*, Prickly Tree Fern and other tree ferns and a number of climbers are common. Ferns such as *Blechnum spp.* and *Lastreopsis microsora* form a dense ground cover. These communities are described as Hinterland Warm Temperate Rainforest by Keith and Bedward (1999). This type is the most common rainforest found in the parks of the region but the small area of cool temperate rainforest near Mt Victoria is unique within the region because of its proximity to the coast and is of conservation importance.

Warm temperate rainforest (described by Keith and Bedward 1999 as Coastal Warm Temperate Rainforest) dominated by Lilly Pilly is found in gullies at the northern end of Table Ridge. A small area of rainforest occurs in a littoral position on the southern side of Bay Cliff adjacent to Wonboyn Lake. It consists mainly of Lilly Pilly and Sweet Pittosporum. Nadgee makes a significant contribution to the conservation of Coastal Warm Temperate Rainforest in the region. Coastal and Hinterland Warm Temperate Rainforest are considered regionally vulnerable and Coastal Warm Temperate Rainforest is under represented in the reserve system. It could be considered vulnerable to regional decline if not managed carefully (Eden RFA 1999).

The occurrence of rainforest has probably been reduced by repeated and/or extensive high intensity fires (Floyd 1990 cited in Keith and Bedward 1999). High

intensity fires occurred in the reserve and surrounding forests in 1972 and 1980. Remaining affected rainforest areas are showing good signs of recovery.

Open forest and woodland

Tall open forest occurs extensively in protected gullies, slopes and creek flats in the Nadgee, Little Creek and Table Creek catchments, and along the Merrica River. There are several associations, dominated by Monkey Gum *Eucalyptus cypellocarpa*, Yellow Stringybark *E. muelleriana*, Gully Gum *E. smithii*, White Ash *E. fraxinoides* and Messmate *E. obliqua*. Common shrubs include Bower Wattle, Blanket Leaf, Blueberry Ash *Elaeocarpus reticulatus* and Elderberry *Panax Polyscias sambucifolius*. The Eden RFA (1999) found these Hinterland Wet Fern and Hinterland Wet Shrub Forests to be adequately reserved in the region.

Open forests are the most widespread vegetation type in Nadgee, occupying ridges, hills and well drained coastal areas. Keith and Bedward (1999) mapped nine open forest ecosystems in the reserve. The ridges and western slopes mainly supported Silvertop Ash *Eucalyptus sieberi* with Sunshine Wattle *Acacia terminalis*, *Amperea xiphoclada*, Old Man Banksia *Banksia serrata*, Black Oak *Allocasuarina littoralis*, Smooth Geebung *Persoonia levis* and Bracken *Pteridium esculentum* in the understorey and ground cover. Woollybutt *E. longifolia*, White Stringybark *E. globoidea*, Bastard Eurabbie *E. globulus* ssp *pseudoglobulus*, Yellow Stringybark, Red Bloodwood *Corymbia gummifera* and Rough-barked Apple *Angophora floribunda* form associations in the more moist locations and have a more mesic group of shrub and ground cover species, including Apple Berry *Billardiera scandens*, Blue Flax-lily *Dianella caerulea*, Pale-fruit Ballart *Exocarpos strictus*, Sword Grass *Gahnia radula* and Running Postman *Kennedia rubicunda*.

Open forest ecosystems of particular conservation concern are the Eden Dry Shrub Forests, Lowland Dry Shrub Forest/Woodland and Lowland Gully Shrub Forest/Woodland (renamed Coastal Dry Shrub Forest *Angophora floribunda* in the Eden RFA). While the Eden RFA (1999) identified these three ecosystems as adequately represented in conservation reserves it must be recognised that Nadgee is the major contributor towards achieving this conservation goal.

Eden Dry Shrub Forest covers most of the Merrica River catchment, the mid sections of the Nadgee catchments and the drier forests of Table Ridge, Cape Howe Range and the footslopes of Mt Nadgee. It is the most common forest type found in the reserve. It is dominated by Silvertop Ash and Rough-barked Apple, with Black Oak in the midstorey, an open shrubby understorey and herbs.

Lowland Dry Shrub Forest/Woodland occurs on ridges and gentle dry slopes below 150 metres, mainly in the eastern and lower sections of the reserve and in patches either side of the Merrica River upstream of the Ranger Station. It is dominated by Red Bloodwood, Silvertop Ash and White Stringybark. The midstorey sometimes contains Rough-barked Apple and Black Oak. It has a diverse shrub layer.

Lowland Gully Shrub Forest/Woodland occurs on gully flats below 100 m on alluvium or sandy soils. It is generally intermixed with Lowland Dry Shrub Forest, heathland and tall open forests in sheltered gullies. Lowland Gully Shrub Forest/Woodland is the predominant ecosystem in the open forests of the Wonboyn dunes (where it is equivalent to Ecology Australia's Coastal Barrier Woodland) and also occurs on east and southeast facing lower slopes south from Jane Spiers Beach. It is dominated by Rough-barked Apple with Monkey Gum and occasionally Brown Stringybark *E. baxteri* and White Stringybark. The midstorey is mainly Sydney Golden Wattle *Acacia longifolia* and Black Oak with smaller shrubs.

Keith and Bedward (1999) mapped Timbillica Low Dry Shrub Forest as occupying low ridges and slopes in undulating terrain between 50-300 metres elevation between Nadgee River and Old Battery Creek catchments. It occupies low ridges and slopes in undulating terrain between 50-300 metres elevation and is predicted to occur in the middle section of the Nadgee River and Old Battery Creek catchments. Occurrences outside the reserve have been extensively modified. Dominant species are Common Yertchuk *Eucalyptus considiana*, Silvertop Ash and Blue-leaved Stringybark *E. agglomerata* sometimes with White Stringybark. Further survey work is required to provide an accurate database of the extent and condition of this vegetation type.

Oldgrowth

Much of the eucalypt forest in and around Nadgee has been seriously affected by high intensity wildfire and/or logging. Large areas of forest have not been able to grow to maturity or beyond. Where past disturbances have not been intense or frequent enough to reduce the number of senescent trees, oldgrowth stands have remained.

These oldgrowth forests are of high conservation importance and their persistence in the region was a key target of the Eden RFA. Oldgrowth forests provide important habitat and are of scientific and cultural interest since they probably represent the species diversity and structure of forests as they were prior to the arrival of Europeans.

Significant stands of oldgrowth in Nadgee exist in the south of the reserve in the upper sections of the Nadgee River, Old Battery Creek, Table Creek and Little River catchments where it is intermixed with mature forest and some young forest. Another significant oldgrowth area extends along the east facing slopes between Jane Spiers Beach and Greenglades. The rest of the reserve is mostly young forest, with a few larger patches of mature forest occurring in the Merrica River catchment and some smaller stands of mature and oldgrowth in sheltered gullies and slopes.

Nadgee contains the only examples of oldgrowth Timbillica Dry Shrub Forest on NPWS estate in the region and almost the entire area of this oldgrowth forest conserved. Oldgrowth areas of the other forest/woodland ecosystems above are also significant. Maintenance of the structural character of all oldgrowth forest stands in Nadgee and the careful management of young and regrowth forests into mature and oldgrowth forest life stages are important management goals. An increased area of oldgrowth forest in Nadgee is essential to balance the young and severely disturbed forests surrounding the reserve.

Scrub and heath

Coastal scrub (or Coastal Scrubland as identified by Keith and Bedward 1999) occurs behind beaches and on headlands along the length of the reserve. Giant Honey-myrtle *Melaleuca armillaris* is dominant, often occurring in pure stands. Other species include Coastal Tea Tree *Leptospermum laevigatum*, Coastal Banksia *Banksia integrifolia*, Coastal Wattle *Acacia sophorae*, Coastal Beard Heath *Leucopogon parviflorus*, White Correa *Correa alba* and Sword Rush *Lepidosperma gladiatum*.

Small areas of Beach Strand Grassland occur on foredunes along the coast. This community is dominated by Hairy spinifex *Spinifex sericeus* and *Festuca littoralis*.

Coastal heath (equivalent to Coastal Lowland Heath) is found in small areas along most of the coastline and in three large areas south of Little Creek on shallow soils behind headlands (on old leached dune systems). Species vary considerably

depending on drainage and fire history. The heath can be divided broadly into grassy wet heath, dry heath dominated by *Casuarina* and *Hakea* species and dry heath dominated by Kangaroo Grass *Themeda australis* and Silver Spyridium *Spyridium cinereum*. Common species include Scrub She-oak *Allocasuarina paludosa*, Bushy Needlewood *Hakea sericea*, Common Heath *Epacris impressa*, *Schoenus brevifolius* and, in wetter areas, Blunt-leaf Heath *Epacris obtusifolia*, *Goodenia stelligera* and *Leptocarpus tenax*. Nearly half of the Coastal Lowland Heaths reserved in the region occur in Nadgee.

Upland heath (Mt Nadgee Heath) occurs on the rocky sandstone plateau around Mt Nadgee at elevations up to 450 m. Upland heath tends to be damper and more complex than the coastal heaths and has a greater graminoid component. It is dominated by Paperbark Tea-tree *Leptospermum trinervium* and Swamp Banksia *Banksia paludosa* with the groundcover dominated by a wide variety of sedges along with Common Heath, Screw Fern *Lindsaea linearis* and *Dampiera stricta*. Swards of *Xanthorrhoea resinifera* occur on damper sites. Scattered individuals of Brown Stringybark emerge from the shrub stratum. Nadgee contains the only example of this heath type in the region.

Ecology Australia further identified a community called Xanthorrhoea Plain, dominated by *Xanthorrhoea resinifera*, in poorly drained dune swales south of Nadgee River. Nadgee is likely to be the northern limit of this community (Ecology Australia 1998).

Wetland and riparian communities

Nadgee contains significant examples of coastal wetlands and riparian ecosystems that require well considered conservation management. Pastoral improvement, riverbank clearing and inappropriate fire regimes have significantly affected the condition and extent of these important ecosystems in the region.

A variety of freshwater wetland communities occur scattered throughout the reserve. These are mainly swamp heath and sedgeland and are localised to gullies and basins with poor drainage. The coastal wetlands tend to be very restricted and biogeographically distinct (Ecology Australia 1998). Species compositions vary greatly but commonly include Scented Paperbark *Melaleuca squarrosa*, Swamp Baeckea *Baeckea linifolia*, *Leptocarpus tenax*, Tall Yellow-eye *Xyris operculata* and Pink Swamp Heath *Sprengelia incarnata*. Nadgee contains the most extensive areas of lowland swamps reserved within the region (Keith and Bedward 1999).

Areas of Button Grass Sedgeland *Gymnoschoenus sphaerocephalus* have been located at Howe Swamp (Ecology Australia 1998) and within Mt Nadgee Heath (Peter Catling Pers comm 2001). Small patches may also occur elsewhere in the park. This is a rare vegetation type (Ecology Australia 1998) and further survey is needed to comprehensively record its occurrence in the reserve.

There are small areas of estuarine wetland on the shores of Wonboyn Lake and in an inter-dune area at Cape Howe. Species vary but include the rush *Eleocharis sphacelata*, *Baumea* spp., *Isolepis* spp., Glasswort *Sarcocornia quinqueflora* and Sea Rush *Juncus kraussii*. A small estuarine wetland on the Nadgee River estuary is dominated by rushes, sedges and Swamp Paperbark *Melaleuca ericifolia* (Ecology Australia 1998). Estuarine wetlands and Saltmarshes are important coastal communities under-represented in existing reserves in the region (Keith and Bedward 1999). Nadgee contains around a quarter of the total area of saltmarsh found in the reserves of the region. Coastal Saltmarsh is generally very restricted in southern Australia and displays considerable biogeographic variation (Ecology Australia 1998).

A riparian scrub of Water Gum *Tristaniopsis laurina*, Woolly Tea-tree *Leptospermum lanigerum* and Manuka *L. scoparium* has developed along the major watercourses. Keith and Bedward (1999) describe this community as Southern Riparian Scrub. Riverine scrub is seriously under represented in conservation reserve in the region. Nadgee contains nearly half of all the reserved examples and the conservation of this scrubland in Nadgee is of particular regional concern.

Rare and threatened species

The nationally rare and threatened plants in the reserve occur along the Merrica River (*Pomaderris brogoensis*, *Pseudanthus divaricatissimus*), in poorly drained woodland areas (*Eucalyptus ignorabilis*), in upland heath (*Burnettia cuneata*) and coastal heath (*Spyridium cinereum*) and along headlands and beaches (*Lepidium hyssopifolium*). Further survey is needed to locate occurrences of these species.

At least three species occurring within the reserve represent disjunct populations. These include *Burnettia cuneata*, *Helichrysum collinum* and *Schoenus villosus* (Keith and Ashby 1992).

One species *Astrotricha* sp 'Nadgee' has been identified as endemic to the Nadgee/Cape Howe wilderness areas (Keith, Miles & Mackenzie 1999).

Significant plant species occurring within Nadgee Nature Reserve are listed in the tables below (adapted from Keith & Ashby 1992 and Keith, Miles & Mackenzie 1999).

NATIONAL SIGNIFICANCE		
SPECIES NAME	COMMON NAME	Category of Significance
<i>Burnettia cuneata</i>	Burnettia	3(3RC)8
<i>Eucalyptus ignorabilis</i>	Green Scentbark	3(3KC),7N
<i>Lepidium hyssopifolium</i>	Small Pepper-cress	2(3eca+) #
<i>Pomaderris brogoensis</i>	Pomaderris	3(3RC),4,7S
<i>Pseudanthus divaricatissimus</i>	Tangled Pseudanthus	3(3RCa)
<i>Spyridium cinereum</i>	Tiny Spyridium	3(3RCa)

REGIONAL SIGNIFICANCE		
SPECIES NAME	COMMON NAME	Category of Significance
<i>Acacia subporosa</i>	Bower Wattle	4
<i>Amphipogon strictus</i> var. <i>strictus</i>		5
<i>Apalochlamys spectabilis</i>	Showy Apalochlamys	5,7N
<i>Astrotricha</i> sp. 'Nadgee'		1,3
<i>Austrostipa semibarbata</i>		5
<i>Baeckea ramosissima</i> ssp <i>prostrata</i>		5
<i>Baloskion tetraphyllum</i> subsp. <i>Tetraphyllum</i>		5
<i>Baumea teretifolia</i>		5
<i>Blechnum chambersii</i> *		
<i>Cassinia uncata</i>		5
<i>Clematis microphylla</i> var. <i>leptophylla</i>		5
<i>Cyathea leichhardtiana</i>	Prickly Tree-fern	5
<i>Disphyma crassifolium</i> subsp.		5

<i>Clavellatum</i>		
<i>Diuris corymbosa</i>		5,7N
<i>Drosera pygmaea</i>		5
<i>Eucalyptus pseudoglobulus</i>	Victorian Eurabbie	5,7N
<i>Eucryphia moorei</i>		3
<i>Gleichenia rupestris</i>	Coral Fern	5,7S
<i>Goodenia paniculata</i>		5
<i>Goodenia stelligera</i>		5
<i>Helichrysum collinum</i>	Everlasting	5,7S,8
<i>Hibbertia prostrata</i>		5
<i>Isolepis aucklandica</i>		5
<i>Isopogon prostratus</i>	Prostrate Cone-bush	3
<i>Laxmannia sessiliflora*</i>		
<i>Lepidosperma forsythii</i>		5
<i>Limonium australe</i>		3
<i>Linum marginale</i>		5
<i>Mazus pumilio</i>		5
<i>Mimulus repens</i>		5
<i>Notodanthonia setacea</i>		5
<i>Notothixos subaureus</i>	Golden Mistletoe	5
<i>Olearia rugosa</i>	Wrinkled Daisy-bush	5
<i>Phebalium squamulosum subsp argenteum</i>		5
<i>Phebalium squamulosum subsp squamulosum</i>		5
<i>Plantago hispida</i>		5
<i>Pomaderris betulina</i>		5
<i>Prostanthera decussata</i>	Dense Mint-bush	5
<i>Pultenaea paleacea var. sericea</i>		5
<i>Santalum obtusifolium</i>	Blunt Sandalwood	5
<i>Sarcochilus australis</i>	Butterfly Orchid	6
<i>Scaevola albida</i>		5
<i>Scaevola calendulacea</i>	Dune Fan-flower	5,
<i>Schoenus moorei</i>	Bog-sedge	5,7S
<i>Schoenus nitens</i>		5
<i>Schoenus turbinatus</i>	Top Bog-sedge	5
<i>Schoenus villosus</i>	Bog-sedge	5,7S,8
<i>Senecio spathulatus</i>		2
<i>Sticherus tener</i>		5
<i>Symphionema paludosum</i>	Symphionema	5,7S,8
<i>Tetrarrhena acuminata</i>	Pointed Rice-grass	3
<i>Thelionema umbellata</i>	Blue-lily	5
<i>Thysanotus juncifolius</i>		5
<i>Tricostularia pauciflora</i>		5
<i>Villarsia exaltata</i>		5
<i>Zieria sp. 0 (littoralis ms)</i>	Dwarf Zieria	3,8

SPECIES REACHING THEIR SOUTHERN LIMIT WITHIN NADGEE		
SPECIES NAME	COMMON NAME	Category of significance
<i>Aphanopetalum resinosum</i>	Gum Vine	7S
<i>Banksia paludosa</i>	Coast Banksia	7S
<i>Breynia oblongifolia</i>	Breynia	7S
<i>Eucalyptus longifolia</i>	Woollybutt	7S
<i>Eucalyptus pilularis</i>	Blackbutt	7S
<i>Gleichenia rupestris</i>	Coral Fern	5,7S
<i>Hakea maccreana</i>	Macrae's Hakea	7S
<i>Helichrysum collinum</i>	Everlasting	5,7S,8
<i>Lepidosperma filiforme</i>		5,7S
<i>Lepyrodia scariosa</i>	Lepyrodia	7S
<i>Lobelia dentata</i>		7S
<i>Lomandra confertifolia</i> ssp. <i>rubiginosa</i>	Slender Mat-rush	7S
<i>Omаланthus populifolius</i>	Omаланthus	7S
<i>Phebalium diosmeum</i>	Phebalium	7S
<i>Pomaderris andromedifolia</i> subsp. <i>confusa</i>		3,7S
<i>Pomaderris brogoensis</i>	Pomaderris	3(3RC-),4,7S
<i>Poa affinis</i>		5,7S
<i>Sarcophilus olivaceus</i>		5,6,7S
<i>Schoenus moorei</i>	Bog-sedge	5,7S
<i>Schoenus lepidosperma</i> subsp. <i>pachylepis</i>		7S
<i>Schoenus villosus</i>	Bog-sedge	5,7S,8
<i>Senecio glomeratus</i>		7S
<i>Symphionema paludosum</i>	Symphionema	7S,8
<i>Westringia fruticosa</i>	Coast Rosemary	7S

SPECIES REACHING THEIR NORTHERN LIMIT WITHIN NADGEE		
<i>Acacia oxycedrus</i>	Spike Wattle	5,7LN
<i>Apalochlamys spectabilis</i>	Showy Apalochlamys	5,7N
<i>Eucalyptus pseudoglobulus</i>	Victorian Eurabbie	5,7N
<i>Eucalyptus</i> sp. aff. <i>globoidea</i>	White Stringybark	3,4,7N
<i>Senecio squarrosus</i>		2,7N #

ROTAP (Rare or Threatened Australian Plant) codes from Briggs and Leigh (1995).

- 3 Geographic range in Australia greater than 100 km
- E species considered endangered in Australia
- R species considered rare in Australia
- C at least one population known to occur within a conservation reserve
- K species considered poorly known in Australia, but suspected of being rare, vulnerable or endangered
- a 1000 plants or more are known to occur within a conservation reserve
- + overseas occurrence

Threatened Species Conservation Act

- # Listed as Endangered Schedule 1 Part 1 of the NSW Threatened Species Conservation Act.

Categories of Significance codes from Keith, Miles & Mackenzie (1999).

- 1 Endemic to the region

- 2 Listed as threatened in Australia (E:endangered, V:vulnerable on schedules of the Commonwealth *Endangered Species Protection Act 1992* and/or in New South Wales (e:endangered, v:vulnerable) on schedules of the NSW Threatened Species Conservation Act.
 - 3 Rare (i.e. listed under category R by Briggs & Leigh 1996), poorly known and potentially rare or threatened (i.e. listed under category K by Briggs and Leigh 1996), or uncommon throughout range, but not threatened.
 - 4 Restricted distribution outside region, but maybe locally common within region.
 - 5 Uncommon within region
 - 6 Habitat extensively depleted, or species harvested or collected, but not yet rare or threatened.
 - 7 Geographic limit of distribution within the region (N: northern, S: southern limit, LN: local northern limit with disjunct population(s) known further north, LS: local southern limit with disjunct population(s) known further south).
 - 8 populations in the region disjunct from other occurrences of the taxon, usually separated by at least 100 km from other populations of the taxon.
- * Unconfirmed record, if confirmed then plant would be regionally significant

Disturbances

Recent reserve additions in the Merrica River catchment and south west corner of the reserve contain dense stands of regrowth forest. These have replaced what were formerly areas of tall open forest, open forest and woodland. The forests are a successional stage following logging and frequent burning, consisting of even-aged stands of immature silver top ash with an often dense shrub understorey. Only occasional mature trees of the original associations have persisted.

Clearings associated with former agricultural use, a staff house and recreation use are located at Nadgee Flat, behind Newtons Beach, behind Wonboyn Beach and at the Merrica River crossing. The Nadgee Flat area is regenerating towards open forest. Considerable regeneration has occurred at Newtons Beach but appears to be inhibited by rabbit grazing. Rabbit control is dealt with in section 4.1.3. Clearings at Merrica Crossing and Greenglade are maintained for management or recreational use.

Introduced Plants

A number of garden plants grow on the site of a former farmhouse at Nadgee Flat. Some of these are potential weeds including Cape Gooseberry *Physalis peruviana*, Blackberry *Rubus ulmifolius*, Small-leafed Privet *Ligustrum sinense*, Arum Lilly *Zantedeschia aethiopica*, Bamboo, Yellow Jasmine *Jasminium mesneyi*, Bushy Starwort *Aster subulatus*, Fleabane *Conyza albida*, *Yucca aloifolia*, *Cordyline rubra*, and *Agapanthus* sp, (Gilmore 1983, Evans 1995). Other introduced species occurring elsewhere in the reserve include Sea Spurge *Euphorbia paralias* and Spear Thistle *Cirsium vulgare* (Evans 1995).

The most extensive weed in the reserve is blackberry, which is found at several locations in clearings and along management tracks. Blackberry is a noxious weed and the Service is required under the *Noxious Weeds Act 1993* to prevent its spread. The noxious weed Pampas Grass *Cortaderia* sp. has previously been removed from Nadgee Flat and monitoring is occurring to check for reappearance of this species.

Beach Strand Grassland has become severely depleted throughout its range by overuse, artificial stabilisation and weed invasions. A major threat to this community is the replacement of the original native dominants with exotics such as Marram Grass *Ammophila arenaria*, Sea Wheat Grass *Thinopyrum junceum* and forbs such as Sea Spurge *Euphorbia paralias*.

Coastal Saltmarsh in southern Australia may be threatened by the highly invasive *Spartina* spp. (Ecology Australia 1998) and Sharp Rush *Juncus acutus* subsp. *acutus*. Assessment of any threats to the saltmarsh community is needed.

A weed management plan has been prepared for the reserve identifying weed locations and strategies to control these weeds. This plan will be updated as necessary to reflect any changes as a result of weed control works undertaken and newly discovered weed occurrences.

Policies

- * The reserve will be managed to maintain its native floristic diversity and enhance the long term conservation of the region's biodiversity.
- * Rare and threatened plants and rare vegetation types will be protected from disturbance and will be actively managed if necessary to ensure their survival.
- * Research into the distribution and management needs of the rare and threatened floristic communities and plant species will be encouraged and the information gained will be incorporated into management prescriptions.
- * Only indigenous species will be used for coastal stabilisation works.
- * Active restoration of native vegetation will be considered on sites significantly disturbed by past land use activities.
- * The reserve will be managed to be as free of introduced plant species as possible. Priority will be given to treatment of infestations of weed species in the wilderness area or where they pose a threat to native plant communities, there is risk of invasion into uninfested areas or they are agricultural pests.

Actions

- * Surveys will be progressively undertaken to validate and review the extent and condition of rare and threatened plant populations and communities, including old growth ecosystems, in the reserve.
- * The Nadgee Fire Management Plan will consider strategies for maintaining the integrity of rainforest, oldgrowth and other vegetation communities of particular management concern.
- * Ongoing monitoring of Saltmarsh communities against threats such as invasive weed species will occur.
- * Ongoing monitoring within the Beach Strand Grassland vegetation type will be undertaken for the presence/extent of exotic species including Sea Spurge, Sea Wheat-grass and Marram grass. If found, these species will be removed.
- * Introduced plants will be removed from Nadgee Flat.
- * Other weeds will be treated in accordance with the Weed Management Plan and *Noxious Weeds Act 1994*.
- * The Weed Management Plan will be reviewed regularly and updated as necessary to reflect any change.

4.1.3 Native and Introduced Animals

Mammals

Native mammal species commonly found in the reserve include Eastern Grey Kangaroo *Macropus giganteus*, Swamp Wallaby *Wallabia bicolor*, Common Wombat *Vombatus ursinus*, Sugar Glider *Petaurus breviceps*, Agile Antechinus *Antechinus agilis*, Dusky Antechinus *A. swainsonii*, Bush Rat *Rattus fuscipes*, Swamp Rat *Rattus lutreolus*, Platypus *Ornithorhynchus anatinus*, Common Brushtail Possum *Trichosurus vulpecula*, Greater Glider *Petauroides volans*, Common Ringtail Possum *Pseudocheirus peregrinus* and Dingo *Canis lupus dingo*.

Sixteen species of bats have been recorded in the reserve. Most are tree-dwelling species, of which the most common are the Lesser Long-eared Bat *Nyctophilus geoffroyi*, King River Eptesicus *Vespadelus regulus*, Little Forest Eptesicus *V. vulturnus* and Chocolate Wattled Bat *Chalinolobus morio*. The Eastern Horseshoe Bat *Rhinolophus megaphyllus* and the threatened Common Bent Wing Bat *Miniopterus schreibersii* are found in the sea caves.

Reptiles and Frogs

Reptile species recorded in the reserve include the Red-bellied Black Snake *Pseudechis porphyriacus*, Garden Skink *Lampropholis guichenoti*, Highland Water Skink *Eulamprus tympanum*, Blue Tongued Lizard *Tiliqua scincoides*, Tiger Snake *Notechis scutatus*, Common Scaly-foot *Pygopus lepidopodus* and Lace Monitor *Varanus varius*.

Frog species recorded include Common Eastern Froglet *Crinia signifera*, Brown Toadlet *Pseudophryne bibronii*, Lesueur's Frog *Litoria lesueuri*, Leaf Green Tree Frog *Litoria phyllochroa* and Eastern Banjo Frog *Limnodynastes dumerilii*.

Information about reptiles and frogs in Nadgee is scarce, with information limited to incidental records collected during general fauna surveys. Sampling of frog and reptile habitats is needed to assess the status of threatened or regionally significant species such as the Green and Golden Bell Frog *Litoria aurea*, Giant Burrowing Frog *Heleioporus australiacus*, Diamond Python *Morelia spilota* and Lace Monitor (see section 4.3.2).

Birds

The coastal heaths have 34 bird species of which 27 are heath residents. Heathland birds commonly occurring in Nadgee include Southern Emu-wren *Stipiturus malachurus*, Welcome Swallow *Hirundo neoxena*, New Holland Honeyeater *Phylidonyris novaehollandiae* and Tawny-crowned Honeyeater *P. melanops*. The Tawny-crowned Honeyeater and the threatened Striated Fieldwren *Calamanthus fuliginosus* and Ground Parrot *Pezoporus wallicus* are restricted to heath. Most of the heath species prefer heathland having a large proportion of shrubs and low trees. For these species fire must be sufficiently infrequent to allow seed production in the food plants. The status of bird populations within the upland heath is largely unknown due to insufficient surveys having been undertaken within this vegetation community.

Birds of the forests include Wonga Pigeon *Leucosarcia melanoleuca*, Yellow-tailed Black Cockatoo *Calyptorhynchus funereus*, Crimson Rosella *Platycercus elegans*, Fantail Cuckoo *Cacomantis pyrrophanus*, Superb Lyrebird *Menura novaehollandiae*, Grey Fantail *Rhipidura fuliginosa*, Scarlet Robin *Petroica multicolor* and Striated Thornbill *Acanthiza lineata*.

Sea birds such as Short-tailed Shearwater *Puffinus tenuirostris*, Crested Tern *Sterna bergii* and Gannet *Sula serrator* use the rock platforms and beaches.

A large number of waterbirds are found in the estuaries including Black Cormorant *Phalacrocorax carbo*, Pied Cormorant *P. varius*, White-faced Heron *Egretta novaehollandiae*, Black Swan *Cygnus atratus* and Black Duck *Anas superciliosa*.

Raptors recorded include Wedge-tailed Eagle *Aquila audax*, White-breasted Sea Eagle *Haliaeetus leucogaster*, Whistling Kite *Haliastur sphenurus* and Brown Falcon *Falco berigora*.

Threatened species

Species listed in the Threatened Species Act that have been recorded in Nadgee are listed in the table below.

Endangered Species

Common name	Scientific name
Green and Golden Bell Frog	<i>Litoria aurea</i>
Wandering Albatross	<i>Diomedea exulans</i>
Bush Stone-curlew	<i>Burhinus grallarius</i>
Hooded Plover	<i>Thinornis rubricollis</i>
Little Tern	<i>Sterna albifrons</i>
Eastern Bristlebird	<i>Dasyornis brachypterus</i>
Southern Brown Bandicoot	<i>Isodon obesulus</i>

Vulnerable Species

Common name	Scientific name
Giant Burrowing Frog	<i>Heleioporus australiacus</i>
Providence Petrel	<i>Pterodroma solandri</i>
Black Bittern	<i>Ixobrychus flavicollis</i>
Square-tailed Kite	<i>Lophoictinia isura</i>
Osprey	<i>Pandion haliaetus</i>
Sanderling	<i>Calidris alba</i>
Painted Snipe	<i>Rostratula benghalensis</i>
Sooty Oystercatcher	<i>Haematopus fuliginosus</i>
Pied Oystercatcher	<i>Haematopus longirostris</i>
Glossy Black Cockatoo	<i>Calyptorhynchus lathamii</i>
Swift Parrot	<i>Lathamus discolor</i>
Turquoise Parrot	<i>Neophema pulchella</i>
Ground Parrot	<i>Pezoporus wallicus</i>
Barking Owl	<i>Ninox connivens</i>
Powerful Owl	<i>Ninox strenua</i>
Masked Owl	<i>Tyto novaehollandiae</i>
Sooty Owl	<i>Tyto tenebricosa</i>
Striated Field Wren	<i>Calamanthus fuliginosus</i>
Pink Robin	<i>Petroica rodinogaster</i>
Olive Whistler	<i>Pachycephala olivacea</i>
Tiger Quoll	<i>Dasyurus maculatus</i>
White-footed Dunnart	<i>Sminthopsis leucopus</i>
Koala	<i>Phascolarctos cinereus</i>
Yellow-bellied Glider	<i>Petaurus cinereus</i>

Long-nosed Potoroo	<i>Potorus tridactylus</i>
Giant Pipistrelle	<i>Falsistrellus tasmaniensis</i>
Common Bent-wing Bat	<i>Miniopterus schreibersii</i>
Large-footed Mousewing Bat	<i>Myotis adversus</i>
Broad-toothed Rat *	<i>Mastacomys fuscus</i>
Eastern Cave Bat	<i>Vespadelus trougtoni</i>

* Hair Tube Record Only. Listed in NSW Wildlife Atlas Database, Southern CRA Fauna

The threatened Eastern Bristlebird, Ground Parrot and Striated Fieldwren inhabit areas of heath, sedgeland and scrub in the reserve. They can be severely affected by inappropriate fire regimes and their fire management needs are discussed in section 4.1.4.

Baker 1996,1997 has estimated the total population for the Eastern Bristlebird as less than 2000. Nadgee Nature Reserve with Croajingolong National Park supports the entire extant southern population of the Eastern Bristlebird estimated at 120 individuals. The near-coastal areas of heathland, scrubland and woodland/forest between Little Creek estuary and Cape Howe are significant breeding and foraging habitat for the Eastern Bristlebird. Conservation of Eastern Bristlebird habitat is a very important priority in the reserve because of the few locations where this species is still found. It is an endangered species in the Threatened Species Conservation Act, the southern population is a biologically relict population and the northern population is in decline, so increasing the significance of the central and southern populations (J. Baker pers comm.). A strategy for the conservation and management of Ground Parrots and Eastern Bristlebirds within Nadgee has been prepared. This report outlines a protocol for monitoring both species annually.

A small population of Little Terns is located in the reserve at Nadgee Lake. While the nesting area receives comparatively little recreational use it is probable that some disturbance of the colony does occur. Little Terns tend to leave their nests while intruders are still a long way off. Frequent and extended disturbance keeps the birds away from their eggs and young, affecting breeding success. The area is also susceptible to storm damage and predation by dingoes and foxes.

Breeding, foraging and roosting requirements of the threatened Masked Owl, Powerful Owl and Sooty Owl are centred within Nadgee around the riparian forests including rainforest, tall wet sclerophyll forest and low-open forest with a dense heath understorey (Kavanagh 1997). Patches of old growth forest distributed throughout the reserve are of particular conservation value for the provision of large breeding and roosting hollows for the owl species (Ecology Australia 1998).

Other threatened animal species occurring in the reserve which rely on maintenance of the moist and old growth forests, include the Long-nosed Potoroo, Southern Brown Bandicoot, Yellow-bellied Glider and Tiger Quoll. Other gliders, possums and many other species also depend upon these forests. Protection of the forests of the reserve from frequent fire is vital.

The reserve's sea caves are important for conservation of the Common Bent-wing Bat and the Eastern Horseshoe Bat. A population at Newtons Cave appears to have greatly declined, possibly because of visitation (Helman 1990). Merrica Beach sea cave also supports a highly sensitive and significant guano-dependent invertebrate colony. Protection of the sea caves from disturbance by visitors is vital for protection of their high conservation values (Eberhard 1997, Spate 1998). A draft action plan has been prepared for conservation of the bat populations, covering monitoring,

signage to discourage entry to the caves by visitors, route marking to protect the invertebrate population and possible gating.

Under the Threatened Species Conservation Act a recovery plan must be prepared for endangered (Schedule 1) and vulnerable (Schedule 2) flora and fauna. The purpose of a recovery plan is to promote the recovery of a threatened species, population or ecological community to a position of viability in nature. Recovery plans will be implemented in Nadgee Nature Reserve when prepared.

Estuarine and ocean intertidal areas

As stated in section 2.2.2, catchments within Nadgee have the potential to provide habitat for exclusively native fish assemblages. Survey work is needed to describe and assess fish fauna within the reserve (see section 4.3.2). Management of fish in NSW is the responsibility of NSW Fisheries but where their habitats are located in Service areas they are considered to be part of the total ecosystem.

There is no tradition of commercial fishing in the reserve and the lakes and estuaries are presently closed to commercial netting by proclamation under the *Fisheries Management Act 1994*. Some illegal netting of the estuaries may occur from time to time but is largely curtailed by the inaccessibility of the reserve.

The estuarine and shoreline habitats of the reserve would be severely affected by an oil spill reaching them from passing shipping. Strategies which should be undertaken in the event of a spill are detailed in the coastal resource atlas for the area (State Pollution Control Commission 1991). Oil spills should be dealt with as quickly as possible before reaching near shore areas. Any proposals to close the estuaries by bulldozing would be of concern because of potential disturbance to little tern and hooded plover nesting areas and to Aboriginal sites and disruption of hydrological regimes.

Introduced species

Introduced animal species occurring in the reserve are the feral cat *Felis catus*, rabbit *Oryctolagus cuniculus*, house mouse *Mus musculus*, fox *Vulpes vulpes*, feral dog *Canis familiaris*, rat *Rattus rattus*, blackbird *Turdus merula* and possibly hares *Lepus capensis* and occasional deer and pigs *Sus scrofa*. Numbers are generally low but rabbit control is needed in several locations. Control of cats has been undertaken close to Wonboyn and at the Merrica Crossing.

The status of feral animals in the southern end of the reserve is monitored by CSIRO Sustainable Ecosystems through their research project which is investigating the long term responses and interactions of ground dwelling fauna to wildfire, changes in habitat structure and predation by feral animals (Newsome and Catling 1979, Catling and Newsome 1981). The southern end of Nadgee is identified in the above project and in the Draft Fox Threat Abatement Plan as a control site where baiting does not occur. Information from the above research programs are important in implementing future species conservation programs for critical weight range mammals and in deriving best practice techniques for the control of feral predators such as dogs and foxes.

Policies

- * The diversity of habitats and native animal species occurring in the reserve will be conserved, with emphasis on maintenance of populations of rare and threatened species.

- * Visitor use of the sea caves will not be promoted and will be discouraged through interpretative signage and other methods, in order to protect their habitat values.
- * The provisions of recovery plans for threatened species will be implemented in the reserve when prepared.
- * Introduced animals will be controlled as far as is practicable, with priority to species or areas where they significantly compete with or prey on native animals or threaten the regeneration of native plant communities.
- * Pest control programs will be undertaken in cooperation with other authorities and reserve neighbours where appropriate.
- * In the event of an oil spill offshore from the reserve, the Service will liaise with relevant authorities and organisations to encourage a clean up strategy that will minimise environmental impact on the reserve.

Actions

- * Ground Parrot and Eastern Bristlebird populations will be monitored in accordance with the management strategy and draft recovery plan. Other actions outlined within the draft Recovery Plan for Ground Parrot and Eastern Bristlebirds will be implemented.
- * The Little Tern colony will be monitored in accordance with the guidelines in the Species Management Plan for the Little Tern.
- * The action plan for protecting the bat species and invertebrate community located within the sea caves will be implemented, including encouragement of research into population dynamics of the bat population, continued monitoring of bat species, investigation of the feasibility of installing a gate to the inner chamber, and route delineation / temporary fencing of sensitive areas within the cave.
- * Vertebrate pest control programs will continue to be undertaken in the northern end of the reserve and along the reserve's boundaries. Pest control programs in the southern section of Nadgee will be subject to the outcomes of the current research programs or advice from CSIRO Sustainable Ecosystems that baiting is required to maintain threatened fauna.
- * Vertebrate pest control programs will be considered adjacent to key refuge areas after a major fire event.
- * Rabbit control will be undertaken in the area behind Newtons Beach and other locations where necessary.

4.1.4 Fire Management

Fire is a natural feature of the environment in Nadgee Nature Reserve and is considered essential to the survival of some plant communities. Frequent fire, however, can cause loss of particular plant and animal species and communities. Fire can also damage some types of Aboriginal sites, historic sites and recreation facilities and threaten visitors and neighbouring land.

Management of fire in the reserve is an important and complex issue. Management must aim to achieve both long term conservation of natural communities and ongoing protection of life and property within and adjacent to the reserve.

Fire history

The pre-European fire history of the reserve is not known. From research conducted elsewhere it appears likely that the present frequency and intensity of fire differs from traditional Aboriginal burning practices.

It is possible that Aborigines burnt the heaths for ease of access as after about 10 years much of the coastal heath becomes dominated by prickly Hakea shrubs. It is thought to be less likely that the forests were deliberately burnt by Aborigines.

The heaths were regularly burnt by graziers from the 1890's until the 1960's. The fires were reported to be allowed to burn into the forests and to have created a grassy understorey in affected areas.

Several major wildfires (as well as a number of smaller fires) have occurred this century in and near the reserve. A high intensity wildfire occurred in the area of Nadgee River in the late 1920's, whilst the 1956 wildfire was quite patchy leaving many valleys untouched. A severe intensity fire burnt all but some of the gullies and about 30 ha of valley floor in 1972.

The reserve burnt again in 1980. Although not as severe or extensive as in the 1972 fire, this fire was particularly intense in the central and northern parts of the reserve and killed many mature eucalypts. These areas now contain even-aged regeneration. Fortunately large areas of mature forest in the southern part of the reserve survived.

Unplanned bushfires which affect the reserve have historically been started by a number of causes. These include lightning, arson, negligence such as escaped camp fires and escaped hazard reduction burns from different land tenures, and unknown causes.

Ecological requirements

Many of the tall open forests and rainforests were severely affected by the 1972 and 1980 fires as they were successive high intensity wildfires with a short inter-fire interval. There is a need to protect these vegetation types from further fire for a considerable period in order to ensure seed bank production and maximise animal habitat. Studies by Lunney (1987) and Lunney, Peggy and O'Connell (1991) have shown that regrowth forest is unsuitable habitat for some fauna species for at least 15 years.

Frequent fire has probably determined the structure and species composition of much of the heathland and resulted in marginal habitat for small mammals. Bryant (1990) found that frequent fires on the coastal heath of Nadgee had significant effects on the numbers of some plant species which rely on seed production to regenerate, with some species having been excluded from sites which have been burnt at intervals of 6 years or less. Low numbers of small mammals in the heathland and the absence of *Pseudomys spp.* from Nadgee may indicate too-frequent fire in the past (Catling 1986).

Maintenance of suitable habitat for the Ground Parrot, Striated Fieldwren and Eastern Bristlebird is an important consideration in fire management in the heathlands and woodlands. It was reported that the Ground Parrot had declined in abundance prior to the 1972 fire because of overgrowth of the heaths by shrubs and

trees (Recher 1981). A survey in 1979 found the ground parrot to be common on all the coastal and upland heaths and further survey in 1994 found large numbers of Ground Parrots on the coastal heaths (Baker, 1994). Research into the fire regime most suitable for Ground Parrots indicates that the parrots utilise an area 1-3 years after a fire and that numbers are high until at least 10 years after fire but may decline in some areas thereafter. Meredith found that populations in Croajingolong National Park reached a maximum at 17 years after fire but declined rapidly after that (Meredith & Isles, 1980). From research at Barren Grounds Nature Reserve, Baker and Whelan (1994) stressed that vegetation characteristics are important in determining Ground Parrot density, not fire age in itself. It is probable that the coastal heath and upland heath at Nadgee remain suitable for ground parrots for longer than 17 years after fire. The recovery of the Striated Fieldwren after fire is probably similar to the Ground Parrot, although little is known about them (Jack Baker, pers. comm.).

Eastern Bristlebird populations appear to be severely affected by fire and rely on the availability of nearby fire refuges. Recolonisation is relatively slow after fire (Baker, 1996). Populations in Nadgee are slowly recovering from near extinction in the 1972 and 1980 fires (Baker, 2000). Baker recommended that areas of bristlebird habitat be protected from fire until further information is known about the management needs of the species in the reserve (Baker, 1994ii).

Based on current knowledge there is insufficient information to indicate which fire frequencies will benefit Ground Parrot, Striated Fieldwren or Eastern Bristlebird populations. Fire management for these species must be based on monitoring of vegetation recovery since previous fires and on site specific research. This will be done in accordance with the recovery plans and reserve management plan for these species.

A variety of fire regimes is needed in order to conserve floristic diversity and provide diversity of habitat for animals. Fire management aims to maintain this diversity by restricting planned and, if possible, unplanned fires to only a part of the distribution of a vegetation type within the reserve at any one time. This approach will ultimately result in a mosaic of age classes for the vegetation types of the reserve.

The fire response of the rare and threatened plants in the reserve is not known. Many rare plants tend to be fire sensitive, however, and management will aim to ensure fire effects do not lead to reductions in populations.

Strategies and cooperative arrangements

A range of fire management strategies have been developed including fuel management, fire trails, detection and cooperative arrangements. Some, or at times all, of these are applied where appropriate to best protect life, property and natural and cultural assets within and adjacent to the reserve. The Service in conjunction with State Forests and other neighbours will maintain an Asset Protection Zone adjacent to Wonboyn Village. Within this zone fire trail maintenance works and fuel reduction programs are designed to reduce the risk of damage to life and property adjacent to the reserve from wildfire events. A fire protection plan has been prepared detailing fire management strategies and programs, cooperative arrangements and fire trail network requirements.

The Service participates in local cooperative fire management arrangements. Bega Valley Bush Fire Management Committee, which has been set up under the *Rural Fires Act 1997*, aims to coordinate and monitor fire management and fire control on a district basis. The Eastern Border Fire Operations Committee has been established to cooperatively manage cross-border fire issues with Victorian authorities.

As part of the coordinated approach to fire management the Service has cooperated with the Wonboyn Fire Protection Committee to produce a Village Fire Protection Plan for Wonboyn and surrounding lands. The Wonboyn Village Fire Protection Plan establishes a safe and effective fire response strategy, a protocol for fire threat mitigation and bushfire management zones surrounding the village. The Wonboyn Village Fire Protection Plan accompanies the Nadgee Nature Reserve draft evacuation plan which identifies suitable evacuation routes and refuge locations for day users and overnight bushwalkers in case of a threat from wild fire. Information is distributed via the overnight hikers permit system and information notice boards.

Policies

- * Fire will be managed in accordance with the Nadgee Nature Reserve Fire Management Plan, Wonboyn Lake Village Fire Protection Plan, Nadgee Nature Reserve Evacuation Plan and the principles below to ensure:
 - protection of human life and property within and adjacent to the reserve;
 - conservation of rare, threatened and biogeographically significant plant and animal species and communities;
 - maintenance of plant and animal species and communities through the provision of fire regimes compatible with their conservation;
 - maintenance of the stability of the sand dune areas and catchment values;
 - protection of wilderness qualities; and
 - protection of Aboriginal cultural values, historic places, visitor facilities and management structures.
- * Prescribed burning will be used to implement a range of fire regimes, paying particular attention to heath, shrublands and woodlands.
- * Prescribed burning may be undertaken to produce habitat suitable for species with specific requirements such as ground parrots. Prior to any such burning an assessment of vegetation characteristics and the status of key species in the area will be undertaken to determine the need for fire and its likely effects.
- * On-going review will be undertaken of the impact of prescribed burning on vegetation. Programs will be modified where necessary to minimise adverse impacts.
- * The use of heavy machinery for fire suppression will where possible avoid rare plants, Aboriginal sites and historic places, swamps, sand dunes and heathland.
- * Areas disturbed by fire suppression operations will be rehabilitated as soon as practical after the fire.
- * Records and maps will be maintained of all fires as they occur.

- * Fire management will be carried out in cooperation with neighbours for mutual protection as per the Nadgee Nature Reserve Fire Plan and the Wonboyn Village Fire Protection Plan.
- * Land use planning and development authorities and private developers will be encouraged to incorporate boundary fire breaks and other fuel reduction measures in any development adjacent or in proximity to the reserve.
- * The reserve may be closed to public use during periods of acute fire danger.

Actions

- * A Fire Management Plan for the reserve will be prepared by 2003.
- * Fuel management programs will be prepared detailing fuel reduction burns and trail maintenance requirements in accordance with the policies outlined above and the Fire Management Plan.
- * The Bush Fire Emergency Procedures brochure will be distributed with all overnight permits.
- * The Asset Protection Zone adjacent to Wonboyn Village will be maintained.
- * Research into the ecological effects of fire in the reserve, particularly the fire response of rare and threatened plant species and the requirements of the Eastern Bristlebird, Ground Parrot and Striated Fieldwren, critical weight range species such as bandicoots, potoroos and feral animal dynamics, will be supported.
- * Close contact and cooperation will be maintained with volunteer bush fire brigades, Fire Control Officers, State Forests of NSW and Victorian Fire Management Authorities. The Service will continue to actively participate in the Bega Valley Bush Fire Management Committee, Eastern Border Fire Operations Committee and the Wonboyn Fire Protection Committee.

4.2 CULTURAL HERITAGE

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

4.2.1 Aboriginal Culture

The area of the reserve is part of the lands of the Bidawal people and shared with the Dtharwa and Manaroo people. Other groups also have associations with the area. The presence of shelter, water, food resources and fine-grained stone has supported Aboriginal occupation of the area of the reserve, as evidenced by the large number of Aboriginal sites in the area. Today Nadgee is in the area of the Eden Local Aboriginal Land Council.

Despite the decimation of the population following British colonisation, these extended families have survived and retained their identity. The transfer of traditional knowledge continues amongst contemporary Aboriginal people, and there is considerable interest in retaining links with country and culture. It is recognised that Aboriginal people have a strong attachment through spiritual and cultural links with the whole landscape, and specific locations within the reserve. These locations may include archaeological sites, spiritual sites, ceremonial sites, hunting and

gathering and contact sites. Some of these sites may not contain any physical evidence of past use or occupation.

There has been no systematic survey of Nadgee's archaeological resources but more than 20 sites have been recorded. Most of the known sites are along the coast and are mainly open shell middens, shelters with middens and open campsites, mostly associated with rock platforms. There are also two known burials, shelters containing art and an axe grinding groove site. It is highly likely that other sites occur, particularly along the water courses and ridge crests.

Material located in the middens includes rock platform and estuarine shell species, bones of small mammals, macropods, seals, whales, birds and fish, stone artefacts and hearths (Lourandos, 1974).

Midden deposits in shelters near Wonboyn have been excavated by Colley (Colley, 1990). It was found that the deposit in one of the shelters was very deep and had been built up over an unusually short time period.

The known Aboriginal sites are clustered at estuaries and beaches and are therefore vulnerable to disturbance by visitors. Pedestrian access control works have been undertaken at Bay Cliff to protect middens located along the Wonboyn Lake foreshore and beach, and a section of the Baycliff road has been realigned away from the lake foreshore

While the Service presently has legal responsibility for the protection of Aboriginal sites it acknowledges the right of Aboriginal people to make decisions about their own heritage. It is therefore policy that Aboriginal communities be consulted about decisions regarding the management of Aboriginal sites and related issues and how the Aboriginal culture and history of an area controlled by the Service will be promoted and presented.

During negotiations over the Eden Regional Forest Agreement the Service agreed to establish cooperative management arrangements for national park areas and other areas identified as significant to the Aboriginal communities. As part of this process the Service has agreed to allow vehicle access, for the short term, by Aboriginal people to Newton's Beach to facilitate cultural activities. The Service seeks a long term outcome in Nadgee Nature Reserve of agreed use by Aboriginal people for traditional purposes consistent with protection of the area's wilderness values and maintenance of its wilderness qualities.

Policies

- * Aboriginal cultural sites will be protected as far as possible from deterioration and disturbance.
- * Relevant Aboriginal community organisations and individuals will be consulted and actively involved in all aspects of management of Aboriginal sites and values in the reserve.
- * Co-management opportunities for all or part of the reserve will be explored with relevant Aboriginal Groups.
- * The Service will support relevant Aboriginal community groups in the preservation, continuance and promotion of their cultural lore. Aboriginal people will be able to carry out activities in the reserve related to maintenance of Aboriginal culture. Any such activities must comply with the objectives and policies of this plan of management and have minimal environmental impact.

- * Maintenance and development work will have regard for potential impacts on Aboriginal heritage values. All work involving ground disturbance will be preceded by an assessment of cultural heritage values.
- * Where Aboriginal heritage values are identified close to recreation facilities or walking routes they will be protected if necessary by appropriate measures such as placement of barriers or re-direction of walkers.
- * The location of Aboriginal heritage sites will not be publicised except where:
 - the Aboriginal community agree; and
 - a conservation study has been prepared and any management works necessary to protect the site from damage have been implemented.
- * With the agreement of the Aboriginal community certain sites may be interpreted to promote public knowledge and appreciation of Aboriginal culture.
- * Research into past Aboriginal use of the area and the distribution of Aboriginal sites will be encouraged.

Actions

- * Protection works will be undertaken where necessary for sites subject to disturbance by visitors.
- * The Service will work towards resolving the requirements of the Aboriginal community for access to Nadgee Nature Reserve in order to facilitate traditional activities and ensure use is consistent with wilderness management principles.

4.2.2 Historic Places

Captain Cook named Cape Howe on his trip north along the coast in 1770.

The Eden area was first settled by Europeans in the 1830's. The main land uses were cattle grazing, timber getting, fishing, whaling and provision of port facilities for the Monaro area.

The Nadgee area was used at least from the 1860's for stock agistment and as a stock route to Mallacoota. Two graziers, Will Palmer and Wally Newton, moved to Nadgee following the 1890's bank crash, living at Nadgee Flat and Newtons Flat. They used the area, mainly the heaths, for rough grazing.

In 1916 Palmer's son Jim constructed a road across the Merrica River to Nadgee Flat and began to clear and build up a farm. By 1933 the farm at Nadgee Flat comprised a homestead, about 60 ha of improved pasture, an orchard and 20 ha of cultivation, mainly beans and maize. In 1933 Nadgee Flat was severely flooded, causing heavy damage and stock losses. The Palmers worked Nadgee until their lease was terminated shortly before creation of the reserve. The Nadgee Flat homestead progressively deteriorated and was later removed. A number of garden plants remain around the site but the area has substantially regenerated to native vegetation.

The house at Newtons Flat was destroyed by a bush fire in 1933 and there are few remains. Much of the clearing at Newtons Flat was until recently maintained for camping but will now be allowed to regenerate.

Other families ran cattle on the heathlands from time to time and one attempted to grow wheat on Black Head.

During World War I a group of men was stationed on Black Head to collect grass tree (*Xanthorrhoea*) gum. Nadgee Bay was reputedly used by a German raider as a base to lay mine fields across the Gabo Island/Green Cape shipping lane.

Troops were stationed in a watch tower on Impressa Moor during the Second World War. It is reported also that a Light Horse contingent was stationed near Greenglade on coast-watching duty.

In the 1950's the nature conservation value of the Nadgee area was realised, leading to its dedication as a faunal reserve in 1957.

Many shipwrecks have occurred along the Nadgee coastline including one just offshore at Jane Spiers Beach (the *Jane Spiers* in 1878) and another near the Bunyip Hole (the trawler *Dinjerra* in 1981). Disaster Bay at the northern end of the reserve took its name from shipwrecks in the area.

The only standing structure of historic interest in the reserve is Harry's Hut. The hut is reported to have originally been the buggy shed adjacent to the Palmers homestead, and to have been rebuilt by fisherman Harry Redman after whom it is named. The hut was later extended by Service staff and in recent times has been used for accommodation of researchers. It is of corrugated iron and is in an unstable condition. Huts located on Service land are considered to be an interesting and valuable part of the cultural heritage. Assessment of the significance of Harry's Hut and preparation of a management strategy are needed.

Other features include the route of a telegraph line which ran from Eden to Gabo Island Lighthouse, the concrete floor of a former fisherman's hut at Bay Cliff and footings of a building and remains of a windlass at Greenglade (a 1950s fisherman's retreat). A concrete marker at Conference Point at the eastern end of the state border was erected in the 1870s, replacing the original cairn.

Following dedication of the original fauna reserve (see section 2.2.1) a hut for staff and study group accommodation was constructed at Merrica River crossing in 1962. This was followed by a staff house and workshop in 1967 and a suspension bridge in 1968. A stock pound was erected at Nadgee Lake. It is now proposed to remove the stock pound erected at Nadgee Lake to enhance the wilderness value of the reserve (see section 4.3.3). Assessment of their heritage significance will be undertaken prior to any work being undertaken.

With the possible exception of Harry's Hut, none of the structures or remains within the reserve are thought to be of high historical significance or value for interpretation, although assessment is needed to confirm this. The historic features are, however, of local interest and are useful for understanding the history of use of the reserve area.

There has been a long standing social, economic and cultural connection by the Wonboyn community with the Nadgee area since the early 1900's. The local community still maintains this strong attachment to the Reserve, particularly the northern end which they use on a daily basis for recreation.

Policies

- * The historic places of the reserve will be conserved in accordance with the Burra Charter of Australia ICOMOS.
- * Clearings will be allowed to revegetate except where they are maintained for management or recreational purposes.
- * Harry's Hut will be maintained to a basic standard pending preparation of a conservation plan.
- * Other historic features (apart from clearings) will not be maintained but will be retained and protected from disturbance.
- * All work involving ground disturbance within the reserve will be preceded by a check for historic places.

Actions

- * Historic places will be progressively recorded and assessed.
- * A conservation plan will be prepared and implemented for Harry's Hut.

4.3 USE OF THE AREA

It is an important aspect of the management of Nadgee Nature Reserve to ensure that its use - whether by the Aboriginal community, general public, special interest groups, researchers, Service managers or other authorities - conforms with the management objectives and management strategy for the reserve (see section 3).

The major categories of use that can be appropriate, to varying degrees, on Service areas are:

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

The extent to which these categories of use will be provided for in Nadgee Nature Reserve is outlined below:

4.3.1 Public Use

It is estimated that up to 20,000 people per year currently visit Nadgee Nature Reserve by land. Visitor numbers are an underestimation as they do not consider the many visitors accessing Nadgee Nature Reserve by boat. Most are day visitors during the summer and Easter school holidays from nearby towns and the village of Wonboyn. During the holiday period the population of Wonboyn increases fivefold (K. Henry Pers comm 2001).

Planning and management of visitor use is undertaken in a regional context. Adjacent Ben Boyd and Croajingalong National Parks provide coastal picnicking, camping and walking facilities and further visitor opportunities are available in Bournda National Park and South East Forests National Park. Nearby towns also provide a variety of visitor facilities including accommodation.

As a nature reserve with special scientific and wilderness values, the management emphasis in Nadgee is directed towards maintaining its integrity as a natural area. Limited recreational opportunities are provided and recreation is subordinate to other roles.

The main access to the reserve is from the Princes Highway via the village of Wonboyn. Access may also be gained along Old Bridge Road and Newtons Road (see map, centre pages) and from roads in Nadgee State Forest.

Public Vehicular Access

Public vehicular access (2WD standard) is provided from Wonboyn Village to Wonboyn Beach via Bay Cliff and Greenglade Road and to Wonboyn Lake via Bay Cliff Road. 2WD access is also available via Lookout Fire Trail and Newtons Road to Merrica Crossing, Mountain Road on the north-western boundary of the reserve and Mines Road on the south-western boundary (refer map, centre pages).

Day use areas

Day use facilities are provided at the northern end of the reserve at Wonboyn Beach and Wonboyn Lake as set out below:

- Bay Cliff - carpark, pit toilet, pedestrian access to lake and beach;
- centre of beach - carpark and pedestrian access to beach;
- Greenglade - carpark, picnic area and toilet with disabled access, pedestrian access to beach.

Wood fires are not permitted in the Wonboyn Beach area to avoid damage caused by wood collection.

A small day use area, Mallacoota Lookout, is also provided in the southwestern corner of the reserve. This site provides extensive views to the coast and into Victoria. It has a car park, picnic area and viewing area. Limited on-going removal of tree regrowth will be undertaken to retain a view.

Vehicles have been using a fire trail just inside the reserve boundary near Wonboyn (Evan's Boundary Fire Trail) to gain access to the Wonboyn Lake foreshore, resulting in degradation of the foreshore wetlands. This road has been gated to prevent further public vehicular use. As a result of a successful grant from Coastcare to Wonboyn Lake Ratepayers Association a cooperative program will be implemented by Wonboyn Village community and the Service to construct a boardwalk across the wetland thereby providing pedestrian access to the lake and to rehabilitate damaged sections along the foreshore.

Day walks

The reserve provides opportunities for both short walks along formed tracks and extended wilderness walks. The latter are discussed in the next sub-section. Day or shorter walks in the northern part of the reserve are:

- a short walk to the northern end of Bay Cliff along the Wonboyn Lake shore;
- walking access to the central part of Wonboyn Beach from Baycliff Road;
- a walk to the mouth of the Merrica River along a walking track from the Merrica River crossing and thence the Merrica Entrance Fire Trail; and
- access to the top of Tumbledown Mountain where views of most of the reserve may be obtained, via Newton's Road and Table Ridge fire trail;

The latter two walks lie partly in the wilderness area. These walking opportunities are complemented by extensive walking track systems in nearby national parks, including those in Victoria.

Use of the wilderness area

Walks of several days duration can be undertaken in the Nadgee wilderness and walking along the Nadgee coastline through to Croajingalong National Park (or vice versa) is widely recognised as an outstanding coastal wilderness walk. Ben Boyd National Park can also be included in extended walks. The main entrance to the Nadgee wilderness is from the Merrica River crossing, where there is a carpark, toilet, water and trackhead information.

A joint approach to management of walking has been negotiated with Parks Victoria. A joint permit system and restrictions on group size, total number of walkers and length of stay have been introduced to enable walking in both reserves to be managed at levels which will minimise environmental impacts and retain opportunities for solitude.

Only a small number of locations along the reserve's coastline are suitable for camping because of the limited availability of drinking water and the environmental sensitivity of many areas. These locations are the Merrica River entrance, Little Creek estuary, northern and southern end of Nadgee Beach, Nadgee Flat, northern side of Nadgee Lake, Bunyip Hole near Cape Howe and the southern end of Cape Howe Beach. Monitoring of campsite usage has been established at key locations throughout the reserve and Cape Howe wilderness area within Croajingalong National Park. Information collected includes changes to vegetation structure, ground cover, evidence of social tracks, firewood availability, evidence of human waste and litter, tree damage and campsite formalisation. Strategic water sampling at key locations will be undertaken during selected peak times. This information will help assess and determine what strategies are necessary to minimise camping impacts and protect environmental values of the area. Strategies may include the production of additional interpretative material, low impact toilets and modification to the permit system. Track maintenance and stabilisation works and limited track identification may also be necessary.

In certain sensitive locations the exclusion of open camp fires would reduce the risk to significant habitat, and threatened species. Campfires will not be permitted in the Cape Howe, Bunyip Hole and Nadgee River areas.

There is currently no formal route for long distance walkers entering Nadgee from Ben Boyd National Park or wishing to walk north through Nadgee to Ben Boyd. There are significant environmental constraints in pursuing a coastal route via the Merrica River Entrance. The Service will investigate an alternative route inland. If a viable route which is environmentally acceptable is located then this link will be established.

Horse riding, cycling and orienteering

In accordance with the over-riding purpose of protection of natural values in a nature reserve, activities such as horse riding, cycling and orienteering will not be permitted apart from cycling on the roads to Bay Cliff and Greenglade. Each of these activities can cause unacceptable environmental impacts and conflict with wilderness values.

Waterborne Visitors

An increasing number of visitors access the reserve from the sea by boat and sea kayaks. These visitors land along the Nadgee coastline at sheltered locations and camp overnight or sometimes for extended periods. Permits will be required by all waterborne visitors if they wish to camp overnight, in the same manner as for walkers.

Information, interpretation and education

Provision of information about the values of the reserve, its recreation opportunities, and methods to minimise impacts on the reserve including the promotion of minimal impact camping and walking practices, is an important part of management. Its purpose is to enhance the enjoyment and safety of visitors, encourage appropriate visitor behaviour, foster environmental awareness in the community and gain the support and co-operation of neighbours.

Information shelters are located in the Wonboyn village area, Baycliff and Greenglade carparks and at the Merrica River trackhead. Interpretive information will also be provided at the Mallacoota Lookout picnic area and Mallacoota Inlet.

A number of educational programs occur within the reserve including overnight bushwalking/camping activities and students participating in research programs. Field programs are being developed for students to participate in a variety of research and management activities. The remote setting of the reserve provides additional educational opportunities for promoting minimal impact camping/bushwalking techniques, team building and bush safety skills.

Policies

- * The Bay Cliff and Greenglade areas will be managed for low key day use with car parking, pit toilets and beach access at both areas and basic picnicking facilities at Greenglade. No wood fires will be permitted at these locations.
- * The Mallacoota Lookout and picnic area will be maintained. Limited removal of tree regrowth will be undertaken as needed to retain a view.
- * A trackhead facility will be maintained at the Merrica Crossing for day and overnight bushwalkers. Facilities will consist of a parking area, toilet, drinking water supply and information.
- * Public vehicle access will be permitted only on the public access roads shown on the map (centre pages). These roads will be maintained to basic 2WD standard.
- * A permit will be required for overnight bushwalking and the following will apply:
 - walk-in camping will be permitted more than 1km from roads but not in the vicinity of the Nadgee Lake Bar;
 - no more than 2 nights to be spent at each camp site;

- no open camp fires in designated areas;
 - a maximum group size of 8 and maximum total of 20 overnight bushwalkers in the reserve; and
 - other requirements established in consultation with the management authority of Croajingolong National Park.
- * A permit will be required for waterborne visitors wishing to stay overnight within the reserve. Waterborne visitors will be included within the limit of 20 campers at any one time.
- * Understanding and appreciation of the natural and cultural values of the reserve by visitors and the local community will be promoted. The following themes will be emphasised:
- the importance of the reserve for conservation of a large number of rare, threatened and biogeographically significant plant and animal species;
 - the high value of the reserve as a scientific reference area and for scientific research;
 - the special status of the reserve as the only coastal wilderness area declared to date in NSW;
 - the geomorphological and scientific value of the Wonboyn dunes;
 - the ecological and scientific value of the estuaries;
 - Aboriginal heritage and cultural values of the area and the variety and value of Aboriginal sites; and
 - the importance of responsible public use in maintenance of the natural and cultural heritage.
- * Information will be provided about the values of the reserve and about recreational and educational opportunities by means such as signs, leaflets, media releases and staff contact with user groups. All information provided will be consistent with the Regional Interpretive Strategy.
- * Minimal impact bushwalking and camping practices will be encouraged, including use of fuel stoves.
- * The reserve may be closed to public use during periods of wet weather, extreme fire danger or when necessary for scientific research purposes or management programs.
- * Horse riding, orienteering and other activities which may have an adverse effect on the environment will not be permitted in the reserve.
- * Bicycle riding will be permitted only on the public access roads.
- * Visitors will be required to remove their own rubbish.
- * Practices to minimise the introduction of pathogens and weeds will be promoted.

- * Educational activities which are compatible with wilderness and reserve objectives will be encouraged.

Actions

- * A boardwalk will be constructed along part of Evans Boundary Fire Trail to the Wonboyn Lake foreshore. Damage to the wetland will be rehabilitated.
- * The impact of overnight bushwalking will be monitored and actions to minimise impacts such as restriction of camping or provision of low impact pit toilets will be implemented if proven necessary. No facilities other than toilets will be built.
- * Walking track markers will be located where essential.
- * A permit system will be established for waterborne visitors wishing to stay overnight within the reserve.
- * Interpretive information will be provided at the Mallacoota Lookout picnic area.
- * Interpretive information will be provided at Mallacoota Inlet in Victoria, in association with Parks Victoria.
- * The Service will actively assist and participate in educational programs that operate within the reserve.
- * An alternative inland route linking Nadgee Nature Reserve with Ben Boyd National Park will be investigated.

4.3.2 ESFM, Monitoring and Research

Nadgee Nature Reserve will be managed within a bioregional landscape framework, in accordance with the principles of ecological sustainability developed for the Eden Regional Forest Agreement. Under the Regional Forest Agreement (RFA) all forest managers including State Forests of NSW, Dept Land & Water Conservation and the Service must demonstrate ecologically sustainable forest management (ESFM). ESFM aims to maintain or increase the full suite of forest values for present and future generations across the NSW native forest estate, including:

- ecosystem biodiversity, health, vitality, productive capacity and functional processes;
- soil and water productive capacity and functional processes;
- global geochemical cycles;
- long term social and economic benefit; and
- natural and cultural heritage values.

ESFM is an over-riding management principle but will be implemented primarily through research and monitoring to provide feedback on management programs. Performance indicators of ecologically sustainable forest management are identified in the ESFM report. Monitoring programs developed in association with the indicators will be used to demonstrate the impact of management actions on the ecological functions within forests and to test the adequacy of management. Remedial management actions will then be undertaken as required.

Monitoring of threatened species will also be an important part of implementing recovery plans prepared under the Threatened Species Conservation Act.

Monitoring is particularly important for critical weight mammals and other species that act as indicators to habitat change.

Research projects undertaken in the reserve have included small mammal ecology, the effects of fire on animal populations, bird survey, river turbidity, the behaviour of dingoes, fruit fly mobility and the movement of pollutants through an estuary. Much of the research work that has been undertaken in Nadgee provides insights into the factors affecting the dynamics of natural ecosystems throughout eastern and southern Australia.

One study undertaken by CSIRO Sustainable Ecosystems commenced in 1972 and is ongoing. It has documented the changes in abundance of twenty-one fauna species at 122 study sites throughout Nadgee, with concurrent information recorded on changes in vegetation structure. This research is the longest running study of post-disturbance abundance of mammals in Australia (Ecology Australia 1998). Other significant long term studies which are still ongoing include long term monitoring of heathland bird communities by Harry Recher, and long term study of the impact of fire, drought and flood on forest-dependent mammals by NPWS (Daniel Lunney).

Research will be managed to ensure that environmental impact and conflicts with other values including wilderness values are minimised and that research provides information leading to improved management of the reserve or similar natural systems. A system of registration of research visits has been introduced combined with a requirement for permission to undertake particular research activities.

Research priorities identified under the RFA will be pursued by the Service along with topics identified in this plan of management. It may be feasible to arrange for CSIRO or other organisations to undertake some of the necessary research and monitoring as part of other research programs or student projects.

Policies

- * The principles of Ecologically Sustainable Forest Management will guide management operations in the reserve, and monitoring and research will be carried out in accordance with ESFM requirements.
- * The reserve will continue to be made available for approved research by other organisations and individuals.
- * Research programs will be subject to environmental assessment.
- * Harry's Hut will be available for temporary accommodation of researchers, if it can be demonstrated that its use is essential.
- * Researchers will be required to confine vehicle use to designated management tracks and the Coast Track as set out in section 4.3.3. Use of the tracks will only be permitted if it can be demonstrated that their use is central to the project.
- * No long term research structures or markers may be erected in the reserve unless they are lower than surrounding vegetation and of minimal visibility.
- * New research programs will be encouraged if they provide information which will be of direct benefit to management.

- * Close liaison will be maintained with researchers to obtain as much mutual information and assistance as possible. The results of research will be required to be provided to the reserve managers.

Actions

- * Survey monitoring work necessary to improve the accuracy with which NPWS reports on ESFM criteria and indicators under the Eden RFA will be undertaken in the reserve.
- * The Service will actively encourage other organisations to carry out research in identified priority areas, particularly herpetofauna survey and survey to comprehensively describe the fish fauna.
- * Research registration and licensing arrangements within the reserve will be actively maintained.
- * Improvements to the current research registration arrangements will be developed to more accurately capture research site location and disseminate information to researchers operating within the reserve.
- * Existing research markers located in the reserve will be required to be removed if no longer needed, or replaced with new markers of minimal visibility.

4.3.3 Management Operations

A staff residence, workshop, a hut for accommodation of researchers and visiting staff (Merrica Hut), a suspension bridge and track head facilities are located at the Merrica River crossing. The ranger station (comprising the staff accommodation and workshop) will remain while the Service carries out a detailed evaluation of the management value, community value and cost effectiveness of the ranger station with regard to fire management, security of reserve, emergency response, education and wider management activities. A decision will be made on the ranger station's long term future following this investigation. The suspension bridge, Merrica research hut and track head facilities will be retained and ongoing maintenance will be carried out. The bridge will be subject to regular engineering assessment. In the event of significant safety concerns the bridge may be removed.

Harry's Hut, which is regularly used for accommodation of researchers as well as occasionally by management staff, is located in the south of the reserve near Nadgee Beach. Harry's Hut is useful for storage of research equipment, accommodation for researchers thus saving time and costs, and is an asset for long term research. While the hut will be maintained for its cultural value, it will not be replaced in the event of being destroyed by fire.

A stock pound erected at Nadgee Lake following establishment of the reserve is no longer needed and will be removed.

A quarry is located on Mines Road within 1997 additions to the southern end of the reserve. The quarry will be used as a source of road material for NPWS operations, but in the medium term alternative sources of such materials will be sought, and the existing quarry will then be stabilised and rehabilitated.

Vehicle tracks in the reserve have been classified according to their management status, type of vehicle usage permitted and maintenance schedule. This ensures a consistent approach to use and maintenance of the trails, and that wilderness

management obligations are fulfilled. Tracks to be maintained are shown on the map (centre pages). A number of others have been classified as negotiable routes. These will not be maintained but may be re-opened during emergencies such as fire suppression operations. Several tracks resulting from former logging activities are located within the recent wilderness area additions. Those not considered essential for management purposes will be closed and allowed to revegetate.

Vehicle use within wilderness is limited to necessary management operations where there will be no significant long-term impacts and it is the only feasible option available.

A number of existing long term monitoring research studies which are recognised as an essential management activity are reliant on vehicle access to undertake their research. Negotiated access between Little River and Nadgee Lake will be allowed to continue with the view of keeping vehicle access to the minimum and as far as practical off the heath areas. New research proposals will only be permitted vehicle access through the coastal heath in exceptional circumstances. Only minimal maintenance will be undertaken to the track.

Newton's Road south of Table Ridge Fire Trail will be rehabilitated to a condition similar to the Coast Track when negotiations with the Aboriginal community lead to termination of vehicle access to Newtons Beach (see section 4.2.1).

In order to prevent introduction of weeds, vehicles will be required to be washed before entering the wilderness area.

Rubbish is disposed of outside the reserve.

Trigonometrical stations are located at Mount Nadgee and Wonboyn. Access is permitted via management tracks and by foot.

As stated in section 4.1.4 and 4.3.1 cooperative cross border management arrangements are in place with Parks Victoria regarding fire management, monitoring of threatened species such as the Eastern Bristlebird and Ground Parrot and wilderness walking. Other cooperative arrangements will be negotiated as appropriate.

Methodist Ladies College Marshmead in Victoria is accessed through the reserve via Mines Road. Development of a maintenance agreement is needed for the road.

Shared access roads are located along the boundary of Nadgee Nature Reserve and the State Forests of NSW. Co-operative maintenance agreements for Mountain Road, Merrica River Road, Storkys Fire Trail and Lookout Fire Trail will be entered into with State Forests of NSW.

Policies

- * Existing management structures will be maintained.
- * Management tracks shown on the map (centre pages) will be maintained in a stable and trafficable condition.
- * Retained management tracks within the wilderness area will be used only for essential management and approved research purposes.
- * Sections of the Coast Track will be maintained to a standard necessary to enable access for long term research purposes and prevent erosion. Vehicle

access along the Coast Track will be kept to a minimum and as far as practical avoid the heath areas.

- * Tracks classified as negotiable routes will not be maintained but may be re-opened during emergencies.
- * Use of management tracks by any vehicle will not be permitted during wet periods except in agreed emergency situations.
- * All vehicles will be required to be hosed down prior to entering the wilderness area, except in an emergency such as search and rescue or wildfire.
- * On-going negotiation will be undertaken with Parks Victoria regarding compatible management policies and cooperative programs for fire management, wilderness walking, information provision, threatened species management and other issues.

Actions

- * Detailed investigation will be undertaken of the management value, social value and cost effectiveness of the ranger station.
- * Regular routine maintenance of the suspension bridge, staff accommodation, research hut will occur.
- * The suspension bridge will be subject to periodic engineering assessment.
- * Periodic maintenance checks will occur to Harry's Hut and the associated pit toilet.
- * The stock pound at Nadgee Lake will be removed.
- * The quarry on Mines Road will be stabilised and rehabilitated when alternative sources of materials for road maintenance are identified.
- * Drainage and erosion control work will be undertaken where necessary on the management tracks.
- * Newton's Road south of Table Ridge Fire Trail will be rehabilitated to a walking track/negotiable route.
- * Former logging tracks within the wilderness area which are not considered essential for management purposes will be closed and rehabilitated.
- * Maintenance agreements will be negotiated for shared access roads with State Forests and MLC (Marshmead).

5. PLAN IMPLEMENTATION

This plan of management is part of a system of management developed by the National Parks and Wildlife Service. The system includes the *National Parks and Wildlife Act 1974*, *Wilderness Act 1987*, management policies, established conservation and recreation philosophies, and strategic planning at corporate, Directorate and Regional levels.

The implementation of this plan will be undertaken within the annual programs of the Service's Far South Coast Region. Priorities, determined in the context of regional strategic planning, will be subject to the availability of necessary staff and funds and to any special requirements of the Director General or Minister.

Regional programs are subject to ongoing review within which works and other activities carried out at Nadgee Nature Reserve are evaluated in relation to the objectives laid out in this plan.

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

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

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

High priority	Plan ref
* Control erosion on walking tracks/routes and management tracks	4.1.1, 4.3.3
* Undertake monitoring and removal of exotic species within the Beach Strand Community	4.1.2
* Remove introduced plants from Nadgee Flat	4.1.2
* Treat other weeds in accordance with the Weed Management Plan. Update the Weed Management Plan as necessary	4.1.2
* Implement actions identified in the Eastern Bristlebird and Ground Parrot Recovery Plan and management strategy	4.1.3
* Implement action plan for the sea cave bat population and invertebrate community	4.1.3
* Prepare reserve fire management plan	4.1.4
* Prepare and undertake fuel management programs	4.1.4
* Distribute Bush Fire Emergency Procedures Brochure with overnight permits	4.1.4
* Maintain Asset Protection Zone adjacent to Wonboyn Village	4.1.4

- * Actively participate in various fire committees and maintain contact and cooperation with fire suppression forces 4.1.4
- * Resolve access requirements to Newtons Beach by the Aboriginal Community 4.2.1
- * Construct boardwalk to Wonboyn Lake foreshore and rehabilitate damaged sections of wetland 4.3.1
- * Undertake monitoring programs developed under ESFM 4.3.2
- * Evaluate management value, social value and cost effectiveness of the staff house and workshop 4.3.3
- * Ensure periodic engineering assessment of suspension bridge occurs 4.3.3
- * Rehabilitate Newtons road to negotiable route standard when no longer needed for Aboriginal community access 4.3.3
- * Close/rehabilitate roads within wilderness not essential for management 4.3.3

Medium priority

- * Undertake survey to validate and review extent and condition of rare and threatened plant communities and populations. 4.1.2
- * Consider strategies for maintaining the integrity of sensitive vegetation communities and include in fire management plan 4.1.2
- * Implement works identified in the Weed Management Plan 4.1.2
- * Monitor saltmarsh against threats such as invasive weed species 4.1.2
- * Monitor little terns 4.1.3
- * Implement pest control programs in the northern end of the reserve and along the reserve's boundaries 4.1.3
- * Consider vertebrate pest control programs adjacent to key refuge areas after a major fire event 4.1.3
- * Control rabbits 4.1.3
- * Support research into ecological effects of fire on threatened species 4.1.4
- * Undertake protection works as required on Aboriginal sites subject to disturbance 4.2.1
- * Monitor overnight bushwalking impacts 4.3.1
- * Install walking track markers where essential 4.3.1
- * Provide interpretative sign at Mallacoota Inlet 4.3.1
- * Establish a permit system for overnight waterborne visitors 4.3.1

- * Assist and participate in educational programs within the reserve 4.3.1
- * Investigate an alternative inland walking route between Nadgee Nature Reserve and Ben Boyd National Park 4.3.1
- * Actively maintain research registration and licence conditions 4.3.2
- * Improve current research registration arrangements 4.3.2
- * Identify research priorities for the reserve and encourage organisations to carry out research in these areas 4.3.2
- * Undertake regular routine maintenance of the suspension bridge, staff accommodation and research hut 4.3.3
- * Undertake periodic maintenance checks of Harry's Hut and associated toilet 4.3.3
- * Stabilise and rehabilitate quarry on Mines Road 4.3.3

Low priority

- * Review pest control in the southern section of the reserve 4.1.3
- * Record and assess historic places 4.2.2
- * Prepare and implement conservation plan for Harry's Hut 4.2.2
- * Provide interpretive information at Mallacoota Lookout 4.3.1
- * Require removal or replacement of research markers 4.3.2
- * Remove stock pound at Nadgee Lake 4.3.3
- * Negotiate road maintenance arrangements with State Forests and MLC 4.3.3

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