THE CASTLES NATURE RESERVE

PLAN OF MANAGEMENT

NSW National Parks and Wildlife Service

February 2004

This plan of management was adopted by the Minister for the Environment on 5 February 2004.

Acknowledgments
This plan of management was prepared by NPWS Macleay Area staff, NPWS Mid-North Coast Regional staff and the NPWS Northern Directorate Planning Group.

Further information
The process leading to the development of this plan has involved the collection and use 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 any aspect of the plan, contact the NPWS Mid North Coast Regional Office at 152 Horton Street, Port Macquarie or by phone on (02) 6586-8300.

NSW National Parks and Wildlife Service

ISBN 0 7313 6606 9

FOREWORD

The Castles Nature Reserve is located on the Mid North Coast of NSW in the upper Macleay River catchment, 50 km north west of Kempsey.

The Castles Nature Reserve contains a limestone karst system with at least one cave that is used by bats for hibernation, as well as a cave dwelling spider unique to the area. There are extensive areas of shatterwood rainforest as well as other rainforest associations. Due to the natural values of the reserve, most of the reserve has been listed as part of the Central Eastern Rainforest Reserves of Australia (CERRA) World Heritage Area.

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

A draft plan of management for The Castles Nature Reserve was placed on public exhibition for three months from 13th December 2002 until 28th March 2003. The exhibition of the plan of management attracted 6 submissions which raised 7 issues. All submissions received were carefully considered before adopting this plan of management.

This plan of management aims to preserve the karst features, the cave habitat used by bats and the dry rainforests of the reserve. In addition, it aims to protect, conserve and present the natural values of the reserve in accordance with the World Heritage Convention.

This plan of management establishes the scheme of operations for The Castles Nature Reserve. In accordance with section 76 of the *National Parks and Wildlife Act 1974*, this plan of management is hereby adopted.

BOB DEBUS
MINISTER FOR THE ENVIRONMENT

1. NATURE RESERVES IN NEW SOUTH WALES

1.1 LEGISLATIVE AND POLICY FRAMEWORK

The management of nature reserves in NSW is in the context of a legislative and policy framework, primarily the *National Parks and Wildlife Act 1974* (NPW Act), the NPW Regulation, the *Threatened Species Conservation Act 1995* (TSC Act) and the policies of the National Parks and Wildlife Service (NPWS). Section 72AA of the NPW Act lists the matters to be considered in the preparation of a plan of management. The policies arise from the legislative background and internationally accepted principles of park management. They relate to nature conservation, Aboriginal and historic heritage conservation, recreation, commercial use, research and communication. Other legislation, international agreements and charters may also apply to management of the area. In particular, the *Environmental Planning and Assessment Act 1979* (EPA Act) requires the assessment and mitigation of environmental impacts of any works proposed in this plan.

The Castles Nature Reserve includes one Ministerial road, Carrai Road, which is vested in the Minister for the Environment on behalf of the Crown for the purposes of Part 11 of the NPW Act. These roads are not dedicated as part of the nature reserves. They were created by section 7 of the *Forestry and National Parks Estate Act 1998* to ensure that the access arrangements that existed immediately before a reserve's creation (primarily for timber hauling and private property access) could continue, even if they were for purposes that did not meet the objectives of the NPW Act. The management of these roads is subject to the *NPW Regulations 2002*, and the requirements of the EPA Act.

1.2 IUCN GUIDELINES FOR CAVE AND KARST PROTECTION

The International Union for Conservation of Nature and Natural Resources (IUCN), also known as the World Conservation Union, is an inter-governmental agency of which Australia is a member. IUCN seeks to conserve the integrity and diversity of nature and to ensure that any use of natural resources is equitable and ecologically sustainable.

In 1997 the World Commission on Protected Areas, a commission of the IUCN, produced Guidelines for Cave and Karst Protection (Watson et al. 1997). These guidelines were developed to increase awareness of cave and karst protection issues and the special management considerations essential for the protection of cave and karst areas. They were designed to provide a guide for planners, managers and users of karst. This plan of management is based on the IUCN guidelines (Watson et al. 1997), although not all are specifically mentioned and some strategies have been modified where appropriate to better apply to the management of the reserve.

1.3 MANAGEMENT OBJECTIVES

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

Under the Act, nature reserves are managed to:

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

Nature reserves differ from national parks in that they do not have as a management principle to provide for visitor use.

In addition, the specific objectives for The Castles Nature Reserve are:

- preservation of karst features;
- preservation of cave habitat used by bats; and
- preservation of dry rainforests.

World Heritage

The International Convention for the Protection of the World Cultural and Natural Heritage (the World Heritage Convention) was adopted by the United Nations Educational, Scientific and Cultural Organisation (UNESCO) in 1972. The Convention establishes the World Heritage List, which comprises places of outstanding universal value, and provides a framework for international co-operation and collective protection of the cultural and natural heritage of places on this list. Under this convention Australia has obligations to ensure the identification, protection, conservation, and presentation of the cultural and natural heritage situated on its territory.

The former The Castles Flora Reserve (and so, the majority of the Castles Nature Reserve) was included on the World Heritage List in 1994, as part of the Central Eastern Rainforest Reserves of Australia World Heritage property (CERRA). CERRA comprises a series of national parks and reserves between south-east Queensland and the Hunter Valley, including the nearby Werrikimbe and Oxley Wild Rivers national parks and the Banda Banda section of Willi Willi National Park. CERRA has outstanding natural universal values and meets the following criteria for World Heritage Listing:

- it is an outstanding example representing the major stages of earth's evolutionary history;
- it is an outstanding example representing significant ongoing biological evolution;
- it contains habitats where populations of rare or endangered species of plants and animals still survive.

World Heritage is a matter of national environmental significance and thus NPWS has obligations under the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act). This plan has been guided by the broader strategies for the management of the CERRA (CERRA 2000) and the Australian World Heritage Management Principles set out in the EPBC Act. These principles place an obligation on NPWS for long-term care and stewardship of the reserve to ensure that their values are conserved and if necessary rehabilitated, and that individual or cumulative actions do not degrade their values.

Under the Convention, Australia has obligations to do all it can to ensure that effective and active measures are taken for the identification, protection, conservation, and presentation of the cultural and natural heritage situated on its territory by:

- developing policies which aim to give this heritage a function in the life of the community, to strengthen appreciation and respect for the reserve's World Heritage values;
- developing policies which aim to integrate the reserve's protection into comprehensive planning programs;
- establishing scientific and technical studies and research aimed at counteracting threatening processes and learning more about the condition and management of the World Heritage values; and
- implementing measures to identify, protect, conserve, present and rehabilitate the World Heritage values of the protected areas so they can be transmitted to future generations.

The Australian World Heritage Management Principles also require review of plans of management for declared World Heritage properties in terms of implementation and success in meeting the stated objectives at intervals of not more than 7 years.

2. THE CASTLES NATURE RESERVE — BASIS FOR MANAGEMENT

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

2.1 LOCATION, GAZETTAL AND REGIONAL SETTING

Location

The Castles Nature Reserve (hereafter called "the reserve") was created on January 1 1999 as part of the Regional Forest Agreement (RFA) process and covers an area of 2720 ha. 2360ha of the reserve was formerly The Castles Flora Reserve, which was listed as a World Heritage Area in 1994, whilst the remaining 360ha (chiefly the western section adjoining Carrai Road) was formerly part of Carrai State Forest. The reserve is located on the Mid North Coast of NSW in the upper Macleay River catchment, 50 km north west of Kempsey.

The reserve is particularly important as it contains a limestone karst system with at least one cave that is used by bats for hibernation, as well as a cave dwelling spider unique to the area. There are extensive areas of shatterwood rainforest as well as other rainforest associations. Due to the natural values of the reserve, it been listed as part of the Central Eastern Rainforest Reserves Australia (CERRA) World Heritage area (refer to Section 1.3).

The reserve is adjacent to Carrai National Park, and the declared wilderness and World Heritage areas of Oxley Wild Rivers National Park and Willi Willi National Park. These adjoin Werrikimbe National Park, also a wilderness and World Heritage area. The reserve has been identified as part of the Carrai Wilderness, however there is no proposal to declare the wilderness at this stage (NPWS 2001). The reserve surrounds a cleared, leased inholding (see the map and refer to Cultural heritage in section 2.2 and Modification of surrounding land in section 2.3).

The reserve is within the Kempsey Local Aboriginal Land Council area, the Kempsey Rural Lands Protection Board area, and the Mid North Coast Catchment Management Board area. The bulk of the reserve is within the Kempsey Local Government Area (LGA), with approximately 60ha above the escarpment being within the Walcha LGA.

Regional Forest Agreements

RFAs are one of the principal 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.

The North East RFA covers the reserve area. The process leading up to the RFA provided for major additions to the reserve system, including establishment of The Castles Nature Reserve.

2.2 LANDSCAPE CONTEXT

Natural and cultural heritage and on-going use are strongly inter-related and together form the landscape of an area. Much of the Australian environment has been influenced by past Aboriginal and non-Aboriginal land use practices and the activities of modern day Australians continue to influence bushland through recreational use, cultural practices, the presence of introduced plants and animals and in some cases air and water pollution.

The geology, landform, climate and plant and animal communities of the area, plus its location, have determined how it has been used by humans. The Castles Nature Reserve was lightly logged in the lower elevation hardwood areas, however, with limited access to other parts of the reserve, little disturbance has occurred and a number of significant plant and animal species are known and predicted to occur.

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

2.3 NATURAL AND CULTURAL HERITAGE

Landform, Geology, Karst and Soils

The reserve is on the boundary of the Nambucca and the Hastings geological blocks, and includes a folded and faulted limestone stratum. The non-limestone areas of the reserve are part of the Parrabel beds which are chiefly sandstones and siltstones. There is an outcrop of serpentinite on the Haydonville lease, an inholding within the reserve (Dept Min Res. 1992) (refer park map).

The reserve includes part of the escarpment of the Carrai Plateau, which is a group of granite (Adamalite) plutons, on the southern side of the Macleay River. These plutons consist of Fifes Knob, Jacobs Ladder and the massive flat-topped Carrai Plateau. These geological features have precipitous escarpments or cliffs, connected to each other by narrow ridges with very steep side-slopes.

The granite interrupts a limestone stratum called the Yessabah formation, which runs from near Kundabung to the upper Kunderang Brook. This limestone forms the karst

areas of Yessabah Nature Reserve, Willi Willi Caves Nature Reserve, Crystal Hill, Moparrabah and those within the reserve.

The Yessabah limestone formation consists of massive limestone almost entirely composed of fern-like corals indicating the limestone is of lower Permian to Carboniferous age (Northcott 1973), interbedded with well-sorted calcium carbonate rich sands, shales and conglomerates.

A total of 37 caves within the reserve have been recorded under the Australian Speleological Federation's numbering system. Additional caves are known to occur in the reserve, however there is no consolidated listing and the numbers indicated in available information are likely to underestimate the true number of caves found in the reserve (Spate 1994). Two of the cave entrances have been gated by the Kempsey Speleological Society to protect the decorative secondary mineral deposits formed in caves, known as speleothems, from vandalism. Most of the caves have been numbered, tagged and internally mapped by the society.

Features of the karst within the reserve are the East and West Castles, The Bathtub, The Natural Arch, the Carrai Bat Cave and unusual underground drainage patterns. The East and West Castles are limestone cliffs resembling the walls and battlements of a castle. The creek running between these cliffs has cut a curved walled channel, which is so smooth that it resembles a bathtub.

The soils are highly variable, as indicated by the complex geology. The majority of the reserve has shallow, poor, stony soils, apart from those areas enriched by materials high in mineral nutrients. These mineral rich materials are alluvial deposits derived from less soluble weathered limestone and later included within the younger geology of the reserve (Floyd 1983).

Catchment values

Rossiters Creek and Stockyard Creek drain the majority of the reserve into the Macleay River between Comara and Bellbrook. A small area beyond the Natural Arch drains into Warbro Brook, which runs into the Macleay River above Toorooka.

Normal surface drainage from Haydonville runs through the Natural Arch into Warbro Brook, which joins the Macleay River above Toorooka. Dye tracing has found that any runoff which enters an in-filled sink-hole within the Haydonville lease emerges in River Cave in the catchment of Rossiters Creek. Flow-stone has formed from deposition of calcium carbonate from this water between River Cave and Rossiters Creek.

Water flowing from the reserve is used for domestic stock watering along Stockyard Creek, Warbro Brook and the Macleay River, as well as for the domestic supply for the town of Kempsey.

Native Plants

The reserve contains a large area of dry rainforest dominated by yellow tulipwood (*Drypetes australasica*) and shatterwood (*Backhousia sciadophora*). There are also smaller areas of other rainforest types including subtropical rainforest, part of which

has been logged. Much of the dry rainforest occurs on limestone and represents one of the few occurrences of rainforest on limestone in NSW (Floyd 1983). One of unusual species in the rainforest is the small-leaved laurel (*Cryptocarya williwilliana*). This species is listed as a Rare or Threatened Australian Plant (ROTAP) (Briggs & Leigh 1995) and is known only from this limestone belt.

The reserve also contains areas of dry and moist eucalypt forest. The results of a survey of forest types by SFNSW (1965) are outlined in Table 1.

Table 1 Forest types known to occur within the reserve

Name	Area (ha)	%
Dry and subtropical rainforest	986.7	36.2
New England blackbutt (dry)	447.7	16.4
grey gum, grey ironbark, white mahogany (dry)	360.3	13.2
New England blackbutt (moist)	254.8	9.4
Rock outcrop	195.8	7.2
inland brush box	88.4	3.2
myrtle brush	79.3	2.9
booyong	79.1	2.9
crabapple, sassafras, corkwood	69.4	2.5
grey gum, grey ironbark, white mahogany (moist)	68.3	2.5
tallowwood, Sydney blue gum	45.4	1.7
logged brushwood	20.1	0.7
mountain/manna gum	18.3	0.7
Sydney blue gum	10.7	0.4
viney scrub	0.2	0.0

A vegetation survey was conducted within the brush component of the reserve by Floyd (1983). Table 2 lists the significant plant species found in this survey, together with those recorded as incidental sightings.

Table 2 Significant plants recorded in the reserve

Common name	Scientific name	Status under the TSC Act or other significance
an orchid	*Sarcochilus hartmannii*	Vulnerable
a shrub	*Haloragis exalata ssp velutina*	Vulnerable
small-leaved laurel	*Cryptocarya williwilliana*	ROTAP
common burrawang	*Macrozamia communis*	Northern limit
a shrub	*Helichrysum bidwillii*	Southern limit
corky prickle-vine	*Caesalpinia subtropica*	Southern limit
a shrub	*Muehlenbeckia rhyticarys*	Regionally rare

The reserve was modelled during the comprehensive regional assessment (CRA) process as potentially containing six additional significant plant species, including two listed as endangered and two listed as vulnerable under the TSC Act (Table 3).

Table 3 Significant plant species predicted to occur within the reserve

Common name	Scientific name	Status under the TSC Act or other significance
acomis	*Acomis acoma*	ROTAP
a vine	*Tylophora woollsii*	Endangered[#]
a vine	*Cynanchum elegans*	Endangered[#]
an orchid	*Schistotylus fitzgeraldii*	Vulnerable[+]
a grevillea	*Grevillea gutheriana*	Endangered[#]
a silkpod	*Parsonsia dorrigoensis*	Vulnerable[+]

also listed as endangered under the *Environment Protection and Biodiversity Conservation Act 1999*
+ also listed as vulnerable under the *Environment Protection and Biodiversity Conservation Act 1999*

Another ROTAP listed orchid, *Schistostylus purpuratus*, has been recorded near the reserve and may also occur within the reserve.

The reserve's diversity of vegetation, particularly its rainforest and the number of endemic, relictual and threatened plant species, contributes to CERRA's outstanding universal values and the reasons for CERRA's inclusion on the World Heritage list.

Native Animals

Nine significant animal species are known to occur within the reserve, including eight species listed as vulnerable under the TSC Act (Table 4). Other significant species are known to occur near the reserve and may also occur within the reserve (Table 5).

Table 4 Significant species known to occur in the reserve

Common name	Scientific name	Status under the TSC Act or other significance
Mammals		
spotted-tailed quoll	*Dasyurus maculatus*	Vulnerable[+]
little bent-wing bat	*Miniopterus australis*	Vulnerable
common bent-wing bat	*Miniopterus schreibersii*	Vulnerable
Birds		
wompoo fruit dove	*Ptilinopus magnificus*	Vulnerable
powerful owl	*Ninox strenua*	Vulnerable
masked owl	*Tyto novaehollandiae*	Vulnerable
sooty owl	*Tyto tenebricosa*	Vulnerable
olive whistler	*Pachycephala olivacea*	Vulnerable
Insects		
a spider	*Progradungula carraiensis*	Only record

+ also listed as vulnerable under the *Environment Protection and Biodiversity Conservation Act 1999*

The spider is the sole member of the family *Gradungulidae* and is only known from Rolys Cave and Carrai Bat Cave within the reserve. This spider feeds mainly on beetles, guano moths and larval cave crickets (Foster 1979; Gray 1983).

The Carrai Bat Cave is a major hibernation cave for the eastern horse-shoe bat (*Rhinolophus megaphyllus)*, as well as two vulnerable species listed above, the bent-wing bat and common bent-wing bat.

Table 5 Significant species known to occur near the reserve

Common name	Scientific name	Significance
Mammals		
koala	*Phascolarctos cinereus*	Vulnerable ⊗
red-legged pademelon	*Thylogale stigmatica*	Vulnerable
parma wallaby	*Macropus parma*	Vulnerable
greater broad-nosed bat	*Scoteanax rueppellii*	Vulnerable
Hastings River mouse	*Pseudomys oralis*	Endangered#
eastern false pipistrelle	*Falsistrellus tasmaniensis*	Vulnerable
Birds		
glossy black-cockatoo	*Calyptorhynchus lathami*	Vulnerable⊗
rufous scrub-bird	*Atrichornis rufescens*	Vulnerable⊗
Amphibians		
Booroolong frog	*Litoria booroolongensis*	Endangered⊗
New England tree frog	*Litoria subglandulosa*	Vulnerable⊗
stuttering frog	*Mixophyes balbus*	Vulnerable+⊗

⊗ Known in Willi Willi National Park 5 km to the south-east
\# also listed as endangered under the *Environment Protection and Biodiversity Conservation Act 1999*
\+ also listed as vulnerable under the *Environment Protection and Biodiversity Conservation Act 1999*

The reserve was modelled during the CRA process as providing suitable habitat for 27 significant species, including 15 listed as vulnerable and one listed as endangered under the TSC Act (Table 6).

Table 6 Significant species predicted to occur within the reserve

Common name	Scientific name	Significance
Mammals		
grey-headed flying-fox	*Pteropus poliocephalus*	Vulnerable
koala	*Phascolarctos cinereus*	Vulnerable ⊗
eastern pygmy-possum	*Cercartetus nanus*	Vulnerable
yellow-bellied glider	*Petaurus australis*	Vulnerable ⊗
brush-tailed phascogale	*Phascogale tapoatafa*	Vulnerable
eastern forest bat	*Vespadelus pumilus*	Regionally significant
eastern false pipistrelle	*Falsistrellus tasmaniensis*	Vulnerable ⊗
golden-tipped bat	*Kerivoula papuensis*	Vulnerable
greater broad-nosed bat	*Scoteanax rueppellii*	Vulnerable
large-eared pied bat	*Chalinolobus dwyeri*	Vulnerable
eastern free-tail bat	*Mormopterus norfolkensis*	Vulnerable
white-striped free-tail bat	*Nyctinomus australis*	Regionally significant

Table 6 (continued)

Common name	Scientific name	Significance
Birds		
paradise riflebird	*Ptiloris paradiseus*	Regionally significant
pale-yellow robin	*Tregellasia capito*	Regionally significant
Reptiles		
alpine water skink	*Eulamprus kosciuskoi*	Regionally significant
a burrowing skink	*Ophioscincus truncatus*	Regionally significant
mountain dragon	*Tympanocryptis diemensis*	Regionally significant
southern angle-headed dragon	*Hypsilurus spinipes*	Regionally significant
a lizard	*Eulamprus tenuis*	Regionally significant
leaf-tailed gecko	*Saltuarius swainii*	Regionally significant
Amphibians		
a frog	*Litoria revelata*	Regionally significant
new England tree frog	*Litoria subglandulosa*	Vulnerable⊗
green-thighed frog	*Litoria brevipalmata*	Vulnerable
sphagnum frog	*Philoria sphagnicolus*	Vulnerable⊗
giant barred frog	*Mixophyes iteratus*	Endangered^⊗
a large frog	*Mixophyes balbus*	Vulnerable +⊗

⊗*Known in Willi Willi National Park, 5 km south-east of the reserve*

NPWS is required by the TSC Act to prepare and implement recovery plans for all listed threatened species. These are progressively being prepared and will be used to guide management of threatened species in the area.

The reserve is part of the Castles regional fauna corridor, and is the link between the Crystal Hill/Mt Mystery and the Carrai/Oxley Wild Rivers regional fauna corridors. The reserve contains regionally important key habitat. The reserve is considered to contain high quality dingo habitat and is declared a dingo management area under the *Rural Lands Protection Act 1998* (RLP Act) (refer to 2.3 Introduced animals).

The large number of endemic, relictual and threatened animal species found in the reserve contributes to CERRA's outstanding universal values and the reasons for CERRA's inclusion on the World Heritage list.

Aboriginal Heritage

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

There are no Aboriginal sites recorded in or near the reserve.

The reserve is within the Dunghutti tribal area and the Kempsey Local Aboriginal Land Council area.

Non-Aboriginal Heritage

There are no registered historic places within the nature reserve. Carrai Road was built during World War II, to obtain timber supplies.

Exploratory bores, which were drilled in the mid-1980's for mineral water, occur within the reserve on the western side of Rossiters Creek. These bores were never used due to the water's hardness. Two capped bore pipes remain protruding above ground level.

The area surrounding the reserve is remote and rich in timber-getting history. There is a substantial in-holding, which was the site of the first saw-milling village in the Carrai area. This in-holding was originally called Haydonwood for the leaseholders, who were Bill Haydon, a local cedar getter and sawmiller, and Percy Woods, who owned a sawmill and furniture factory in Sydney. The Kookaburra sawmill was later set up by Mr. Woods within Carrai State Forest and Haydonwood was renamed Haydonville. Haydonville is now a freeholding.

2.4 THREATS TO THE RESERVE'S VALUES

Introduced plants

There has been no formal survey of weed species within the reserve, however casual observation indicates that the main body of the reserve is relatively free of weeds. Pink lantana *(Lantana camara)* is present on the edges of the reserve adjacent to Rossiters Trail and Carrai Road, but does not appear to be invading the shaded rainforest areas.

Blackberry (*Rubus fruticosus*) is prevalent in the Kookaburra area in Carrai State Forest, and has the potential to invade some areas of the reserve. This infestation has been the subject of frequent control efforts by SFNSW and the graziers who used to lease the Kookaburra site.

Introduced animals

Introduced animals have the potential to cause detrimental effects on the ecological values of the reserve. There has been no formal survey of pest animals carried out within the reserve. Feral pigs (*Sus scrofa*) have been recorded to the south in Willi Willi, Oxley Wild Rivers and Werrikimbe National Parks, but there is no evidence of pigs in the reserve. Foxes *(Vulpes vulpes)* have not been observed but feral cats *(Felis catus)* are known to occur at Kookaburra and Daisy Plains. Wild dogs have been sighted in Carrai National Park, the adjoining Carrai State Forest and Fifes Knob Nature Reserve. Those introduced species known to occur nearby may also occur in the reserve.

The NPWS considers the dingo to be part of the native fauna of NSW, which it has a responsibility to conserve. It is also recognised that wild dogs from NPWS estate can impact on livestock on adjacent areas and that there is a need for management to minimise their attacks on stock.

Wild dogs, including dingos, have been declared as pest animals under the RLP Act throughout NSW. Hence, the NPWS has a statutory responsibility to control wild dogs on its estate. Under the RLP Act, however, public lands which are considered to contain high quality dingo habitat have been listed as dingo management areas. This includes The Castles Nature Reserve, Carrai State Forest and Carrai National Park. The RLP Act requires public land managers, such as the NPWS, to assist in the preparation of a wild dog management plan for dingo management areas. These plans are to identify methods for the control of wild dogs and the conservation of dingoes in these areas and are to be approved by the Kempsey Rural Lands Protection Board (RLPB).

In 2002 NPWS, SFNSW the Kempsey RLPB and neighbours conducted a cooperative wild dog baiting program. This program involved the use of sand mounds, soft jawed traps and 1080 poisoning.

Stock from the leased inholding rarely enter the reserve and then only immediately adjoining Carrai Road on the south eastern section of the reserve. The steep nature of the terrain, the absence of watering points and the lack of grazing in the heavily shaded forests does not encourage stock to leave the well watered, undulating grassed area of the lease or to remain in the reserve.

Fire

There is no published meteorological data available for sites close to the reserve, however it is believed that the plateau experiences relatively cool temperatures during the typical fire season, similar to those of Katoomba–Mt Victoria and Bowral–Moss Vale (BOM, 2001). Mean monthly rainfall is similar in distribution and intensity to that at Coffs Harbour and Mount Tamborine, with higher spring and summer rainfall. This indicates that wildfire is likely only when both spring and summer rains fail. Hazard reduction in areas adjoining the reserve is very difficult due to the terrain and the limited days during the year when burning at a suitable intensity can be carried out under appropriate climatic conditions.

The only wildfire known to have occurred on the reserve since the early 1960's was in the 2001/2002 season, when the dry hardwood areas around Carrai Road north-east of the Natural Arch and in upper Stockyard Creek were burnt. The plateau top area in the western section of the reserve, adjacent to the Fitzroy Tableland was subject to hazard reduction burns twice in the period 1986-1990.

Assets which border the reserve include Carrai State Forest, as well as steep forested Crown land leaseholdings which support minimal seasonal grazing. A private inholding (refer to Modification of surrounding lands), supporting cattle grazing, is surrounded by the reserve and contains a periodically occupied residence.

The NPWS approach to fire management emphasises the protection of life and property as well as providing direction for the protection of natural and cultural heritage. To achieve these objectives the NPWS uses a system of bushfire management zones (NPWS 2002). These zones are compatible with the system adopted by the Bushfire Coordinating Committee for use in District Bushfire Management Committee (DBFMC) bushfire risk management plans.

The approach divides reserves into fire management zones. These zones are management areas where specified fire management operational objectives, strategies and performance indicators have been developed to mitigate against the threat of a wildfire.

NPWS has assessed the reserve for fire management planning purposes and has zoned the reserve as a Heritage Area Management Zone (HAMZ). The primary fire management objectives for this zone are to prevent the extinction of all species that are known to occur naturally within the reserve, and to protect culturally significant sites. The reserve has been designated as a HAMZ because of the sensitivity of rainforest vegetation to fire, invertebrate fauna, bat communities, the presence of a number of significant plant and animal species and the likely presence of a number of additional significant species.

Ecological research in fire-prone ecosystems has established some general principles about fire regimes and the conservation of biodiversity. That is, groups of plants and animals respond similarly to fire according to characteristics of their life history. Therefore it is not necessary to individually specify fire regimes for the conservation of every species. Requirements for most plant species can be summarised on the basis of vegetation communities and there is a threshold in fire regime variability which marks a critical change from high species diversity to low species diversity. The following fire regime guidelines have been identified for the reserve:

Table 7: Fire Regime Guidelines

Vegetation type	Minimum interval	Maximum interval	Notes
Rainforest	n/a	n/a	Fire should be avoided
Wet sclerophyll forest	25	60	Crown fires should be avoided in the lower end of the interval range
Shrubby dry sclerophyll forest	7	30	

Source: Auld & O'Connell (1991), Keith (2002), Keith et al (2002), Morrison et al (1995)

The HAMZ does not require intensive management and focuses on those actions appropriate to conserve biodiversity and cultural heritage, including exclusion of fire from rainforest and karst systems of the reserve. Management of fire regimes for other vegetation communities will be in accordance with fire regime guidelines identified in table 7, above, any threatened species requirements or further research.

Fire is highly unlikely to enter the majority of the reserve due to its rainforest vegetation. Exceptions to this are the plateau area adjacent to the Fitzroy Tableland, which is chiefly a blue gum (E. saligna) open forest with blady grass (Imperata cylindrica) understorey, and the dry hardwood areas of upper Stockyard Creek. In the blue gum area, Carrai Road separates the Fitzroy Tableland freeholdings from the narrow section of reserve above the precipitous escarpment. Hazard reduction by graziers has not occurred in the Stockyard Creek area due to the lack of fire containment boundaries.

Rossiters road allows access to the lower elevation north-eastern section of the reserve and to water in Rossiters Creek. Due to the terrain and lack of fire advantages it is impracticable to hazard reduce any section of the reserve without the cooperation of adjoining landholders, other than adjacent to the Fitzroy Tableland.

Modification of surrounding lands

Much of the inholding that has been cleared for grazing is regenerating to bracken fern, wild tobacco and some rainforest species, due to a decline in grazing activity. The summit of Mount Hogsback, which is also part of the inholding, was partly cleared for vegetable growing in the early 1940's but is now rapidly regenerating to native species. The inholding currently supports limited grazing.

The Fitzroy tableland to the west of the reserve has been cleared for grazing, as have some parts of Stockyard Creek downstream from the reserve. Carrai State Forest adjoining to the south-east has been heavily logged in the accessible ridge top areas but is unlogged in the vicinity of the reserve due to the steep nature of the terrain.

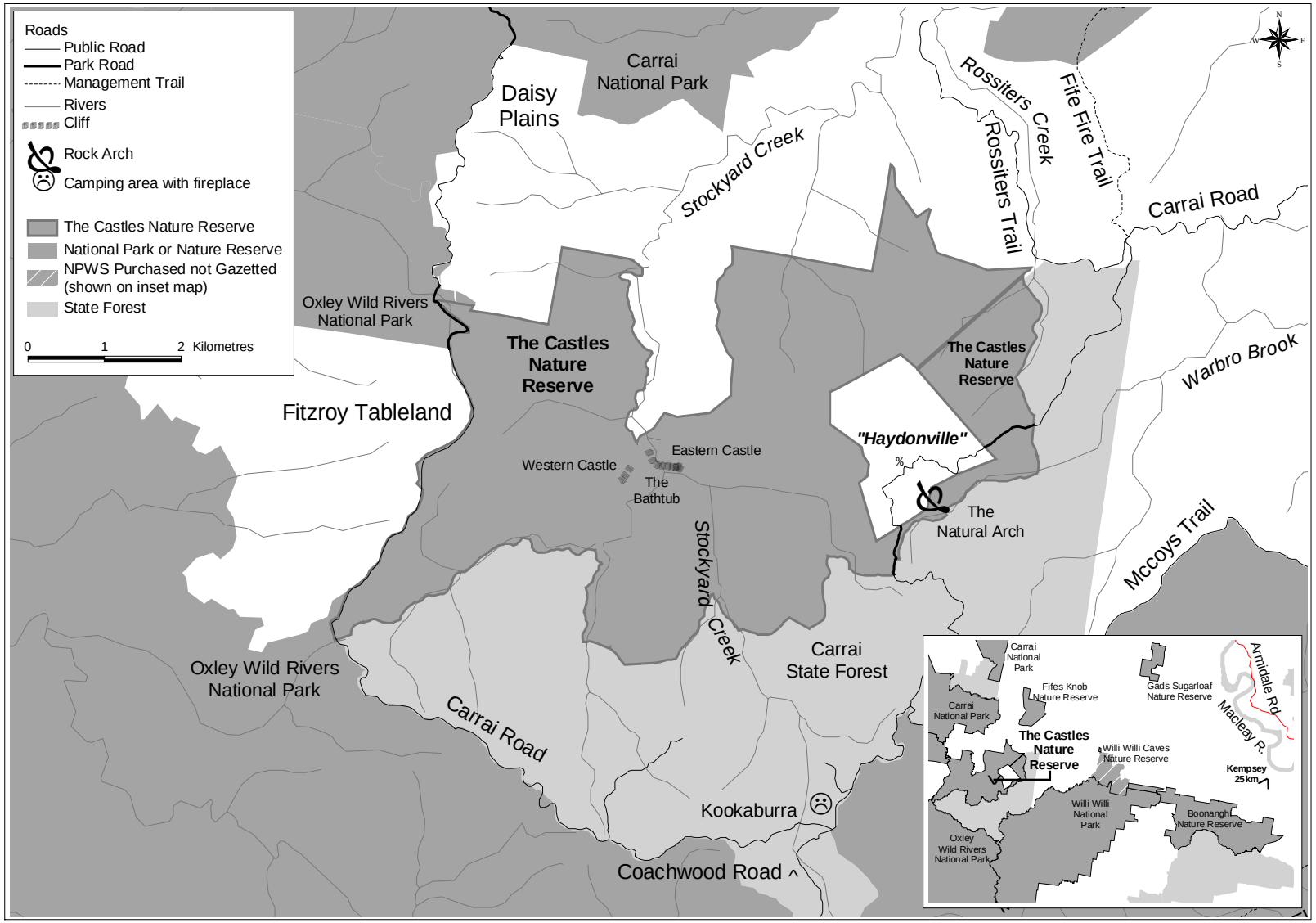
2.5 VISITOR USE

Access by conventional vehicles to the upper elevation areas of the reserve is by Carrai Road, which forms the western boundary of the reserve and passes through Haydonville in the south-east. Carrai Road also serves grazing properties on the Fitzroy tableland, Daisy Plains and the central Carrai plateau. This road is jointly maintained by NPWS, State Forests NSW (SFNSW) and Kempsey Shire Council. Rossiters Trail, which was built by and is maintained by Kempsey Council, provides access to the lower elevation north-east corner of the reserve. Both these roads provide two wheel drive all-weather access. Coachwood Road provides four wheel drive access to Carrai Road from Brushy Mountain.

While public vehicles drive along Carrai Road, there is no public access by foot or vehicle permitted off Carrai Road through the Haydonville private leasehold to reach the Natural Arch. It may only be accessed by parking alongside Carrai Road within the reserve and walking through the reserve. No constructed tracks exist. A roughly constructed road on reserved alignment runs off Carrai Road, west of the Haydonville homestead. The foot track to The Bathtub leaves this road where the road is the boundary of the reserve.

There are no recreation facilities in the reserve. Barbecues and toilets are available at Kookaburra, 4 km to the south-west in Carrai State Forest. The reserve currently experiences a low level of recreation, such as caving by speleological clubs, sightseeing at the Natural Arch and bushwalking, particularly to view the Bathtub formation. There is potential for abseiling to damage the karst formations, as well as the plants growing on rock faces. Alternative abseiling sites are available nearby. Horse riding through the reserve on Carrai Road is thought to be at a relatively low level and occur as part of longer rides. Recreational activities that are not consistent with the appreciation of nature and natural environments are generally considered inappropriate uses of a nature reserve.

3. THE CASTLES NATURE RESERVE AND LOCALITY MAP



4. THE CASTLES NATURE RESERVE—MANAGEMENT ISSUES AND STRATEGIES

High priority activities are those imperative to achievement of the objectives and desired outcomes. They must be undertaken in the near future to avoid significant deterioration in natural, cultural or management resources.
Medium priority activities are those that are necessary to achieve the objectives and desired outcomes but are not urgent.
Low priority activities are desirable to achieve management objectives and desired outcomes but can wait until resources become available.

Current Situation	Desired Outcomes	Strategies	Priority
World Heritage Most but not all of the reserve is on the World Heritage list as part of CERRA. The reserve's World Heritage status is not widely recognised and there is poor understanding of this status.	• There is improved awareness of the reserve's World Heritage status.	• Ensure that any interpretation of the reserve includes reference to its World Heritage Status. • Seek to include all of the reserve as part of CERRA.	High Low
Soil and water conservation There are currently no problems with erosion or water quality. The exploratory drill holes for mineral water in upper Rossiters Creek (refer to Visitor Use) do not affect surface water quality as the bores are capped. However, the bores are under a lease until 2008. If these bores are utilised there may be impacts on water quality and hydrology within the reserve.	• There is no evidence of accelerated soil erosion. • There is no reduction in water quality or long-term change in hydrology in the reserve.	• Undertake all works, such as trail maintenance and hazard reduction, in a manner that minimises erosion and water pollution. • Liaise with the Mid North Coast Catchment Management Board and SFNSW to maintain water quality in the reserve's catchment. • Should the bores within the reserve become productive, liaise with the lessee to minimise any potential impacts on water quality and hydrology.	High Low Low

Current Situation	Desired Outcomes	Strategies	Priority
The Karst Two of the caves within the reserve are gated, with the key being held by the Kempsey Speleological Club. These caves contain some decorative mineral deposits. Caves to the west of Rossiters Road within Carrai State forest adjoining the reserve are a part of the same karst system. These caves are currently afforded protection from the impact of forestry operations by being zoned as an 'Informal Reserve' by SFNSW. The Natural Arch has been infrequently used for abseiling, with the potential to damage the karst and the associated plants.	• Karst systems are protected from human disturbance and natural processes are allowed to continue. • Appropriate areas of karst outside the current reserve are protected. • Rock climbing and abseiling do not occur on the limestone cliffs within the reserve.	• Access to the caves within the reserve will be restricted (refer below and to Native plant and animal conservation, Visitor use and Research). • The gated caves will be re-keyed with a high security NPWS key. This key will be held in a secure location and only be made available to approved speleological groups, educational groups or researchers. A register will be kept of use (refer to Visitor use and Research). • Contribute to preparation of any SFNSW plan for future management of karst systems outside of the reserve, and investigate the feasibility of incorporating caves within Carrai State Forest into the reserve. • Prohibit rock climbing or abseiling within the reserve.	High High High High

Current Situation	Desired Outcomes	Strategies	Priority
Native plant and animal conservation The Carrai Bat Cave is currently the only known bat hibernation cave in the reserve. This cave should be protected from disturbance during the hibernation period. The reserve is part of a dingo management area. The reserve has been identified as part of a regional fauna corridor. Management of native species in the reserve would be enhanced by further knowledge of threatened flora and fauna. Ecological modelling has identified that the reserve contains potential habitat for a number of threatened species.	• There is no loss of native animal and plant species found in the reserve, or reduction in habitat diversity. • Dingos are managed within the reserve according to a regional dingo management plan. • There is an increased understanding of the reserve's World Heritage values, threats and ecological requirements, including native plants and animals.	• Access will not be permitted to known bat hibernation caves between 1 May and 31 August, unless for approved scientific investigation of bats (refer to Visitor use and Research). • Should any bat breeding caves be located, access to the caves, apart from scientific research with consent, will not be permitted from 1 November to 31 March (refer to Visitor use and Research). • Develop and implement a regional dingo management plan. • Continue to opportunistically carry out DNA sampling of dingo and wild dog populations, to gauge the effect of wild dog incursion on the dingo population. • Encourage or undertake appropriate research into native plant and animal species, in particular to determine the reserve's World Heritage status and the occurrence of significant species. • Work with relevant neighbours, Landcare groups and others to encourage retention of vegetation in the vicinity of the reserve. • Exclude fire from dry rainforest vegetation in the reserve (refer to Fire management).	High High High Medium Low High High

Current Situation	Desired Outcomes	Strategies	Priority
Introduced species			
Pest weeds do not appear to currently be a significant problem on the reserve, although a formal survey has not been undertaken.	• The impact of introduced species on native species and neighbouring lands is restricted. • Blackberry is eradicated in the vicinity of the reserve.	• Monitor, control, and where possible eradicate, introduced pest plant and animal species, in accordance with the Regional Pest Management Strategy. If found in the reserve, control of wild dogs and feral cats will be a priority.	Medium
Blackberry in the vicinity of Kookaburra in Carrai State Forest has the potential to become a severe problem due to dispersal of seed by animal and stream vectors.	• Methods used to control introduced species have minimal impact on native species in the reserve.	• Seek the cooperation of neighbours, the Kempsey Rural Lands Protection Board, Kempsey and Walcha Shire Councils, the Mid North Coast Weeds Advisory Council, and other stakeholders in implementing weed and pest animal control programs.	High
Pest animals such as wild dogs and cats are likely to occur within the reserve.		• Cooperate with SFNSW to eradicate Blackberry in the vicinity of the reserve.	Low
A Pest Management Strategy has been developed for the region as a whole. This strategy identifies pest populations, priorities for control and suggested control methods.		• Encourage or undertake a survey of pest plant and animal species in the reserve. • Use weed control techniques that minimise soil exposure and the potential for herbicides to impact on the karst systems and habitat viability of the reserve.	Low Low

Current Situation	Desired Outcomes	Strategies	Priority
Fire management Fire is a natural feature of the environment and is essential to the survival of some plant communities but can be destructive to others. Frequent or regular fire can cause loss of particular plant and animal species and communities. Rainforest is particularly vulnerable to fire. Fire could also damage some cultural values or threaten neighbouring land. The climate and vegetation indicate a very low fire risk. Karst features, bats and invertebrate fauna are sensitive to fire. Wildfire is rare in the reserve and prescribed burning difficult due to climatic conditions, although portions of the reserve have been burnt in the past (refer to 2.3 - Fire). The reserve is designated as a HAMZ (refer to 2.3 – Fire).	• Fire is excluded from the rainforest areas of the reserve and there is no reduction in the extent of rainforest in the reserve. • Life and property are protected from fire. • The potential for spread of wildfire on, from, or into the reserve is minimised.	• Assist in maintaining Carrai Road as an access road and fire protection zone for the reserve. • Manage the reserve as a Heritage Area Management Zone, where fire is managed to protect karst features and fauna, protect biodiversity in accordance with the identified fire frequency thresholds for vegetation communities (refer Table 7), or in accordance with threatened species requirements or further research. • Prescribed burning will not be undertaken on the reserve unless required to maintain biodiversity, as above, or in cooperation with neighbours in the Fitzroy area. • Should prescribed burning be carried out it will be done in a way that minimises the likelihood of fire entering rainforest or moist sclerophyll communities or karst areas. • Continue to participate in the Kempsey and Walcha Bush Fire Management Committees and maintain close contact and cooperation with neighbours, Council fire officers and volunteer bush fire brigades concerning fire management on and adjacent to the reserve. • The use of heavy machinery and vehicles for fire management purposes must be confined to trails shown on the reserve map. In emergency situations, former trails (e.g. logging trails) may be reopened if essential to protect natural or cultural values in or off the reserve. No new trails are to be constructed anywhere in the reserve.	High High High High High High

Current Situation	Desired Outcomes	Strategies	Priority
Cultural heritage There are no known Aboriginal or European cultural sites within the reserve, however no formal study has been undertaken. Haydonville has the potential for interpretation of an early saw-milling village as photographic records are available.	• Cultural features and values are identified, conserved and managed in accordance with their significance. • The Aboriginal community is involved in the management of, and research into their heritage and culture.	• Undertake an archaeological survey and cultural assessment prior to any works with the potential to impact on Aboriginal or non-Aboriginal sites and values. Maintenance of existing infrastructure will not require this assessment. • Encourage appropriate research into the cultural heritage of the reserve (refer to Research). • Consult with the Dunghutti elders and the Kempsey Local Aboriginal Land Council in all aspects of management of any identified Aboriginal sites, objects, places and values. Provide copies of any research findings on Aboriginal cultural heritage to the Land Council (refer to Research). • Interpret the Haydonville site within the reserve at the north-east boundary with Haydonville, in a lay by off Carrai Road, if a suitable site within Haydonville cannot be negotiated.	High High High Low

Current Situation	Desired Outcomes	Strategies	Priority
Visitor use The karst formations are valued for their scenic qualities. However, the vegetation and wildlife of the karst system are easily damaged. The promotion of community understanding and appreciation of the conservation values of the reserve will be important for minimising damaging activities. There is currently a low level of visitor use by speleological clubs, as well as for sightseeing, bushwalking. Occasional abseiling occurs on easily damaged karst features. The appearance of the capped exploratory mineral water bores (refer to Soil and water conservation) above the ground level in upper Rossiters Creek detracts from the experience of the rainforest in this area.	• Visitor access to the reserve is restricted and does not threaten the karst or other values. • Visitor access to the caves is only available outside bat hibernation and breeding periods and is restricted to approved speleological clubs, educational visits and scientific purposes. • The local community is aware of the significance of the area and of management programs.	• Liaise with neighbours and community organisations to promote community understanding of the reserve's values and management strategies. • Permit remote self-reliant camping for speleological, educational or scientific groups not exceeding 10 in number, with camping to be at least 200m from any road, trail or cave entrance. Written consent should be obtained from the Regional Manager, detailing the number of people, the proposed caves and camping location to be visited. Use and impacts will be monitored and further restrictions may be imposed if necessary. • Only approved speleological groups, educational groups and researchers will be allowed access to the caves, and access will be restricted at certain times (refer to Native plant and animal conservation). • Cave users must be acquainted with, and abide by, the Australian Speleological Federation Incorporated (ASF) *Code of Ethics and Conservation, Safety Code* and *Minimal Impact Caving Code*. • Wood fires will not be permitted, but fuel stoves will be permitted.	Low High High High High

Current Situation	Desired Outcomes	Strategies	Priority
		• Rock climbing and abseiling will not be permitted in the reserve.	High
		• Horse riding will not be permitted on the reserve, except on Carrai Road. Competitive and commercial horse riding will not be permitted.	High
		• Stock and domestic animals in vehicles may only traverse the reserve by utilising Carrai Road.	High
		• Once the lease for mineral water bores has expired, seek to have the bores capped below ground level to lessen the visual impact.	Medium
		• Erect and maintain tenure signage, as well as signage at the Carrai Bat Cave entrance, to show restrictions indicated in this plan (refer to Management Operations).	High
		• No visitor facilities other than tenure or potential interpretive signage will be provided.	High
		• No commercial tours will be permitted with the exception of NPWS discovery tours.	High

Current Situation	Desired Outcomes	Strategies	Priority
Research No formal, comprehensive flora or fauna surveys have been undertaken in the reserve. Further scientific study is needed to improve understanding of the reserve's natural heritage and the processes that affect them. The Kempsey Speleological Society has mapped the known karst system.	• Research that enhances scientific knowledge and assists management of the reserve is undertaken.	• Undertake, or encourage, appropriate research to improve knowledge and management of natural and cultural values (refer to Karst, Native plant and animal conservation, Introduced plants and animals, Cultural heritage and Fire management). • Access to the caves by researchers will require approval by the NPWS and will not be permitted during certain periods of the year, unless for essential scientific investigation (refer to Native plant and animal conservation). • Where appropriate, use information collected from speleologists and researchers to assist with future management of the reserve. • Information obtained on the caves in the reserve must be provided to NPWS. .	Medium Medium Medium High
Management operations Carrai Road and Rossiters Trail provide access to the reserve, private lands, State Forests and other NPWS estate. NPWS, SFNSW and Kempsey Shire Council jointly maintain Carrai Road. There is an unformed road reservation through the north-east section of the reserve, which is impractical to construct due to steep slopes.	• Carrai Road continues to be jointly maintained by NPWS, SFNSW and Kempsey Council to two wheel drive all weather standard. • The road reservation in the north-east section of the reserve is added to the reserve. • Signage informs the public of the reserve's status and restrictions	• Maintain Carrai Road in association with other authorities to a 2WD all weather standard. • Seek the closure and addition to the reserve of the unconstructed road reservation in the north-east section of the reserve. • Erect signage indicating reserve tenure and prohibited activities at the commencement of the boundary of the reserve between Haydonville and the Bathtub and on the Carrai Road at the Fitzroy Tableland, or other suitable sites should additions be made to the reserve.	High Low Medium

5. REFERENCES

Auld, T.D. & O'Connell, M.A. (1991) 'Predicting patterns of post-fire germination in 35 eastern Australian Fabaceae'. *Australian Journal of Ecology* **16**, 53-70.

CERRA (2000) *Strategic Overview for Management of the World heritage Central Eastern Rainforest Reserves of Australia*. Dept of the Environment and Heritage, Canberra.

Department of Mineral Resources (1992) *Dorrigo–Coffs Harbour Metallogenic series sheet SH/56 10-11*

Floyd A.G. (1983) Rainforest Vegetation of the Yessabah Limestone Belt and Carrai Plateau. SFNSW and NPWS Internal Report

Foster R.R. and Gray M.R. (1979) *Prograndungula, a new cribellate genus of the spider family Gradungula (Araneae)* Aust. *J.. Zool.,* 27, pp 1051-71,

Gray, M.R. (1983) *The male of Prograndungula carraiensis (Araneae: Gradungulidae) with observations on the web and prey capture*, Proc. Linn. Soc N.S.W. 107:51-58

IUCN (1994) *Guidelines for Protected Area Management*. International Union for the Conservation of Nature and Natural Resources.

Keith, D. (2002) 'A compilation map of native vegetation for New South Wales, Version 1.1', *NSW Biodiversity Strategy,* NSW Government.

Keith, D.A., Williams, J.E. & Woinarski, J.C.Z. (2002) 'Fire management and biodiversity conservation: key approaches and principles' in Bradstock, R.A., Williams, J.E. & Gill, A.M. (eds) *Flammable Australia. The Fire Regimes and Biodiversity of a Continent,* Cambridge University Press, Cambridge, pp. 401-428.

Morrison, D.A., Cary, G.J., Pengelly, S.M., Ross, DG., Mullins, B.J., Thomas, C.R. & Anderson, T.S. (1995) 'Effects of fire frequency on plant species composition of sandstone communities in the Sydney region: inter-fire interval and time-since-fire' in *Australian Journal of Ecology* **20**, pp. 239-247.

Northcott, I.W. (1973) Biostratigraphy Of The Carboniferous-Permian Succession Of The Parrabel Anticline, West Of Kempsey, Northern N.S.W. B.Sc.(Hons) Thesis (Unpub) University Of New England.

NPWS (2002) *The NPWS Approach to Fire Management Planning*. NSW National Parks and Wildlife Service, Hurstville.

SFNSW (1965) Research Note No.17 *Forest Types in NSW.*

Spate (1994) Karst Reconnaissance - Northern Region.

Watson, J., Hamilton-Smith, E., Gillieson, D. & Kiernan, K. (eds) (1997) *Guidelines for Cave and Karst Protection*, IUCN.

GLOSSARY

ACRONYMS USED

NPW Act	NSW *National Parks and Wildlife Act* (1974)
NPWS	NSW National Parks and Wildlife Service
TSC Act	NSW *Threatened Species Conservation Act* (1995)

SELECTED DEFINITIONS

Biodiversity	Biological diversity, namely the variety of life forms: the different plants, animals and micro-organisms, the genes they contain, and the ecosystems they form. It is usually considered at three levels: genetic diversity, species diversity and ecosystem
Caves	A natural cavity in rock large enough to be entered by man. It may be waterfilled.
Cave system	A collection of caves interconnected by enterable passages or linked hydrologicaly or a cave with an extensive complex of chambers and passages
Cultural heritage	Encompasses past and present cultural associations of all people in Australia, including tradition, knowledge and customs. It can be tangible (i.e. have physical manifestations in the form of art, buildings etc.) or intangible (i.e. spiritual or social associations, songs, stories and cultural practices). Cultural significance includes values that are social, spiritual, aesthetic, historic and scientific. When natural resources acquire meaning for a particular group, they become cultural resources as well.
Ecologically sustainable use	Using society's natural resources within the capacity of the species and ecosystems, so that the health, diversity and productivity of the environment and the ecological processes on which life depends are conserved and enhanced, and the quality of life, now and in the future, can be increased.
Fauna	Any mammal, bird, reptile or amphibian. NPWS has responsibility for the conservation of fauna. Note this definition excludes fish or invertebrates.
Feral species	A domesticated species that has become wild
Fire authorities	Organisations (including land management authorities such as NPWS) vested by the *RF Act* with the responsibility to suppress fires. Under the *RF Act*, Fire

	management activities on NPWS reserves are the responsibility of NPWS
Fire Management	Includes all activity associated with the use and control of fire in bushland designed to achieve stated objectives for the protection of life and property, and the maintenance of wildlife communities.
Fire management plan	A plan of operations to prevent, detect and suppress unplanned fires and to reduce bushfire hazard, prepared by a Bushfire Management Committee, constituted under the Rural Fires Act for coordinated fire management and operations within a rural fire district.
Historic places	Landscapes, sites buildings or other works together with pertinent contents and surroundings and include structures, ruins, archaeological sites and areas
Introduced species	A species occurring in an area outside its historically known natural range as a result of intentional or accidental dispersal by human activities. Also known as exotic or alien species.
Karst	Terrain with special landforms and drainage characteristics on account of greater solubility of certain rocks in natural waters than is common.
Park/ Reserve roads	Access roads, which form part of the gazetted area of a park/ reserve, maintained by the NPWS for public use primarily to access visitor facilities and points of interest.
Pluton	A granitic upwelling through overlaying rocks.
Policy	A statement of attitude and courses of action, directed toward the attainment of NPWS corporate goals and/or objectives.
Recovery plan	A document, prepared under the *TSC Act*, that identifies the actions to be taken to promote the recovery of a threatened species, or endangered population or ecological community.
Speleology	The exploration, description and scientific study of caves and related phenomena.
Speleothem	A secondary mineral deposit formed in caves, most commonly calcite.