



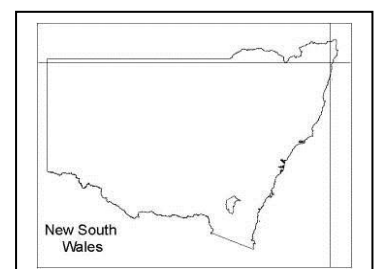
**NSW National Parks
& Wildlife Service**

Office of Environment & Heritage

Plan of Management



Tabbimoble Swamp Nature Reserve



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This plan of management was adopted by the Minister for the Environment on 4 January 2016.

Acknowledgments

NPWS acknowledges that Tabbimoble Swamp Nature Reserve is in the traditional Country of the Bundjalung People.

This plan of management was prepared by the NSW National Parks and Wildlife Service (NPWS), part of the Office of Environment and Heritage, and is based on a preliminary draft prepared by Southern Cross University intern, Warren Lake.

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Front cover: Wetlands (left) and scribbly gum (*Eucalyptus signata*) (right) in Tabbimoble Swamp Nature Reserve. Photos: NPWS/W. Lake.

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Foreword

Tabbimoble Swamp Nature Reserve is situated south of Woodburn on the NSW North Coast. It covers 1074 hectares and was established in 1999.

The reserve is part of an important corridor of lowland coastal vegetation, protecting swamp sclerophyll forest and freshwater wetland endangered ecological communities. Eighteen threatened species are known to occur in the reserve, including six species which are considered threatened at a national level.

Tabbimoble Swamp Nature Reserve is part of the traditional lands of the Bundjalung People and is adjacent to the Minyurnai Indigenous Protected Area. It is part of a group of parks where the Bundjalung People's native title rights have been recognised.

The NSW *National Parks and Wildlife Act 1974* requires that a plan of management be prepared for each nature reserve. A draft plan of management for Tabbimoble Swamp Nature Reserve was exhibited between 11 March and 17 June 2013. The two submissions received on the draft plan were carefully considered before adopting this plan.

This plan contains a number of actions to protect our natural environment, including protection of threatened species and communities, control of pest plants and animals, and fire management to protect life, property and biodiversity. It also fosters partnerships with Aboriginal people through ongoing consultation and involvement of Bundjalung People regarding management of the reserve, and implementation of any negotiated Indigenous Land Use Agreement or other joint management arrangements.

Being a nature reserve, provision for visitor use is not a priority for management. However, the plan provides for low-key, nature-based day use and activities such as birdwatching, cycling on management trails and bushwalking.

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



Mark Speakman

Minister for the Environment

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Map 1: Tabbimoble Swamp Nature Reserve



1. Introduction

1.1 Location, reservation and regional context

Features	Description
Location	Tabbimoble Swamp Nature Reserve (referred to as ‘the reserve’ in this plan) is located approximately 15 kilometres south of Woodburn and south-west of Evans Head.
Area	The reserve occupies 1074 hectares. As well as the area reserved as Tabbimoble Swamp Nature Reserve, this plan covers a road in the south-west of the reserve which lies on Crown land vested in the Minister for the Environment and which provides access to neighbouring private lands. Although not part of the reserve, the management of this road is subject to this plan and the National Parks and Wildlife Regulation.
Reservation date	1 January 1999.
Previous tenure	<p>Tabbimoble Swamp Nature Reserve was previously part of Doubleduke State Forest.</p> <p>The NSW National Parks and Wildlife Service (NPWS) acknowledges that the land now reserved as Tabbimoble Swamp Nature Reserve is part of the traditional lands of the Bundjalung People.</p>
Regional context	
Biogeographic region	The reserve is located in the Clarence Lowlands subregion of the South Eastern Queensland Bioregion (DSEWPAC 2012), in an area formally recognised as part of the NSW North Coast Bioregion under the <i>Threatened Species Conservation Act 1995</i> (DECCW 2010a). It is in close proximity to Bundjalung National Park to the east.
Surrounding land use	<p>The reserve lies adjacent to the Minyurnai Indigenous Protected Area (IPA) which covers more than 2000 hectares of rainforests and floodplain wetlands. The Minyurnai IPA was declared in August 2011 and is managed by the Minyurnai Land Holding Aboriginal Corporation on behalf of the Bundjalung traditional owners.¹</p> <p>Other major land uses in the surrounding area include forestry operations in Doubleduke and Tabbimoble state forests. Beef farming occurs on some private lands. The Pacific Highway adjoins the western boundary of the reserve.</p>
Other authorities	The reserve is located within the geographic areas of a determined native title claim by the Bundjalung People and within the areas of the Bogal Local Aboriginal Land Council, North Coast Local Land Services and Richmond Valley Council.

¹ An Indigenous Protected Area (IPA) is an area of indigenous-owned land or sea where traditional owners have entered into an agreement with the Australian Government to promote biodiversity and cultural resource conservation (Department of Environment 2014).

1.2 Statement of significance

Tabbimoble Swamp Nature Reserve is significant for the following values:

Biological values

- Two endangered ecological communities and 18 threatened species are found within the reserve, six of which are recognised as threatened at a national level.
- The reserve provides high quality habitat for other threatened species predicted to occur within the reserve.
- The reserve provides a valuable corridor of intact habitat that links Bundjalung National Park on the coast to the coastal escarpment through Minyumai IPA.

Aboriginal heritage values

- The reserve is part of the traditional lands of the Bundjalung People and is adjacent to the Minyumai IPA.
- The reserve is part of a group of parks where the Bundjalung People's native title rights have been recognised.

Research and educational values

- Endangered ecological communities in the reserve provide opportunities for scientific research.
- The reserve provides opportunities for universities and other institutions to undertake survey work and other research to further increase the knowledge base for the reserve.

2. Management context

2.1 Legislative and policy framework

The management of nature reserves in New South Wales is in the context of a legislative and policy framework, primarily the *National Parks and Wildlife Act 1974* and Regulation, the *Threatened Species Conservation Act* and NPWS policies.

Other legislation, international agreements and charters may also apply to management of the area. In particular, the NSW *Environmental Planning and Assessment Act 1979* may require assessment and mitigation of environmental impact of works proposed in this plan. The NSW *Heritage Act 1977* may apply to the excavation of known archaeological sites or sites with potential to contain historical archaeological relics. The Environment Protection and Biodiversity Conservation Act 1999 may apply in relation to actions that impact on matters of national environmental significance, such as migratory and threatened species listed under that Act.

A plan of management is a statutory document under the National Parks and Wildlife Act. Once the Minister has adopted a plan, no operations may be undertaken within the reserve except in accordance with the plan. This plan will also apply to any future additions to Tabbimoble Swamp Nature Reserve. Where management strategies or works that are not consistent with this plan are proposed for the reserve or any additions, an amendment to the plan will be required.

2.2 Management purposes and principles

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 National Parks and Wildlife Act (section 30J), 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
- provide for appropriate research and monitoring.

The primary purpose of nature reserves is to conserve nature. Nature reserves differ from national parks in that they do not have the provision of visitor use as a management purpose or principle.

2.3 Specific management directions

In addition to the general principles for the management of nature reserves (see Section 2.2), the following specific management directions apply to the management of the reserve:

- Protect threatened plants and animals, and endangered ecological communities.
- Consult and involve the Bundjalung People and other relevant Aboriginal community organisations in the management of their Country.
- Control any significant occurrences of introduced plant species.
- Support opportunities for low-key, nature-based recreation including nature study and bushwalking, however, visitor facilities will not be provided.
- Support opportunities for appropriate research.

3. Values

This plan aims to conserve both natural and cultural values of the Tabbimoble Swamp Nature Reserve. The location, landforms, and plant and animal communities of an area have determined how it has been used and valued by both Aboriginal and non-Aboriginal people. These 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.

To make the document clear and easy to use, various aspects of natural heritage, cultural heritage, threats and ongoing use are dealt with individually but their interrelationships are recognised.

3.1 Geology, landscape and hydrology

Most of the reserve forms part of the lower Clarence catchment. The reserve is low lying with a maximum altitude of 34 metres above sea level and has an average rainfall of approximately 1300–1600 millimetres per year.

The sandstone, carbonaceous siltstone, shale mudstone, coal and minor oil shale of the Walloon Coal Measures underlie the reserve and these outcrop on the western boundary of the reserve along the Pacific Highway (Morand 2001).

Quartz sandstone underlies the substrate at higher elevations in the west, north and east of the reserve. Soil landscapes formed on this substrate comprise large areas of very poorly drained yellow and grey kurosols (gleyed podzolic soils).

At lower elevations in the central areas of the reserve, and also in the north-east corner of the reserve, soils are described as deep grey kurosols and kandasols. In the centre of the reserve, alluvial plains and drainage depressions have formed from sediments of the Walloon Coal Measures. In the north-east corner of the reserve, the alluvial fans and drainage depressions are formed from sediments of a more recent geological age.

Soils in all areas of the reserve share the characteristics of being strongly acidic with low fertility, are hard setting, have a low permeability and are highly erodible. The low-lying swampy environment is subject to frequent inundation. However the soils in the reserve are not considered to be of potential acid sulfate soil risk.

Issues

- Kurosols are poorly drained and are prone to erosion. Kandasols are also poorly drained and prone to erosion under concentrated flow regimes.
- Regular inundation of Minyumai Road and management trails within the reserve limits access to the reserve.

Desired outcome

- Exposure of acidic subsoils and erosion through road works and other management activities is minimised.

Management response

3.1.1 As far as practicable, slashing for fuel reduction along trails, and use of management trails, will be avoided during wet periods.

3.1.2 Appropriate road drainage and sediment control will be implemented to minimise erosion.

3.2 Native plants

The most prevalent vegetation communities present in the reserve are shrubby dry sclerophyll forest, swamp sclerophyll forest and freshwater wetland (DECCW 2010a). The most extensive forest ecosystems are Rough-barked Apple Forest (dominated by *Angophora* spp.), which is in an old-growth condition, and Dry Heathy Blackbutt – Bloodwood Forest, dominated by blackbutt (*Eucalyptus pilularis*), of which approximately half is old-growth. Lesser stands of paperbark (*Melaleuca* spp.) also occur in the reserve along with three tall dry forest ecosystems: Heathy Scribbly Gum Forest (dominated by *E. signata*), Lowlands Scribbly Gum Forest and Clarence Lowlands Spotted Gum Forest (dominated by large-leaved spotted gum (*Corymbia henryi*)).

Two endangered ecological communities occur in the reserve:

- Freshwater Wetlands on Coastal Floodplains of the NSW North Coast
- Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast.

Also found within the reserve are three threatened plant species (Table 1).

Table 1: Threatened plant species recorded in Tabbimoble Swamp Nature Reserve

Common name	Scientific name	TSC Act	EPBC Act
Thorny pea	<i>Desmodium acanthocladum</i>	Vulnerable	Vulnerable
Swamp mint-bush	<i>Prostanthera palustris</i>	Vulnerable	Vulnerable
Red lilly pilly	<i>Syzygium hodgkinsoniae</i>	Vulnerable	Vulnerable

Strategies for the recovery of threatened species, populations and ecological communities have been set out in a statewide *Threatened Species Priorities Action Statement* (DECC 2007). These actions are currently prioritised and implemented through the Saving our Species program which aims to maximise the number of threatened species that can be secured in the wild in New South Wales for 100 years (OEH 2013d). Individual recovery plans may also be prepared for threatened species to consider management needs in more detail.

The *Northern Rivers Regional Biodiversity Management Plan* (DECCW 2010a) and the *Priorities Action Statement* identify several threats and objectives for the protection of the swamp mint-bush. These objectives include protection from frequent fire, trampling and other damage, and the risk of local extinction because of its small size. Similarly, the priority recovery actions for the thorny pea include a requirement for the reserve fire management strategy to protect the species from fire (see Section 4.2) and to control weeds in habitat areas (see Section 4.1).

The Minyurni Indigenous Protected Area, located adjacent to the reserve, also has conservation significance for threatened species and endangered ecological communities, and provides a significant link of largely uncleared native vegetation between Tabbimoble Swamp Nature Reserve and Bundjalung National Park (McDonald 2011).

Issue

- Only small areas of Freshwater Wetlands on Coastal Floodplains are contained within existing conservation reserves, including Tabbimoble Swamp Nature Reserve (NSW SC 2011). Outside reserves, this community has been extensively cleared and modified. Very few examples within and outside reserves remain unaffected by weeds (see Section 4.1). The most significant threats to vegetation communities and threatened plant species in the reserve are weeds, inappropriate fire regimes and alterations to the hydrological regime.

Desired outcomes

- Native plants and ecological communities are conserved, in particular the reserve's threatened species, and the endangered Freshwater Wetlands on Coastal Floodplains and Swamp Sclerophyll Forest on Coastal Floodplains.
- Negative impacts on native plants and ecological communities from weeds and inappropriate fire regimes are minimised.

Management response

3.2.1 Implement relevant strategies and actions in the *Priorities Action Statement* and recovery plans for threatened species, populations and ecological communities in the reserve. This will include implementation of appropriate pest and fire management (see Sections 4.1 and 4.2).

3.2.2 Develop and maintain a 'green guide post system' identifying sensitive zones and spot locations for threatened plants, including swamp mint-bush along management trails in the reserve, to avoid disturbance when undertaking maintenance works.

3.3 Native animals

The vegetation communities in the reserve are known to support 16 significant native animal species (Table 2), 15 of which are threatened.

Table 2: Significant animal species recorded in Tabbimoble Swamp Nature Reserve

Common name	Scientific name	TSC Act status	EPBC Act status
Oxleyan pygmy perch	<i>Nannoperca oxleyana</i>	n/a #	E
Emu	<i>Dromaius novaehollandiae</i>	E2	n/a
Black-necked stork	<i>Ephippiorhynchus asiaticus</i>	E1	n/a
Little eagle	<i>Hieraaetus morphnoides</i>	V	n/a
Brolga	<i>Grus rubicunda</i>	V	n/a
Comb-crested jacana	<i>Irediparra gallinacea</i>	V	n/a
Bar-tailed godwit	<i>Limosa lapponica</i>	n/a	^
Glossy black-cockatoo	<i>Calyptorhynchus lathami</i>	V	n/a
Little lorikeet	<i>Glossopsitta pusilla</i>	V	n/a
Grey-crowned babbler (eastern subspecies)	<i>Pomatostomus temporalis temporalis</i>	V	n/a
Varied sittella	<i>Daphoenositta chrysoptera</i>	V	n/a
Barred cuckoo-shrike	<i>Coracina lineata</i>	V	n/a
Spotted-tailed quoll	<i>Dasyurus maculatus</i>	V	E
Koala	<i>Phascolarctos cinereus</i>	V	V
Yellow-bellied glider	<i>Petaurus australis</i>	V	n/a
Squirrel glider	<i>Petaurus norfolcensis</i>	V	n/a

E = Endangered under Environment Protection and Biodiversity Conservation Act (EPBC Act)
 under either Act n/a = not listed under Act

V = Vulnerable

E1 and E2 = Endangered species and population (respectively) under Threatened Species Conservation Act (TSC Act)

^ migratory species listed under Commonwealth EPBC Act.

= listed as Endangered under the NSW *Fisheries*

Management Act 1994

The reserve contains good quality freshwater wetland habitat for a number of fish and bird species, including threatened and migratory species. The Oxleyan pygmy perch, which is known to occur within the reserve's waterways and wetlands, is listed as threatened under both the Environment Protection and Biodiversity Conservation Act and the NSW *Fisheries Management Act 1994*.

The bar-tailed godwit is a migratory species under the Environment Protection and Biodiversity Conservation Act that is listed under several conventions and agreements, namely the multilateral Convention on the Conservation of Migratory Species of Wild Animals (known the Bonn Convention), and the bilateral China–Australia Migratory Bird Agreement (CAMBA), Japan–Australia Migratory Bird Agreement (JAMBA) and Republic of Korea – Australia Migratory Bird Agreement (ROKAMBA).

The reserve is also predicted to have high quality habitat for birds such as the red goshawk (*Erythrotriorchis radiatus*) and regent honeyeater (*Anthochaera phrygia*), which are both listed as critically endangered species, at high risk of extinction within New South Wales. Other threatened bird species that are predicted to occur within the habitat include the square-tailed kite (*Lophoictinia isura*) listed as vulnerable and swift parrot (*Lathamus discolor*) listed as endangered under both the Threatened Species Conservation and Environment Protection and Biodiversity Conservation Acts.

Other significant species which may be expected to occur in the reserve based on the available habitat include: common planigale (*Planigale maculata*); grassland melomys (*Melomys burtoni*); pale field-rat (*Rattus tunneyi*); long-nosed potoroo (*Potorous tridactylus*); brush-tailed phascogale (*Phascogale tapoatafa*); eastern long-eared bat (*Nyctophilus bifax*); little bentwing-bat (*Miniopterus australis*); grey-headed flying-fox (*Pteropus poliocephalus*); wallum froglet (*Crinia tinnula*); giant barred frog (*Mixophyes iteratus*); and Stephens' banded snake (*Hoplocephalus stephensi*).

As for plants, strategies for the recovery of threatened animal species and populations have been set out in a statewide *Priorities Action Statement*. These actions include increased road signage and reduced speed limits in areas where emus routinely cross roads, and control of feral animals and predation by domestic dogs.

Individual recovery plans may also be prepared for threatened species to consider management needs in more detail. The recovery plan for the Oxleyan pygmy perch (DPI 2005) includes actions for signage, and incorporation of pygmy perch locations within NPWS management systems to ensure adequate consideration and mitigation of potential impacts on the species, including in fire management.

The adjacent Minyumai Indigenous Protected Area also has significant habitat values and is an important link of mostly uncleared native vegetation which allows for the movement of wildlife between the reserve and Bundjalung National Park. Its plan of management identifies the area as having a high diversity of native animals including 18 species listed under the Threatened Species Conservation Act and one listed under the Environment Protection and Biodiversity Conservation Act, with a further 33 threatened species considered likely to occur. Individuals of the endangered population of coastal emu have been seen within the Minyumai Indigenous Protected Area (McDonald 2011).

Issues

- Introduced species and high frequency of fire are likely to be the major threats to native animals in the reserve (see Sections 4.1 and 4.2).
- Alteration to the hydrological regime is also a threat to native animals in the reserve, given the planned upgrade to the adjacent Pacific Highway.

Desired outcomes

- Populations of native animals, in particular significant animal species, are conserved.
- Negative impacts on native animals, in particular threatened species, are minimised.
- The habitat and populations of all native animals, in particular threatened animal species, are protected and maintained.

Management response

- 3.3.1 Implement relevant strategies in the *Priorities Action Statement* and recovery plans for threatened species, populations and ecological communities in the reserve. This will include implementation of appropriate pest and fire management (see Sections 4.1 and 4.2).
- 3.3.2 Liaise and negotiate with relevant NSW Government agencies, including Roads and Maritime Services, regarding Pacific Highway upgrade routes to ensure alterations to hydrological regimes are minimised.

3.4 Aboriginal heritage

The reserve lies within the traditional Country of the Bundjalung People. The land, water, plants and animals within a landscape are central to Aboriginal spirituality and contribute to Aboriginal identity. Aboriginal communities associate natural resources with the use and enjoyment of foods and medicines, caring for the land, passing on cultural knowledge, kinship systems and strengthening social bonds. Aboriginal heritage and connection to nature are inseparable and need to be managed in an integrated manner across the landscape.

A native title claim on behalf of the Bundjalung People #1 (NC96/16) was recognised by the Federal Court on 2 December 2013, and includes the reserve. This determination of native title rights acknowledges the Bundjalung People's traditional laws and customs, and legally recognises the Bundjalung People's connection to Country. It is likely an Indigenous Land Use Agreement will be negotiated which will provide detailed guidance on how the Bundjalung people will be actively involved in management of the reserve.

There are no Aboriginal sites recorded within the reserve and a cultural heritage assessment is yet to be completed. However, an archaeological survey on the adjacent Minyundai Indigenous Protected Area has identified sites.

While the NSW Government has legal responsibility for the protection of Aboriginal sites and places, NPWS acknowledges the right of Aboriginal people to make decisions about their own heritage. It is therefore policy that Aboriginal communities be consulted and involved in the management of Aboriginal sites, places and related issues, and the promotion and presentation of Aboriginal culture and history.

Issue

- The reserve is located within the traditional Country of the Bundjalung people and it is important that Bundjalung people are given the opportunity to be meaningfully involved in the management of the reserve.

Desired outcomes

- Bundjalung People are involved in management of the reserve.
- Understanding of the cultural values of the reserve is improved.
- Significant Aboriginal places and values are identified and protected.

Management response

- 3.4.1 Continue to consult and involve the Bundjalung People and other relevant Aboriginal community organisations in the management of the reserve, including the management of Aboriginal sites, places and cultural and natural values. This will include implementation of any negotiated Indigenous Land Use Agreement or other joint management arrangements.
- 3.4.2 Undertake an archaeological survey and cultural assessment prior to all works with the potential to impact Aboriginal sites or values.
- 3.4.3 Encourage further research into the Aboriginal cultural heritage values of the reserve with the Bundjalung People.

3.5 Visitor use

NPWS parks and reserves provide a range of visitor opportunities. NPWS aims to ensure that visitors enjoy, experience and appreciate the parks while park values are conserved and protected.

There are no visitor facilities in the reserve and visitation levels are very low. Access to the reserve is via the Pacific Highway turnoff along Minyumai Road and at two access points along the Pacific Highway which connect to North Pacific and South Pacific trails.

Significant areas of the reserve are regularly subjected to inundation, making it difficult to provide public access opportunities. The roads and management trails within the reserve provide some opportunity to explore the reserve on foot or by bicycle. Cycling is permitted on the management trails in the reserve because they have suitable visibility, width, surface condition and gradient for cycling. This is in line with NPWS policy and the *Sustainable Mountain Biking Strategy* (OEH 2011c). It may, however, be necessary to close the trails to public access during times of inundation.

It is recognised that many horse riders enjoy riding in bushland. The NPWS *Strategic Directions for Horse Riding in NSW National Parks* (OEH 2012b) provides a framework to improve riding opportunities in eight priority regions in New South Wales, including the Northern Rivers Region. However, recreational horse riding is not considered appropriate in the reserve due to its low-lying, swampy nature and frequent inundation. Horse riding opportunities in numerous other national parks in the region are being progressed in accordance with the *Northern Rivers Region Horse Riding Work Plan 2013* (OEH 2013c).

While opportunities for visitor use in this reserve are limited, other areas managed by NPWS, other authorities and private operators in the region provide for a range of recreation activities. Horse riding can be undertaken at nearby Bungawalbin National Park and Bungawalbin State Conservation Area. Nearby Bundjalung National Park and Iluka Nature Reserve offer facilities including camp grounds, toilets, walking tracks and picnic areas.

The adjacent Minyumai Indigenous Protected Area also provides for visitor use. It currently offers cultural activities and tours for visitors and allows camping by members of the Minyumai Land Holding Aboriginal Corporation. Its plan of management provides for further expansion of visitor use, including a range of graded walks, guided walks, boardwalks and new camping areas (McDonald 2011).

There are occasional occurrences of unauthorised rubbish dumping in the reserve, particularly adjacent to the Pacific Highway and along roads and management trails. Hunting may be allowed under permit in the nearby Tabbimoble State Forest and it is therefore important the reserve boundary is clearly defined to minimise the risk of hunters unknowingly entering the reserve.

Issues

- Opportunities for visitor use are limited by regular inundation of the reserve and limited access.
- Illegal rubbish dumping occurs adjacent to the Pacific Highway and along management trails.
- Though the reserve is clearly separated from Tabbimoble State Forest by the Pacific Highway, signage along the highway boundary should be maintained to ensure the public are aware of the reserve boundary.

Desired outcomes

- Visitor use of the reserve is maintained at a low level and is ecologically sustainable.
- Visitor opportunities encourage appreciation of the reserve's values and their conservation.
- Illegal activities, such as rubbish dumping, hunting and unauthorised vehicular use of management trails, are minimised.

Management response

3.5.1 Manage the reserve for low-key, nature-based activities such as birdwatching, bushwalking, and cycling on management trails. Camping and horse riding will not be permitted in the reserve, and no visitor facilities will be provided.

3.5.2 Management trails may be periodically closed to visitor use during times of flooding or high rainfall.

3.5.3 Maintain current reserve boundary signage and if necessary install additional signage and gates on management trails to discourage illegal activities.

4. Threats

4.1 Pest species

Pest species are plants and animals that have negative environmental, economic and social impacts; commonly they are introduced species. Pest species can have impacts across the range of reserve values, including impacts on biodiversity, cultural heritage, catchment and scenic values.

NPWS prepares regional pest management strategies which identify pest plants (weeds) and pest animals across that region's parks and priorities for control, including actions listed in the *Threatened Species Priorities Action Statement*, threat abatement plans, and other strategies such as the NSW *Biodiversity Priorities for Widespread Weeds* (NSW DPI & OEH 2011) and the *NSW Biosecurity Strategy 2013–2021* (DPI 2013).

The NPWS regional pest management strategy for Northern Rivers Region (OEH 2012a) identifies pest species and priority programs for this reserve. The overriding objective of the pest management strategy is to minimise adverse impacts of introduced species on biodiversity and other park and community values while complying with legislative responsibilities. The strategy also identifies where other site- or pest-specific plans or strategies need to be developed to provide a more detailed approach. Significant pest species known or likely to occur in Tabbimoble Swamp Nature Reserve are listed in Table 3 and discussed below.

Table 3: Weed and pest animals recorded in Tabbimoble Swamp Nature Reserve

Common name	Scientific name	Comment
Weeds		
–	<i>Ethulia conyzoides</i>	Observed but extent of distribution not clear
Asthma plant	<i>Chamaesyce hirta</i>	Observed but extent of distribution not clear
Whiskey grass	<i>Andropogon virginicus</i>	Observed on roadside verges
Lantana	<i>Lantana camara</i> *#--~	Outbreaks observed along very small sections of management trails
Groundsel bush	<i>Baccharis halimifolia</i> #	Observed on roadside verges & in swampy areas
Pest animals		
Wild dog	<i>Canis lupus</i> subsp. -->	Intermittent use of reserve
European red fox	<i>Vulpes vulpes</i> -->^	Likely to occur
Feral pig	<i>Sus scrofa</i> -->^	Likely to occur
Cane toad	<i>Rhinella marina</i> ->^	Likely to occur
Cat	<i>Felis catus</i> ->^	Likely to occur

Declared 'noxious' under the *Noxious Weeds Act 1993* in Richmond Valley Local Government Area

- Key threatening process under Threatened Species Conservation Act
 Environment Protection and Biodiversity Conservation Act

> Key threatening process under

* Declared Weed of National Significance

~ Declared 'pest' under the *Local Land Services Act 2013*

^ Threat abatement plan endorsed for this species

Weed species such as whiskey grass, groundsel bush and lantana have been identified as having an impact on the biological and landscape values of the reserve. However, the low nutrient levels of the reserve have made it hard for exotic plant species to have a significant effect.

The main factor that contributes to the incidence of weeds in the reserve is the unintentional transport of weed species via cars and trucks to the western edge of the reserve where the

Pacific Highway forms the boundary. The illegal dumping of green waste along management trails is also a contributing factor.

Lantana is listed as a Weed of National Significance (WONS) and noxious weed in New South Wales. Lantana's establishment and spread is considered a key threatening process under the Threatened Species Conservation Act (NSW SC 2006a). Targeted control of lantana will be undertaken in accordance with the regional pest management strategy.

Cane toads have significant adverse impacts on native species include predation of native invertebrates, competition with native wildlife for food and habitat and poisoning native predators. The biological effects, including lethal toxic ingestion, caused by cane toads are listed as a key threatening process under the Environment Protection and Biodiversity Conservation Act (TSSC 2005). Invasion and establishment of the cane toad is also listed as a key threatening process under the Threatened Species Conservation Act (NSW SC 2006b).

Priorities for cane toad control in the reserve are guided by the *Management Plan for Cane Toads in National Parks and Reserves* (OEH 2013b) which focuses on the identification and eradication of outlier populations of cane toads. Bundjalung National Park which adjoins the reserve via Minyurnai Indigenous Protected Area has been identified as one of these outliers. Should cane toads be recorded in the reserve, the regional pest management strategy identifies that control of these populations would be a priority.

Feral pigs intermittently occur in low numbers across the reserve with their distribution being seasonal and dependent upon climatic conditions and food supply. 'Predation, habitat degradation, competition and disease transmission by feral pigs' is listed under the Threatened Species Conservation Act as a key threatening process (NSW SC 2004). Control of feral pigs will occur in accordance with a management strategy prepared for the reserve (NPWS 2012). Cooperative control of feral pigs is undertaken with Minyurnai Indigenous Protected Area when the feral pig populations increase locally.

Foxes also occur in the reserve. However, Tabbimoble Swamp Nature Reserve is not included as one of the 52 reserves that are listed as priority sites for fox control in the *NSW Threat Abatement Plan for Predation by the Red Fox* (OEH 2011b).

Wild dogs intermittently occur in the reserve. Wild dogs, including dingos, are a declared pest under the *Local Land Services Act 2013*. NPWS has a statutory obligation to control wild dogs on its estate. To balance the need to control wild dogs with the conservation of dingos, the *Pest Control Order for Wild Dogs* allows the general destruction obligation for lands listed under Schedule 2 of the Order to be satisfied through the preparation of a wild dog management plan. Tabbimoble Swamp Nature Reserve is listed on Schedule 2 and a wild dog management plan for the area encompassing the reserve has been prepared and approved (North Coast LHPA 2011). Although these lands can be managed for the conservation of dingos as a species, the public managers of Schedule 2 lands have a responsibility to protect livestock on adjoining lands from wild dog predation.

Feral cats are likely to occur in the reserve. Little is known about feral cat populations and their distribution. Technologies and techniques in feral cat control are advancing and may in the future provide opportunity for systematic control.

Myrtle rust is a plant disease caused by the exotic fungus, *Uredo rangelii*. It was first detected on the NSW Central Coast in 2010 and has established through coastal New South Wales from the Shoalhaven River north into Queensland. Myrtle rust infects young actively growing shoots, leaves, flower buds and fruits of plants in the Myrtaceae family. The spores of myrtle rust are spread by wind, animal dispersal and human activity (I&I NSW 2010).

Myrtle rust poses a significant threat to the biological values of the reserve. It is known to infect various species of Myrtaceae that occur in the reserve. A plan outlining how myrtle rust will be managed on national park estate has been developed and incorporates strategies to limit the

spread of myrtle rust and minimise the impacts to threatened species and ecological communities (OEH 2011a).

Desired outcomes

- Pest plants, animals and pathogens are controlled and where possible eliminated.
- Negative impacts of introduced species on reserve values are minimised.

Management response

4.1.1 Manage pest plants and animals in accordance with the regional pest management strategy and other relevant strategies.

4.1.2 Seek the cooperation of neighbours in implementing weed and pest animal control programs where relevant. Undertake relevant control in cooperation with the North Coast Local Land Services, Far North Coast County Council (Far North Coast Weeds) and Forestry Corporation of NSW.

4.1.3 Implement measures outlined in the *Management Plan for Myrtle Rust on the National Parks Estate*, including appropriate hygiene protocols during bush regeneration and general maintenance work to reduce the risk of myrtle rust infection and other potential pathogens.

4.2 Fire

The primary objectives of NPWS fire management are to protect life, property, community assets and cultural heritage from the adverse impacts of fire, while also managing fire regimes in parks to maintain and enhance biodiversity. NPWS also assists in developing fire management practices that contribute to conserving biodiversity and cultural heritage across the landscape, and implements cooperative and coordinated fire management arrangements with other fire authorities, neighbours and the community (OEH 2013a).

Fire is a natural feature of many environments and is essential for the survival of some plant communities. However, inappropriate fire regimes can lead to loss of particular plant and animal species and communities, and high frequency fires have been listed as a key threatening process under the Threatened Species Conservation Act (NSW SC 2000b).

Since 1975 there have been six fires in the area which is now the reserve. Wildfires in 1979–80, 1980–81, 1990–91 and 2001–02 burnt an area of 50 per cent or greater of Tabbimoble Swamp Nature Reserve.

The fire management approach for the reserve is included on sheet 2 of the *Bundjalung NP, Illuka NR and Tabbimoble Swamp NR Fire Management Strategy* (DEC 2006). The fire management strategy outlines the key assets within and adjoining the planning area, including sites of natural and cultural heritage value, fire management zones and fire control advantages such as management trails and water supply points. It also contains fire regime guidelines for conservation of the park's vegetation communities and is regularly updated to incorporate recent fire history.

NPWS maintains cooperative arrangements with surrounding landowners and the Rural Fire Service and is actively involved with the Northern Rivers Bush Fire Management Committee. Cooperative arrangements include fire planning, fuel management and information sharing. Hazard reduction programs, ecological burning proposals and fire trail works are submitted annually to the Bush Fire Management Committee.

Desired outcomes

- Negative impacts of fire on life, property and the environment are minimised.

- The potential for spread of bushfires on, from, or into the reserve is minimised.
- Fire regimes are appropriate for conservation of native plant and animal communities.

Management response

4.2.1 Implement the reserve fire management strategy.

4.2.2 Continue to be involved in the Northern Rivers Bush Fire Management Committee and maintain cooperative arrangements with local Rural Fire Service brigades, other fire authorities and surrounding landowners including the Minyundai Land Holding Aboriginal Corporation for fuel management and fire suppression.

4.3 Climate change

Human-induced climate change is listed as a key threatening process under the Threatened Species Conservation Act (NSW SC 2000a) and the associated loss of habitat is listed under the Environment Protection and Biodiversity Conservation Act (TSSC 2001).

The latest information on projected changes to climate are from the NSW and ACT Regional Climate Modelling (NARClm) project (OEH 2014). The climate projections for 2020–2039 are described as ‘near future’; and projections for 2060–2079 are described as ‘far future’. The snapshot shown in Table 4 is for the North Coast Region which includes the planning area (OEH 2014).

Table 4: North Coast climate change snapshot

Projected temperature changes	
Maximum temperatures are projected to increase in the near future by 0.4–1.0°C	Maximum temperatures are projected to increase in the far future by 1.5–2.4°C
Minimum temperatures are projected to increase in the near future by 0.5–1.0°C	Minimum temperatures are projected to increase in the far future by 1.6–2.5°C
The number of hot days will increase	The number of cold nights will decrease
Projected rainfall changes	
Rainfall is projected to decrease in winter	Rainfall is projected to increase in spring and autumn
Projected Forest Fire Danger Index changes	
Average fire weather is projected to increase during summer and spring	Severe fire weather days are projected to increase in summer and spring

Source: OEH 2014

Climate change may significantly affect biodiversity by changing the size of populations and the distribution of species, and altering the geographical extent and species composition of habitats and ecosystems. Climate change will also induce sea level rise, predicted to be 20–40 centimetres by 2050 and 45–90 centimetres by 2100. The projected increases in temperature, number of hot days and severe fire weather days (OEH 2014) are likely to influence bushfire frequency and intensity across the North Coast Region and result in an earlier start to the bushfire season (DECCW 2010b). Vulnerable ecosystems include saline wetlands, low-lying coastal ecosystems and fragmented forests and woodlands. However, more widespread and fire-adapted forests are likely to be relatively resistant to climate change and undergo more subtle changes (DECCW 2010a).

Expected declines in runoff in spring and winter and increased evaporation are likely to lead to drier soil conditions for most of the year. However it is likely there will be substantial increases in runoff in summer, causing rill and sheet erosion on slopes and exacerbated flooding on floodplains (DECCW 2010b). Sea level rise will also lead to rising water tables and, in permeable substrates, the saltwater table is likely to push fresh water towards the surface. Thus the hydrology of lowland freshwater ecosystems — such as the freshwater and forested wetlands in the reserve — is likely to change, which will likely change the vegetation in affected areas. This would be in addition to the structural and compositional changes of these fire-sensitive ecosystems that may also occur if fire extent increases.

More specific impacts of climate change on the reserve are difficult to assess since they depend on the compounding effects of other pressures, particularly barriers to migration and pressure from feral animals. Species most at risk are those unable to migrate or adapt, particularly those with small population sizes or with slow growth rates. Programs to reduce the pressures arising from other threats, such as invasive species and bushfires, will help reduce the severity of the effects of climate change. See Sections 4.1 and 4.2.

Desired outcome

- The impacts of climate change on natural systems are minimised.

Management response

4.3.1 Continue existing fire, pest animal and weed management programs to increase the reserve's ability to cope with future disturbances, including climate change.

5. Management operations and other uses

5.1 NPWS management facilities and operations

There is a network of management trails in the reserve which provide access for fire management and other operational activities (see Map 1). In accordance with NPWS policy, vehicle use of management trails is only available for NPWS authorised activities, mostly associated with essential reserve management. Use by the public is limited to bushwalking and cycling, and signage and gates may be installed if required to prevent unauthorised vehicular use (see Section 3.5).

There are several Crown road reserves which traverse the reserve (see Map 1) which do not form part of Tabbimoble Swamp Nature Reserve. One of these generally coincides with the alignment of Minyumai Road, a public road that provides access to lands east of the reserve, including Minyumai Indigenous Protected Area. Another in the reserve's south-west is parallel to the alignment of South Pacific Trail which is also used to access private property (see Section 5.2).

A section of road reserve in the north of the reserve is unmade (i.e. does not coincide with a constructed road) and is not distinguishable from the surrounding reserve.

Issues

- There may be an opportunity to consolidate the boundary of the reserve by incorporating the unused Crown road reserve into the reserve.
- Adjustments can be made to the reserve's boundaries under section 188C of the National Parks and Wildlife Act so that the alignment of Minyumai Road and South Pacific Trail coincide exactly with their Crown road reserves.

Desired outcomes

- An effective trail network is maintained for management purposes.
- The boundary of the reserve is consolidated as far as possible.

Management response

5.1.1 Maintain management trails to a dry weather four-wheel drive standard.

5.1.2 Install signposting on trails to provide direction.

5.1.3 Investigate incorporation of the unused Crown road reserve into the reserve.

5.1.4 Investigate an adjustment to the reserve's boundaries in the vicinity of South Pacific Trail and Minyumai Road to exclude the formed alignment of these roads.

5.2 Non-NPWS uses and operations

Private property access

There are several neighbouring or nearby private properties that are accessed by roads traversing the reserve. As discussed in Section 5.1, there are Crown road reserves for Minyumai Road and South Pacific Trail which need to be adjusted to coincide with the roads in use. The unnamed trail which runs south from South Pacific Trail to neighbouring private property is a Ministerial road — its corridor is Crown land vested in the Minister under Part 11 of the National Parks and Wildlife Act. It was excluded from the reserved area of Tabbimoble Swamp Nature Reserve to ensure the continuation of access arrangements that existed immediately before the reserve was established. Its management is subject to this plan and the NPW Regulation. This trail will be designated as a management trail and its corridor added to the reserve should it no longer be required for private property access. Any modification or

upgrade of this trail will only be permitted under the terms of a formal access agreement such as a licence. The corridor of South Pacific Trail is also retained as a Ministerial road, as an interim measure until the reserve's boundary is adjusted.

In accordance with the NPW Regulation and NPWS *Pets in Parks Policy*, pets and livestock may be transported by vehicle along these roads and trail provided they are en route to the private property and remain in the vehicle (NPWS 2015).

Apiary sites

There are four apiary sites within the reserve (see Map 1). These sites are maintained on a seasonal basis and pre-date the reserve's establishment. The NPWS *Beekeeping Policy* allows existing sites to continue but does not allow any new or additional sites (NPWS 2002).

Apiary sites in the reserve are limited in size and maintained by mowing or slashing. Access to apiary sites is via the Pacific Highway and access points along Minyumai Road and South Pacific Trail.

Desired outcome

- Non-NPWS uses, including private property access and beekeeping, have limited impacts on the reserve's values.

Management response

5.2.1 Continue to license and manage apiary sites in the reserve in accordance with NPWS policy and licence conditions.

6. Implementation

This plan of management establishes a scheme of operations for the reserve.

Identified activities for implementation are listed in Table 4. Relative priorities are allocated against each activity as follows:

- **High** priority activities are imperative to achieve the objectives and desired outcomes and must be undertaken in the near future to avoid significant deterioration in natural, cultural or management resources.
- **Medium** priority activities are necessary to achieve the objectives and desired outcomes but are not urgent.
- **Low** priority activities are desirable to achieve the objectives and desired outcomes but can wait until resources become available.
- **Ongoing** activities are undertaken on an annual basis or in response to an issue that arises.

This plan of management does not have a specific term and will stay in force until amended or replaced in accordance with the National Parks and Wildlife Act.

Table 5: Priorities of management responses

Management response	Priority*
3.1 Geology, landscape and hydrology	
3.1.1 As far as practicable, slashing for fuel reduction along trails, and use of management trails, will be avoided during wet periods.	Ongoing
3.1.2 Appropriate road drainage and sediment control will be implemented to minimise erosion.	Ongoing
3.2 Native plants and 3.3 Native animals	
3.2.1 & 3.3.1 Implement relevant strategies and actions in the <i>Priorities Action Statement</i> and recovery plans for threatened species, populations and ecological communities in the reserve. This will include implementation of appropriate pest and fire management.	High/ ongoing
3.2.2 Develop and maintain a 'green guide post system' identifying sensitive zones and spot locations for threatened plants, including swamp mint-bush along management trails in the reserve, to avoid disturbance to species when undertaking maintenance works.	Medium
3.3.2 Liaise and negotiate with relevant NSW Government agencies, including Roads and Maritime Services, regarding Pacific Highway upgrade routes to ensure alterations to hydrological regimes are minimised.	High
3.4 Aboriginal heritage	
3.4.1 Continue to consult and involve the Bundjalung People and other relevant Aboriginal community organisations in the management of the reserve, including the management of Aboriginal sites, places and cultural and natural values. This will include implementation of any negotiated Indigenous Land Use Agreement or other joint management arrangements.	High/ ongoing
3.4.2 Undertake an archaeological survey and cultural assessment prior to all works with the potential to impact Aboriginal sites or values.	Ongoing
3.4.3 Encourage further research into the Aboriginal cultural heritage values of the reserve with the Bundjalung People.	Medium

Management response	Priority*
3.5 Visitor use	
3.5.1 Manage the reserve for low-key, nature-based activities, such as birdwatching, cycling on management trails and bushwalking. Camping and horse riding will not be permitted in the reserve, and no visitor facilities will be provided.	Ongoing
3.5.2 Management trails may be periodically closed to visitor use during times of flooding or high rainfall.	Ongoing
3.5.3 Maintain current reserve boundary signage and if necessary install additional signage and gates on management trails to discourage illegal activities.	Medium
4.1 Introduced species	
4.1.1 Manage pest plants and animals in accordance with the regional pest management strategy and other relevant strategies.	Ongoing
4.1.2 Seek the cooperation of neighbours in implementing weed and pest control programs where relevant. Undertake relevant control in cooperation with the North Coast Local Land Services, Far North Coast County Council (Far North Coast Weeds) and Forestry Corporation of NSW.	Ongoing
4.1.3 Implement measures outlined in the <i>Management Plan for Myrtle Rust on the National Parks Estate</i> , including appropriate hygiene protocols during bush regeneration and general maintenance work to reduce the risk of myrtle rust infection and other potential pathogens.	Ongoing
4.2 Fire	
4.2.1 Implement the reserve fire management strategy.	Ongoing
4.2.2 Continue to be involved in the Northern Rivers Bush Fire Management Committee and maintain cooperative arrangements with local Rural Fire Service brigades, other fire authorities and surrounding landowners including the Minyumai Land Holding Aboriginal Corporation for fuel management and fire suppression.	Ongoing
4.3 Climate change	
4.3.1 Continue existing fire, pest and weed management programs to increase the reserve's ability to cope with future disturbances, including climate change.	Ongoing
5.1 NPWS management facilities and operations	
5.1.1 Maintain management trails to a dry weather four-wheel drive standard. Trails will be signposted to provide direction.	Ongoing
5.1.2 Install signposting on trails to provide direction.	Medium
5.1.3 Investigate incorporation of the unused Crown road reserve into the reserve.	Low
5.1.4 Investigate an adjustment to the reserve's boundaries in the vicinity of South Pacific Trail and Minyumai Road to exclude the formed alignment of these roads.	Low
5.2 Non-NPWS uses and operations	
5.2.1 Continue to license and manage apiary sites in the reserve in accordance with NPWS policy and licence conditions.	Ongoing

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