

MUNRO ISLAND NATURE RESERVE

PLAN OF MANAGEMENT

NSW National Parks and Wildlife Service

Part of the Department of Environment, Climate Change and Water

September 2009

This plan of management was adopted by the Minister for Climate Change and the Environment on 8th September 2009.

Acknowledgements

The NPWS acknowledges that this reserve is within the traditional country of the Yaegl people.

Cover: Aerial photos of Munro Island, demonstrating the rapid growth of the island. The main photo was taken in 2005. The inset photo is of the same section of the Clarence River taken in 1978. Images © Land and Property Management Authority www.lpma.nsw.gov.au, and used with permission.

Further Information

For additional information or inquiries on this reserve or this plan, contact the NPWS Clarence North Area Office at Level 3, 49 Victoria Street (PO Box 361), Grafton or by phone on (02) 6641-1500.

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FOREWORD

Munro Island Nature Reserve is located in the Clarence River, on the north coast of NSW. The reserve, which includes all of Munro Island down to the mean low water mark, is currently approximately 27 hectares in size. Munro Island is one of only four islands included in the protected area system out of the forty islands within the Clarence River system.

The reserve protects a diversity of habitats within a relatively small area, including mangroves and estuarine intertidal zones, as well as developing rainforest and swamp sclerophyll communities. These habitats support a high diversity of bird species, including songbirds, shorebirds and birds of prey. Fourteen significant bird species, including two species listed as threatened in NSW and twelve migratory species protected by Commonwealth legislation and international agreements, have been recorded using the feeding and roosting habitat available on the island, particularly the sandflats and intertidal zones.

The New South Wales *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 an area will be managed in the years ahead.

A draft plan of management for Munro Island Nature Reserve was placed on public exhibition from 7th October 2005 until 30th January 2006. The submissions received were carefully considered before adopting this plan.

This plan contains a number of actions to achieve “Better environmental outcomes for native vegetation, biodiversity, land, rivers, and coastal waterways” (Priority E4 in the State Plan) including flora and fauna surveys and monitoring, preparation and implementation of a pest species management strategy, and fire management strategies.

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

Carmel Tebbutt MP
Deputy Premier
Minister for Climate Change and 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 the legislative and policy framework, primarily the *National Parks and Wildlife Act 1974* (NPW Act), the *National Parks and Wildlife Regulation (2002)* (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 are compiled 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. For example, the NSW *Environmental Planning and Assessment Act 1979* (EPA Act) requires the assessment and mitigation of environmental impacts of any works proposed in this plan. In addition, the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) relates to the protection of listed threatened species and other matters of National Environmental Significance, such as the protection of listed migratory species.

The NPWS has obligations relating to the management of the reserve under international agreements and conventions ratified by the Australian Government, as a number of species listed in these agreements have been observed within the reserve. These agreements are:

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

The plan of management is a statutory document under the NPW Act. Once the Minister has adopted a plan, no operations may be undertaken within Munro Island Nature Reserve except in accordance with the plan. The plan will also apply to any future additions to the nature reserve. Where management strategies or works are proposed for the reserve or any additions that are not consistent with the plan, an amendment to the plan will be required.

1.2 MANAGEMENT PURPOSES AND PRINCIPLES

Nature reserves are dedicated 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.

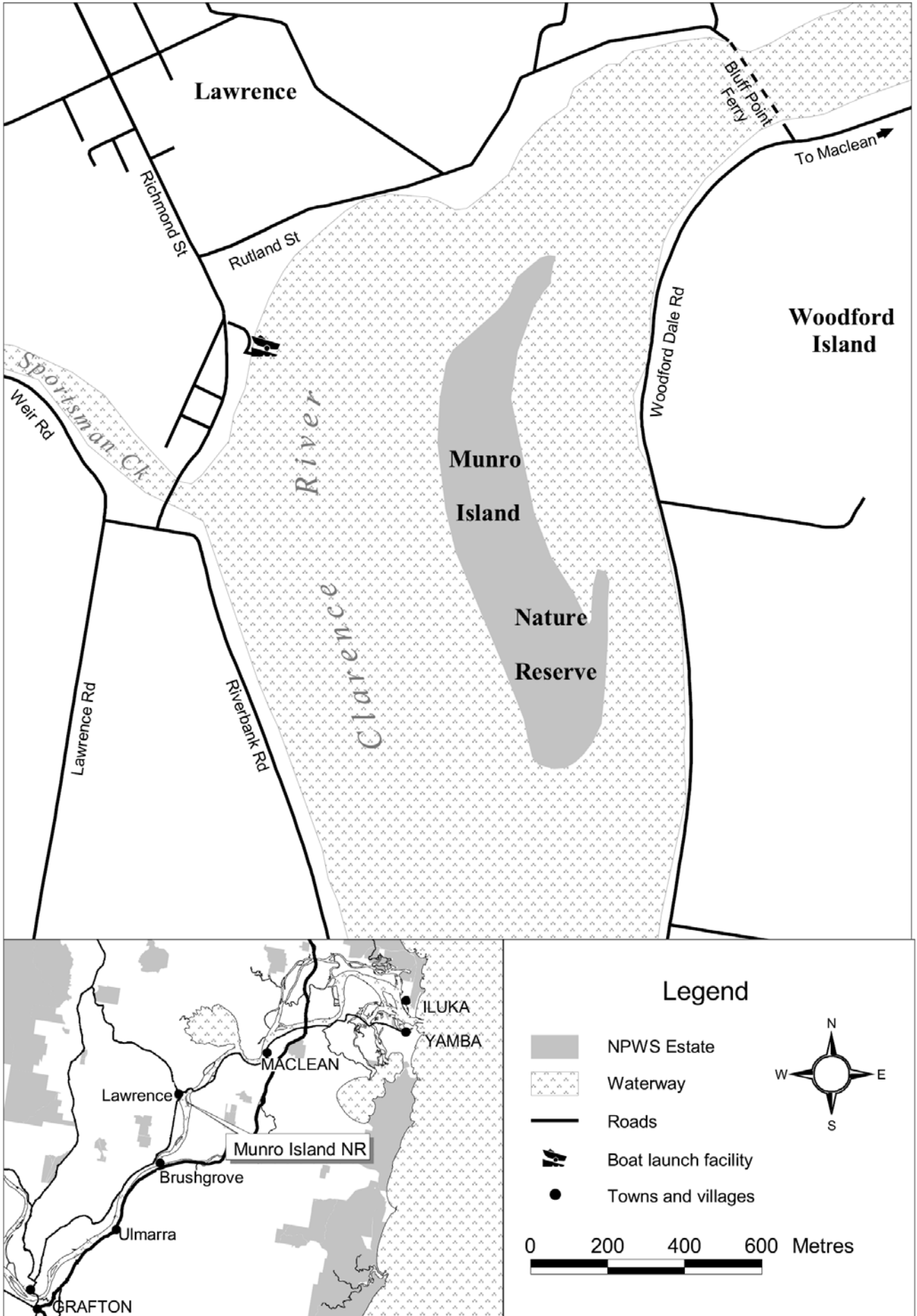
Nature reserves differ from national parks in that they do not have as a management principle to provide for visitor use.

1.3 MANAGEMENT DIRECTIONS

The primary emphasis of this plan is the conservation of the natural and cultural values. The following specific objectives apply to the management of Munro Island Nature Reserve:

- conserve the full range of native flora and fauna, with an emphasis on the developing native vegetation communities and conservation of significant species;
- reduce the impact on reserve flora and fauna communities from weed and pest animal species;
- protect native vegetation and reserve signage from the impacts of fire;
- protect reserve values from inappropriate recreational uses, rubbish dumping and arson; and
- provide for use of the reserve for low impact, self-reliant recreation and scientific investigation, consistent with its values and nature reserve classification.

2. MAP OF MUNRO ISLAND NATURE RESERVE



3. MUNRO ISLAND NATURE RESERVE

3.1 LOCATION, GAZETTAL AND REGIONAL SETTING

Munro Island Nature Reserve (herein referred to as “the reserve”) is located in the Clarence River, one kilometre south east of the village of Lawrence (29°30.3'S, 153°6.3'E) and approximately ten kilometres to the south west of Maclean, on the north coast of NSW (see map). The reserve, which includes all of Munro Island down to the mean low water mark, was gazetted in 1999 and was formerly vacant Crown land. It is currently approximately 27 hectares in size. This area will change as the shape and size of the island changes due to fluvial processes.

The island was named in 1982 after the Munro family that has held land in the vicinity of the reserve since the area was settled. The nature reserve was given the same name as the island.

The Clarence River is a major feature within the region, playing a significant part in shaping the surrounding landscape over time. Munro Island is located adjacent to Woodford Island, the largest island within the Clarence River. The landscape surrounding the reserve supports a range of other landuses and activities, including commercial and recreational fishing, sugar cane farming, cattle grazing, village and rural residential areas, a golf course and State forest. Large parts of the catchment have been cleared of native vegetation for agriculture and have varying degrees of rural residential development.

Munro Island is one of forty islands within the Clarence River system, including several at the confluence of the Esk and Clarence Rivers. The majority of these islands are located downstream of the reserve, closer to the river mouth, with only four islands located upstream of the reserve. Munro Island is one of only four islands in the Clarence River included in the protected area system.

The reserve falls within the Clarence Valley local government area and within the boundaries of the Northern Rivers Catchment Management Authority and the Yaegl Local Aboriginal Land Council.

3.2 LANDSCAPE CONTEXT

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

The reserve protects a diversity of habitats within a relatively small area, including mangroves and estuarine intertidal zones, as well as developing rainforest and swamp sclerophyll communities. These habitats support a high diversity of bird species, including songbirds, shorebirds and birds of prey.

Munro Island Nature Reserve is one of a few reserves that contain estuarine intertidal habitats in the North Coast Bioregion. The reserve is one of only three that incorporate the intertidal zone of the Clarence River estuary in protected areas. Clarence Estuary Nature Reserve and part of Bundjalung National Park also protect estuarine intertidal

environments of the Clarence River system. Together these marine protected areas comprise approximately 27 hectares, which is less than 0.02% of the 15,600 hectares of water covered by the Clarence River estuary.

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.

The reserve occupies part of a landscape of importance to local Aboriginal people. The Clarence River system including the river itself, islands within the channel, the estuary and the surrounding floodplains are of significance to the Yaegl Aboriginal community.

3.3 NATURAL AND CULTURAL HERITAGE

3.3.1 Landform, Soils and Hydrology

Munro Island is comprised of alluvial materials such as sand, clay and loamy sediments sourced from the upstream tributaries and surrounding catchment and deposited by the Clarence River. Elevation in the reserve ranges to approximately 2 metres above sea level, with slopes of less than 10 degrees.

The island has formed to its current state as a result of natural riverine processes, accelerated by the effects of landuses in the surrounding and upstream catchment. A range of landuse activities in the catchment has elevated natural soil erosion rates, contributing increased sediment loads to the Clarence River system. Sediments deposited by river currents and tidal fluctuations over time, resulted in the development of a small midstream island. As conditions became suitable, vegetation established on the island, supporting continuing sediment accumulation.

It is reported by local residents that until approximately the 1960s the island was a tidal sandbar, only exposed at low tide. Attempts were made to dredge the island to prevent it forming a hazard to shipping. Following the deposition of flood debris, salt-tolerant vegetation began to colonise the sandbar and build up the soil profile, allowing the development of more vegetation species. In 1979 the vegetation on the island was cleared, as part of a program to improve the flow of floodwaters, but re-established quickly with dense stands of casuarina or she-oaks (*Allocasuarina glauca*).

The reserve boundary extends to the mean low water mark, meaning that part of the reserve is tidally inundated. A small tidally-flushed channel is located on the eastern side of the island.

An assessment of the health of rivers in NSW has rated the Clarence River as a stressed river system and water quality is variable (Healthy Rivers Commission 1999). While increased sediments in the river contribute to the growth of the island through the deposition of soil, flood events can result in bank erosion as well as soil deposition, damage to vegetation and the import of weed propagules. High velocity floods are generally the most destructive.

3.3.2 Native Plants

Vegetation on the reserve is evolving through natural successional stages that are linked to changes in the island over time. Vegetation structure and floristic composition is strongly influenced by the riverine processes which continue to physically shape the island, as well as introduce new plant materials in river water and sediment.

As the sandbar developed into a small island, the vegetation types that could survive there also developed and changed. Salt tolerant native vegetation and weed species began to colonise the sandspit as the soil profile built up and the area was no longer totally inundated with each tidal cycle. As vegetation continues to develop, sediments also continue to accumulate, increasingly stabilised by plant root systems and debris washing up on the surface. Increasing elevation has allowed larger plants such as eucalypt and rainforest pioneer species to establish, along with more invasive weed species.

A canopy has begun to form in some parts on the island, with native rainforest species competing strongly with exotic plant species. Species recorded on the island are listed in Table 1. Swamp sclerophyll forest is developing, particularly on higher ground. Mangroves have established along the eastern side of the reserve where the river is shallower and the currents are not as strong. Mangroves act as a sediment trap and provide habitat for many species of fish and crustaceans, and are protected under the NSW *Fisheries Management Act 1994*.

Whilst much of the island surface now supports trees and shrubs, there remain some areas of higher ground which are mostly covered by exotic grasses and herbaceous weeds. This may be the result of clearing by people visiting the island, or the result of fires lit in those areas.

No regionally significant species have been recorded, however, a comprehensive flora survey has not been undertaken in the reserve. The vegetation that is present now has the potential to develop into swamp sclerophyll forest and sub-tropical rainforest vegetation communities. Lowland rainforest vegetation on floodplains is listed as an endangered ecological community in the NSW north coast bioregion under the TSC Act.

Table 1 Native plant species recorded within the reserve

Common Name	Scientific Name
blackbean	<i>Castanospermum australe</i>
casuarina	<i>Allocasuarina glauca</i>
common reed	<i>Phragmites australis</i>
forest red gum	<i>Eucalyptus tereticornis</i>
green wattle	<i>Acacia irrorata</i> subsp. <i>velutina</i>
grey mangrove	<i>Avicennia marina</i>
native couch grass	<i>Cynodon dactylon</i>
river mangrove	<i>Aegiceras corniculatum</i>
sally wattle	<i>Acacia melanoxylon</i>
white cedar	<i>Melia azederach</i>

3.3.3 Native Animals

A range of habitat values are represented within the reserve, including developing rainforest and swamp sclerophyll forest, tidally influenced mangrove communities and

sandflats. No formal fauna surveys have been conducted in the reserve, however, a total of 42 native animal species have been recorded in the reserve to date. The reserve features a high diversity of bird life for its size due to the variety of habitat types in and around the reserve. A mix of waterfowl, seabirds and shorebirds, diurnal birds of prey and songbirds have been recorded using the area.

Fourteen significant bird species, including two species listed as threatened in NSW and twelve migratory species protected by Commonwealth legislation and international agreements, have been recorded using the feeding and roosting habitat available on the island, particularly the sandflats and intertidal zones (refer to Table 2). Some of these species, such as the pied oystercatcher (*Haematopus longirostris*) have been regularly observed on the island and may be using the site for nesting.

Table 2 Significant native bird species recorded within the reserve

Common Name	Scientific Name	Status
black-fronted dotterel	<i>Elseyaornis melanops</i>	protected migratory species (EPBC Act)
black-necked stork	<i>Ephippiorhynchus asiaticus</i>	Endangered (TSC Act)
brahminy kite	<i>Haliastur indus</i>	protected migratory species (EPBC Act)
common tern	<i>Sterna hirundo</i>	protected migratory species (EPBC Act)
grey teal	<i>Anas gibberifrons</i>	protected migratory species (EPBC Act)
masked lapwing	<i>Vanellus miles</i>	protected migratory species (EPBC Act)
pacific black duck	<i>Anas superciliosa</i>	protected migratory species (EPBC Act)
pacific golden plover	<i>Pluvialis fulva</i>	protected migratory species (EPBC Act)
peregrine falcon	<i>Falco peregrinus</i>	protected migratory species (EPBC Act)
pied oystercatcher	<i>Haematopus longirostris</i>	Vulnerable (TSC Act)
red-capped plover	<i>Charadrius ruficapillus</i>	protected migratory species (EPBC Act)
whistling kite	<i>Haliastur sphenurus</i>	protected migratory species (EPBC Act)
white egret	<i>Egreta alba</i>	protected migratory species (EPBC Act)
white-bellied sea eagle	<i>Haliaeetus leucogaster</i>	protected migratory species (EPBC Act)

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

The intertidal zone surrounding the island also provides important habitat for a variety of crustacean species and fish. Mangroves are particularly important to many marine species for part or all of their lifecycle stages.

Other fauna likely to use habitat in the reserve are nocturnal species including owls, insectivorous bats and flying foxes, ground dwelling mammals such as native rats, small reptiles, molluscs and numerous insect species.

3.3.4 Aboriginal Heritage

Aboriginal interests in rivers and the landscape manifest themselves in a variety of ways that reflect traditional and contemporary relationships to country (Behrendt and Thompson 2003). Several Islands within the Clarence River are of cultural value to the Yaegl community. For example, Ulahgundi Island is the site of a former Aboriginal reserve and mission, while Micalo Island further downstream contains a burial site and a large shell midden. Although Munro Island itself has formed relatively recently, it comprises part of the

cultural and spiritual landscape of the Clarence River and, as such, is of contemporary cultural significance to local Aboriginal people (Deidrie King pers. comm.).

No Aboriginal sites or artefacts have been recorded in the reserve.

3.3.5 Historic heritage

There are no historic features recorded on the island. However, the reserve has historically been used for recreation by the local community (refer to section 3.4).

3.4 ACCESS AND VISITOR USE

The reserve is accessible by boat, with the nearest boat ramp at the village of Lawrence on the western bank of the Clarence River opposite the reserve. There are no roads, trails or recreational facilities on the island. Signage identifying the island as a nature reserve is located on both the eastern and western shores, at the most convenient landing points.

As Munro Island has developed in the landscape over time, use of the area has also changed. Members of the local community have used the area for both recreational and commercial fishing and bait collection since the island was a small sandspit. Many local families and young people have grown up swimming and boating from and around the island. Fishing activities have continued to the present time, particularly line and net fishing. An annual speedboat race includes that stretch of the Clarence River, although as the island has increased in size, only the western channel is now used for high speed boating.

The reserve currently receives low levels of use for fishing, as well as low-impact, self-sufficient, nature based recreation, such as bird watching and bush walking. The reserve is subject to higher levels of seasonal visitation during the summer period, including camping which is not permitted in the reserve because it cannot be sustainably managed and is not consistent with the island's classification as a nature reserve.

3.5 OTHER USES

Commercial fishing operators have historically used the area around Munro Island and this use has continued as the island has developed to its current state. All fishing activities in NSW waters are regulated under *Fisheries Management Act 1994*. Commercial fishing around Munro Island and other estuary environments in NSW must be in accordance with the Fishery Management Strategy for the Estuary General Fishery (NSW Fisheries 2003). Both commercial and recreational fishing must also be in accordance with licence conditions specified by NSW Fisheries.

Gazettal of the Munro Island Nature Reserve to the mean low water mark has not changed this authority and existing commercial fishing operations will continue to be managed by NSW Fisheries. This includes island-based hauling of nets by hand while standing on the island, whether this is below or above the mean high water mark.

Commercial and recreational fishing species targeted in the reserve and surrounding areas include bully mullet, dusky flathead, school prawns and mulloway (jewfish) with smaller quantities of yellowfin bream and sand whiting taken. Recreational fishermen also

undertake prawning and bait collection on parts of the intertidal sandflats surrounding the island. Fisheries closures and commercial restrictions on fisheries operations may apply.

3.6 THREATS TO RESERVE VALUES

3.6.1 Inappropriate Use

The reserve is subject to higher levels of seasonal visitation during the summer period, including camping, which is not permitted in the reserve. Signs have been vandalised and burnt, and native vegetation has been cut down and used for firewood, creating bare areas and promoting the spread of weeds. Large amounts of rubbish have been dumped on the island, as well as being washed up by floods and tidal action. Broken glass, litter and toilet wastes have been left in parts of the reserve. Several small vessels in various states of decay have been left on the island.

3.6.2 Fire

Fire is a natural feature of the landscape of which the reserve is part and is essential to the survival of some plant communities. It is one of the continuing physical factors influencing the Australian environment. However, inappropriate fire regimes have been identified as a key threatening process affecting the biological diversity of NSW as frequent fire can cause loss of particular plant and animal species and communities.

The fire history of the reserve is poorly recorded. Since gazettal there have been at least two fires, both of which are believed to have been the result of arson. The fire in October 2005 was relatively large, burning approximately 15 hectares of the reserve. There is evidence of numerous campfires being lit in the reserve, particularly around the more cleared areas.

NPWS regards cooperative fire management as essential for the protection of life and surrounding property, as well as for protection of the natural and cultural heritage of the reserve. An important aspect of fire management for the NPWS is participation as a member of the Clarence Valley Zone Bush Fire Management Committee and preparation of district bushfire management plans for the area covered by this committee.

The NPWS is a fire authority under the *Rural Fires Act 1997* that is required to implement the provisions of district fire management plans. Management of NPWS estate is in accordance with the adopted state-wide NPWS Strategy for Fire Management (2003). A recent review of fire management by NPWS has resulted in a modified approach based on the level of complexity involved. In regard to Munro Island Nature Reserve, the NPWS considers that it is appropriate to include the specific fire management strategies for the reserve in this plan of management. Programs are also submitted to the district Bush Fire Management Committee.

NPWS uses a system of zones that are compatible with District Bushfire Management Committee (DBFMC) risk management plans. NPWS has assessed Munro Island Nature Reserve for fire management purposes. The reserve constitutes a very low bushfire risk to community assets and low risk to environmental assets. It is proposed to manage the reserve as a Land Management Zone (LMZ) in accordance with the NPWS Strategy for Fire Management (2003) and the Clarence Valley Zone Bush Fire Management Committee Risk Management Plan. The primary fire management objective within this

zone is to protect plant and animal species that are known to occur naturally within the reserve.

The reserve has been designated as a LMZ because it is not adjacent to built assets which would be exposed to a high level of bushfire risk, and does not have a history of bushfire ignitions or known areas of high bushfire potential. The LMZ does not require intensive management and focuses on those actions appropriate to conserve biodiversity and cultural heritage of the reserve and its developing plant communities. Management will aim to maintain biodiversity by ensuring that recommended fire thresholds are not exceeded, and by excluding fire from fire sensitive communities such as mangroves and developing rainforest.

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 that marks a critical change from high species diversity to low species diversity. In areas that are developing into a swamp sclerophyll forest type fire intervals should be from between 7 and 35 years. Fire should be excluded from developing rainforest and mangrove communities (NPWS 2003).

3.6.3 Introduced Plants and Animals

Munro Island Nature Reserve is affected by severe infestations of a large number of weed species and, due to its position in the landscape, is readily susceptible to ongoing weed invasion. The reserve suffers a high level of exposure to weed seeds and propagules carried by passing river flows, and those contained in sediments accumulating on the island from tidal and flood events.

NPWS weed control activity within the region is conducted in accordance with the North Coast Region Pest Management Strategy (NPWS 2002). This strategy has been developed for the region as a whole and identifies pest populations, priorities for control and control programs. In addition, a weed management strategy will be developed and implemented for the reserve. Weed species will be assessed and prioritised according to threat to biodiversity, legal obligations for control under the *Noxious Weeds Act 1993* and how invasive each species is. The strategy will detail a coordinated approach to weed control in the reserve that will aim to promote habitat development for native species throughout the regeneration process.

While weed treatment will generally follow a 'bush regeneration' approach, priority will be directed at controlling weeds listed under the Noxious Weeds Act, such as lantana (*Lantana camara*) and groundsel bush (*Baccharis halimifolia*). Given the continuing introduction of weed material, new infestations will need to be controlled as they arise.

Table 3 Weed species recorded in the reserve (as at February 2007)

Common Name	Scientific Name	Status *
turkey rhubarb	<i>Acetosa sagittata</i>	
blue billygoat weed	<i>Ageratum houstonianum</i>	
moth vine	<i>Araujia sericifera</i>	
groundsel bush	<i>Baccharis halimifolia</i>	Noxious
balloon vine	<i>Cardiospermum grandiflorum</i>	
Indian coral tree	<i>Erythrina sykesii</i> (syn. <i>E. lysistemon</i>)	
moon flower	<i>Ipomoea alba</i>	
morning glory	<i>Ipomoea indica</i>	
lantana	<i>Lantana camara</i>	Noxious
cat's claw creeper	<i>Macfadyena unguis-cati</i>	
black mulberry	<i>Morus nigra</i>	
smooth tree pear	<i>Opuntia monacantha</i>	Noxious
albizzia	<i>Paraserianthus lophantha</i>	
Barner grass	<i>Pennisetum purpureum</i>	
castor oil plant	<i>Ricinus communis</i>	
coral berry	<i>Rivina humilus</i>	
weeping willow	<i>Salix babylonica</i>	
red salvia	<i>Salvia coccinea</i>	
fireweed	<i>Senecio madagascariensis</i>	
wild tobacco bush	<i>Solanum mauritianum</i>	
stinking roger	<i>Tagetes minuta</i>	
talinum	<i>Talinum paniculatum</i>	

In addition to the species listed in the table above, a number of exotic grasses occur in the reserve.

No introduced animals have been recorded on Munro Island to date.

3.6.4 Climate Change

Climate change has been listed as a key threatening process under the TSC Act. Projections of future changes in climate for NSW include higher temperatures, increasing sea levels and water temperatures, elevated CO₂, more intense but possibly reduced annual average rainfall, increased temperature extremes and higher evaporation. These changes are likely to lead to greater intensity, duration and frequency of fires, more severe droughts and increased regional flooding.

Climate change may significantly affect biodiversity by changing population size and distribution of species, modifying species composition, and altering the geographical extent of habitats and ecosystems. Species most at risk are those unable to migrate or adapt, particularly those with small population sizes or with slow growth rates. The potential impact of climate change is difficult to assess since it depends on the compounding effects of other pressures, particularly barriers to migration and pressure from weeds and feral animals. Programs to reduce pressures arising from such threats will help reduce the severity of the effects of climate change.

4. MANAGEMENT ISSUES AND STRATEGIES

Current Situation	Desired Outcomes	Strategies	Priority
<p>4.1 Soil and water conservation</p> <p>Currently there is no significant threat of soil erosion occurring in the reserve. Sediments are accreting due to natural riverine processes and are gradually increasing the extent of the reserve, particularly on the eastern side.</p> <p>An assessment of the health of rivers in NSW has rated the Clarence River as a stressed river system and water quality is variable (Healthy Rivers Commission 1999).</p>	<ul style="list-style-type: none"> • There is no evidence of increased soil erosion from reserve management activities and visitor use. • There is no reduction in the water quality and health of watercourses in and around the reserve. • Natural flow regimes are maintained. 	<p>4.1.1 Undertake all works, particularly weed control and rubbish removal in a manner that minimises erosion and water pollution.</p> <p>4.1.2 Liaise with local authorities to maintain and improve water quality in the reserve's catchments.</p> <p>4.1.3 Promote the establishment and regeneration of native vegetation in disturbed areas to reduce erosion potential and sedimentation of streams.</p>	<p>High</p> <p>Low</p> <p>High</p>

Current Situation	Desired Outcomes	Strategies	Priority
<p>4.2 Native plant and animal conservation</p> <p>Flora and fauna surveys have not been undertaken in the reserve and are required to identify significant species and/or communities within the reserve.</p> <p>Rainforest species occupying a portion of the reserve are sensitive to fire. Native vegetation on the reserve is competing with moderate to severe weed infestation and has been damaged by inappropriate use, vandalism and unplanned fires.</p>	<ul style="list-style-type: none"> • There is no reduction in the diversity of native plants, animals or populations in the reserve, particularly significant species. • There is an increased understanding and knowledge of the ecological needs and characteristics of plants and animals. • Cleared and disturbed areas in the reserve that are not required for management purposes are rehabilitated. • Further development of native vegetation and associated habitat values is encouraged. 	<p>4.2.1 Undertake or encourage flora and fauna surveys and other appropriate research that increases knowledge of native plants and animals within the reserve, their populations, distribution and ecological needs.</p> <p>4.2.2 Monitor weed invasion and control in conjunction with the development and recovery of native vegetation through annual inspections and reporting and use of fixed photographic points to provide a visual record over time (refer to <i>Introduced species</i>).</p> <p>4.2.3 Implement measures included in recovery plans for threatened species as required and as resources allow.</p>	<p>Medium</p> <p>Medium</p> <p>Medium</p>

Current Situation	Desired Outcomes	Strategies	Priority
<p>4.3 Cultural heritage</p> <p>The area is located within the Yaegl Local Aboriginal Land Council area and is of significance to the Yaegl Aboriginal community.</p> <p>Although Munro Island has formed relatively recently, it is within the Clarence River, which has cultural significance for local Aboriginal people.</p> <p>The reserve has also been used by the local community as a recreation area. Commercial and recreational fishing also occur in the area.</p> <p>Due to its recent formation, it contains no Aboriginal or historic sites.</p>	<ul style="list-style-type: none"> • Cultural heritage features are identified, conserved and managed in accordance with their significance. • Aboriginal heritage values are protected in partnership with the local Aboriginal community. 	<p>4.3.1 Consult and involve the Yaegl Local Aboriginal Land Council in management of the reserve.</p> <p>4.3.2 Consult with the local community regarding the heritage values of the reserve.</p>	<p>Medium</p> <p>Medium</p>

Current Situation	Desired Outcomes	Strategies	Priority
<p>4.4 Visitor use</p> <p>Opportunities exist for low key, nature-based activities on the reserve and visitors are encouraged to be self-reliant. No visitor facilities exist within the reserve.</p> <p>Inappropriate use of reserve does occur including camping and vandalism, which has caused some damage to the natural values of the reserve.</p> <p>Commercial and recreational fishing occurs from and around the reserve and is managed by NSW Fisheries.</p>	<ul style="list-style-type: none"> • Visitor use is ecologically sustainable. • The local community is aware of the significance of the area and of management programs. 	<p>4.4.1 Provide regulatory and minimal impact use information at the two main landing areas in the reserve.</p> <p>4.4.2 Promote community understanding and appreciation of the conservation values of the reserve and adopted management strategies.</p> <p>4.4.3 Permit use for fishing, as well as low key, nature-based activities such as walking, bird watching, and swimming.</p> <p>4.4.4 Permit organised group educational visits, subject to limits on numbers and other conditions if necessary to minimise impacts.</p> <p>4.4.5 Prohibit camping, fireworks, campfires and firewood collection in the reserve.</p> <p>4.4.6 Monitor levels and impacts of visitor use by regular inspections of the reserve and law enforcement if required.</p>	<p>High</p> <p>Medium</p> <p>Low</p> <p>Low</p> <p>High</p> <p>Low</p>

Current Situation	Desired Outcomes	Strategies	Priority
<p>4.5 Management operations and other uses</p> <p>There are no management trails or any other management facilities in the reserve.</p> <p>Commercial and recreational fishing occurs from and around the reserve. These activities must be licensed under the Fisheries Management Act and are controlled by NSW Fisheries.</p> <p>Reserve signage is in place on the island but has been repeatedly vandalised in the past.</p> <p>Dumped and washed up rubbish, including decaying vessels, has accumulated on the reserve.</p>	<ul style="list-style-type: none"> • Management activities have acceptable impact. • Non-NPWS uses are managed in accordance with environmental legislation and impacts to the reserve are minimised. • Threats to reserve values are removed or minimised. 	<p>4.5.1 Maintain reserve signage on the island. No management or other facilities will be constructed on the reserve.</p> <p>4.5.2 Work cooperatively with NSW Fisheries to ensure that activities licensed under the Fisheries Management Act have minimal impact on reserve values.</p> <p>4.5.3 Remove the rubbish, including decaying vessels, from the reserve.</p>	<p>High</p> <p>Medium</p> <p>Medium</p>

Current Situation	Desired Outcomes	Strategies	Priority
<p>4.6 Fire management</p> <p>Fire is a natural feature of the environment and is essential to the survival of some plant communities. Frequent or regular fire, however, can cause loss of particular plant and animal species and communities.</p> <p>Due to the reserve being an island within the Clarence River, there is little possibility for fire on neighbouring properties to threaten the reserve, or vice versa.</p> <p>Vegetation communities developing in the reserve includes swamp sclerophyll forest and some rainforest species. Fire intervals for swamp sclerophyll forest should generally be within 7 to 35 years, whilst fire should be excluded from rainforest and mangroves. A large fire burnt most of the island's vegetation in 2005.</p> <p>The most convenient water source for fire fighting is the surrounding Clarence River.</p> <p>The reserve has been designated as a LMZ because it is not adjacent to built assets which would be exposed to a high level of bushfire risk, and does not have a history of bushfire ignitions or known areas of high bushfire potential.</p>	<ul style="list-style-type: none"> • Life, property and natural values in the reserve are protected from bushfire. • Fire regimes are appropriate for conservation of plant and animal communities. 	<p>4.6.1 Participate in the Clarence Valley Zone Bush Fire Management Committee. Maintain coordination and cooperation with Rural Fire Service brigades and fire control officers with regard to fuel management and fire suppression.</p> <p>4.6.2 Manage the reserve as a LMZ.</p> <p>4.6.3 Manage the reserve within the prescribed fire intervals, including to exclude fire from fire sensitive communities such as rainforest and mangroves, where possible.</p> <p>4.6.4 Promote the development and regeneration of native vegetation in disturbed or degraded areas by implementing more appropriate fire regimes.</p> <p>4.6.5 Encourage further research into the ecological effects of fire in the reserve and monitor any impacts from fire within the reserve.</p>	<p>High</p> <p>High</p> <p>Low</p> <p>Low</p> <p>Medium</p>

Current Situation	Desired Outcomes	Strategies	Priority
<p>4.7 Introduced species</p> <p>Munro Island is affected by a significant weed problem. A variety of weed species are well established and are suppressing development and regeneration of native plant species. To date, weed control has focussed on groundsel bush, a noxious weed. There are no pest animal species recorded in the reserve to date.</p> <p>It will be necessary to evaluate pest species populations in, or likely to invade, the reserve in order to develop an effective control strategy.</p> <p>Significant resources will be required to address the current weed infestation on the island. Weed control will be required on an ongoing basis and will need to be regularly monitored to assess control effectiveness and follow-up requirements.</p>	<ul style="list-style-type: none"> • The impact of introduced species on native species on the island and on downstream lands is minimised. • Control of introduced species has minimal impact on native species. 	<p>4.7.1 Conduct or encourage a weed and pest animal species survey to identify specific threats to reserve values.</p> <p>4.7.2 Prepare and implement a pest species management strategy for the reserve that aims to control noxious weeds and promote regeneration of native vegetation.</p> <p>4.7.3 Control priority introduced species in accordance with the pest species management strategy.</p> <p>4.7.4 Monitor the results of pest species management and regularly inspect the reserve for outbreaks of any new pest species.</p> <p>4.7.5 Use weed control techniques that minimise soil exposure and undertake works to encourage native revegetation following weed control.</p>	<p>Medium</p> <p>Medium</p> <p>Medium</p> <p>Medium</p> <p>High</p>

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.

5. REFERENCES AND BIBLIOGRAPHY

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Personal Communications

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