NSW GOVERNMENT
Office of Environment & Heritage
NSW National Parks & Wildlife Service

Plan of Management

Quanda Nature Reserve

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NSW National Parks and Wildlife Service

September 2012

This plan of management was adopted by the Minister for the Environment on 27th November 2012.

Acknowledgments

The NPWS acknowledges that Quanda Nature Reserve is in the traditional country of the Ngiyampaa Wangaaypuwan people.

This plan of management is based on a draft plan prepared by staff of the Western Rivers Region of the NSW National Parks and Wildlife Service (NPWS), part of the Office of Environment and Heritage, Department of Premier and Cabinet.

FRONT COVER: Isolated patch of Mallee and Red Box Open Woodland dominated by taller "bull" type mallee trees of pointed mallee (*Eucalyptus socialis*), with tall shrub understorey of wilga (*Geijera parvifolia*), scattered budda (*Eremophila mitchellii*), tar bush (*Eremophila glabra*) and sticky hopbush (*Dodonaea viscosa* subsp. *spatulata*). Photo by Marianne F. Porteners (2003) from *Vegetation Survey of Quanda Nature Reserve – Report to the NSW National Parks and Wildlife Service.*

For additional information or any inquiries about this park or this plan of management, contact the NPWS Cobar Office, PO Box 453, Cobar NSW, 2835 or by telephone on 02 6836 2692.

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Foreword

Quanda Nature Reserve is 4,748 hectares in size and is located south-east of Cobar and south-west of Nyngan in western New South Wales.

Quanda Nature Reserve contains three vegetation communities which are poorly conserved, Mallee and Red Box Open Woodland, Mallee Shrubland with Spinifex and Open Box Woodland. It also conserves one threatened plant species, and ten threatened fauna species including the endangered kultarr and the vulnerable superb parrot. A large number of Aboriginal sites are present on the reserve, including scarred trees.

The New South Wales *National Parks and Wildlife Act 1974* requires that a plan of management be prepared for each nature reserve. A draft plan of management for Quanda Nature Reserve was placed on public exhibition from 27 January to 30 April 2012. The submissions received were carefully considered before adopting this plan.

The plan contains a number of actions to achieve the NSW 2021 goal to protect our natural environment, including actions to assist the recovery of threatened species, continued control of introduced plants and animals, encouraging research into the impacts of climate change, and preparation and implementation of a revised fire management strategy for the reserve.

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

Robyn Parker MP
Minister for the Environment

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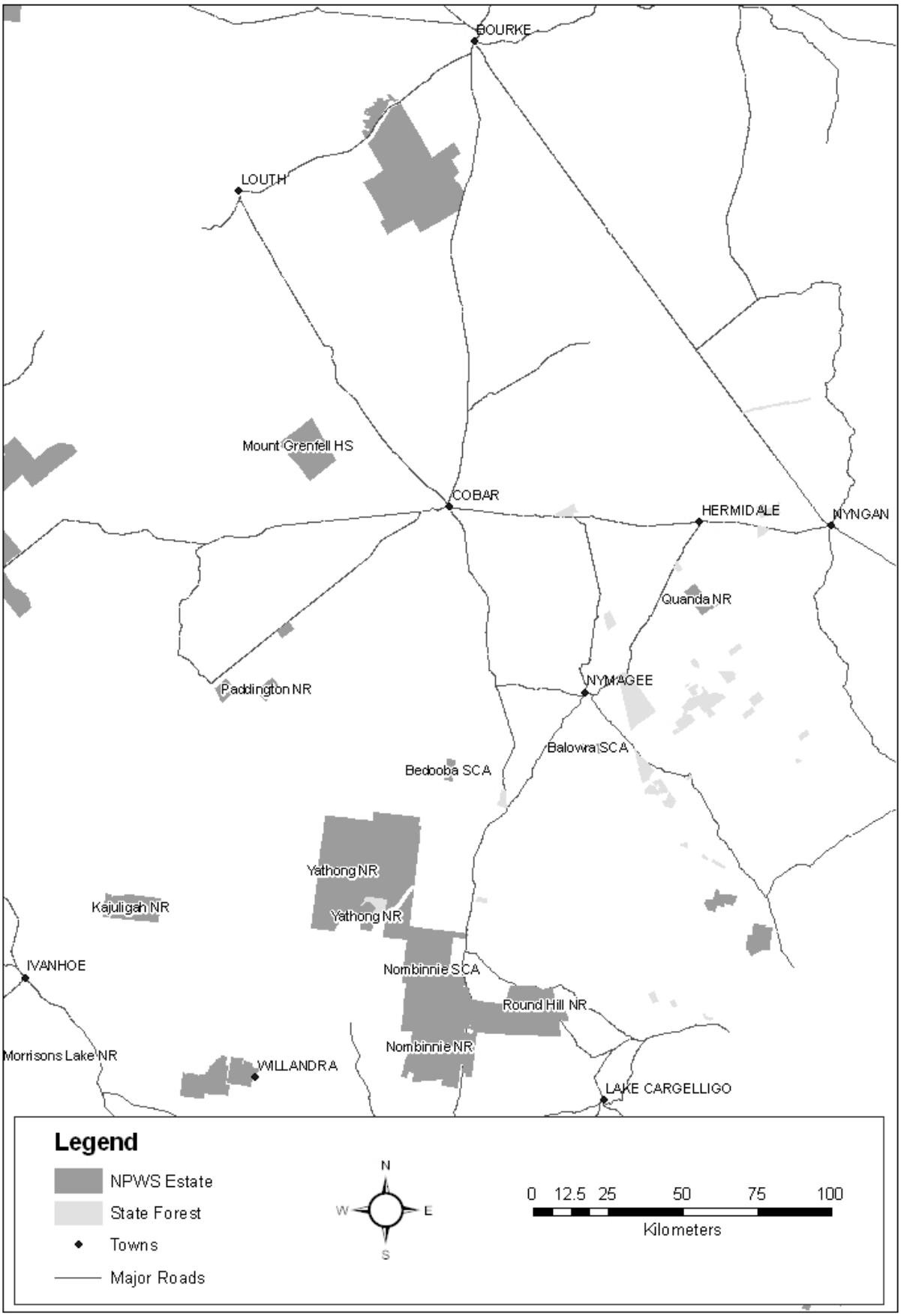

1. Introduction

1.1 Location, gazettal and regional setting

Quanda Nature Reserve is located within the Central West Region of NSW approximately 100 kilometres south-east of Cobar and 65 kilometres south-west of Nyngan (see map 2) within the Cobar Peneplain Bioregion. The reserve lies within the traditional lands of the Ngiyampaa Wangaaypuwan people.

Quanda Nature Reserve was formally gazetted on 25 January 1963 over 429.4 hectares of fauna reserve of primarily mallee vegetation. In 1966, 424.5 hectares was added to the reserve. In 2002 the National Reserve System (NRS) program funded the purchase of part of the adjacent grazing property, Millyvale, which contained old growth mallee. This was gazetted on 21 March 2003, extending the total area of Quanda Nature Reserve to 4,748 hectares.

Quanda Nature Reserve is a vegetated remnant surrounded by grazing and cropping properties which have been extensively cleared. It is part of a disjunct vegetation corridor which runs from Castlereagh River in the south-west to the reserve. The reserve has a history of low intensity grazing and cropping and is characterised by its inland mallee communities of Mallee and Red Box Open Woodland and Mallee Shrubland with Spinifex. It also contains significant areas of Poplar Box Open Woodland.

Quanda Nature Reserve is within the geographical area of the Bogan Shire, the Central West Catchment Management Authority, and the Nyngan Local Aboriginal Land Council (LALC). The reserve is located within the Western Rivers Region of NPWS. A number of state forests are located in the surrounding area and Balowra State Conservation Area is the closest conservation estate.

1.2 Statement of significance

Quanda Nature Reserve is considered to be of significance for the following values.

Biological Values

- Inland mallee communities which are poorly represented in the reserve system, namely Mallee and Red Box Open Woodland and Mallee Shrubland with Spinifex.
- Old growth, long unburnt mallee stands which enhance structural diversity and provide improved habitat values which are rare in the surrounding landscape.
- Open Box Woodland community – recognised as being highly modified and poorly conserved across its range.
- One nationally threatened plant species, the Cobar greenhood orchid (*Pterostylis cobarensis*) and three regionally significant and seven geographically significant species.
- Habitat for the state and nationally vulnerable superb parrot (*Polytelis swainsonii*), and the endangered kultarr (*Antechinomys laniger*) and eight additional fauna species listed as vulnerable in NSW.

Heritage values

The reserve contains evidence of Aboriginal and European heritage, including a large number of scarred trees.

2. Management Context

2.1 Legislative and policy framework

The management of nature reserves in NSW is in the context of a legislative and policy framework, primarily the *National Parks and Wildlife Act 1974* (NPW Act) and Regulation, the *Threatened Species Conservation Act 1995* (TSC Act) and the policies of the National Parks and Wildlife Service (NPWS).

Other legislation, strategies and international agreements may also apply to management of the area. In particular, the *Environmental Planning and Assessment Act 1979* (EPA Act) may require assessment of environmental impact of works proposed in this plan. The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) 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 NPW Act. Once the Minister has adopted a plan, the plan must be carried out and no operations may be undertaken in relation to the lands to which the plan relates unless the operations are in accordance with the plan. This plan will also apply to any future additions to Quanda Nature Reserve. Should management strategies or works be proposed in future that are not consistent with this plan, an amendment to the plan will be required.

2.2 Management purposes and principles

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

Under the Act (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; and
- 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 (refer section 2.2); the following specific management directions apply to the management of Quanda Nature Reserve:

- protection and maintenance of biodiversity and conservation of threatened species within the reserve;
- control of noxious and environmental weeds;
- control of feral animal populations;
- protection of historic heritage through identifying, recording and conserving historic resources;
- recognition and protection of traditional and contemporary Aboriginal cultural heritage; and
- improved knowledge of natural and cultural heritage, corresponding threats and evaluation of management programs through research and monitoring.

3. Values

This plan aims to conserve both natural and cultural values of Quanda 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.

3.1 Geology, landscape and hydrology

The area around Quanda Nature Reserve on the Cobar Peneplain comprises a broad apron of colluvial material of Siluro-Devonian origin (Metcalfe *et al.* 2003). The slightly undulating ridges have relief to 15 metres and are dominated by Ordovician quartzites, sandstones and slates (Girilambone beds), with overlying residual and colluvial quartz and other gravel (Walker 1991).

Quanda Nature Reserve occurs on two land systems. The larger western block, which occurs in the Kopyje Land System, consists of slightly undulating to level slopes and ridges dominated by the mallee community. The soils are predominantly shallow loamy and sandy lithosols, grading to neutral red earths at the bottom of the slopes (Walker 1991). The eastern section of the reserve occurs on the Cobar Land System which comprises a mixture of steep ridge crests and residual hills to 5 percent slope, and low ridges and drainage depressions. The soils here grade from shallow lithosols on the ridges to deep calcareous or neutral red earths in the drainage lines.

Overall, the soils on Quanda Nature Reserve have an acid to neutral pH, low levels of nutrients and are highly susceptible to gullying in the higher slopes, water shedding and wind sheeting at the margins of the drainage lines.

3.2 Native plants

Within Quanda Nature Reserve two comprehensive flora surveys have been undertaken, one before and one after the addition of the Millyvale section (Porteners 1998; Porteners 2003). From this survey work three vegetation communities - Poplar Box Open Woodland, Mallee and Red Box Open Woodland, and Mallee Shrubland with Spinifex have been identified and a vegetation map developed.

Regionally these communities have been affected by large-scale clearing, grazing, agricultural practices and altered fire regimes, resulting in widespread habitat loss and fragmentation and are poorly conserved and vulnerable within New South Wales (NSW) (Porteners 2003). Box woodlands in particular are recognised as some of the most threatened and poorly conserved vegetation types in Australia (Porteners 2003). The vegetation of Quanda Nature Reserve is an excellent example of the mallee and box shrublands and woodlands of central-western NSW, and are distinct from surrounding vegetation in that they are not representative of the vegetation of the floodplains or the rolling hills surrounding the area (Metcalfe *et. al*., 2003).

Poplar Box Open Woodland occurs on flats associated with the lower areas of the landscape on soils which are deep, well-drained and hard setting (Porteners 2003). This community occurs throughout Quanda Nature Reserve, dominating the southern portion of the reserve, and associated with the dominant poplar box (*Eucalyptus populnea* subsp. *bimbil*) are species including wilga (*Geijera parviflora*), budda (*Eremophila mitchellii*), white cypress pine (*Callitris glaucophylla*), red box (*Eucalyptus intertexta*), tar bush (*Eremophila glabra*) and emu bush (*Eremophila longifolia*). There is a high degree of disturbance to the community, due to the long history of pastoral use and the impact of feral animals.

Mallee and Red Box Open Woodland occurs on the slightly higher flat areas of the landscape on deep and well drained soils (Porteners 2003). The community is dominant through the middle of the reserve, and is populated primarily with pointed mallee (*Eucalyptus socialis*) and congoo mallee (*Eucalyptus dumosa*). Associated species include red box, wilga, white cypress pine,

gooma bush (*Bertya cunninghamii*) and tar bush. Within this community, high proportions of timber and litter are protecting the ground from erosion and there is less evidence of the impact of feral animals.

Mallee Shrubland with Spinifex occurs on the highest areas of the landscape on deep and well drained soils (Porteners 2003). The community occurs in fragments in the northern part of the reserve, and is dominated primarily with congoo mallee and pointed mallee. Associated species include white cypress pine, red box, gooma bush, wait-a-while (*Acacia colletioides*), cactus pea (*Bossiaea walkeri*) and tar bush. Within this community, there is a moderate proportion of ground litter and timber protecting the ground and little evidence of feral animal impacts.

The Mallee communities of Quanda Nature Reserve are also one of the easternmost occurrences of this vegetation type in NSW (Porteners 2003).

The most significant threat to the vegetation structure and health of Quanda Nature Reserve is fragmentation and isolation from other vegetation remnants within the landscape (see section 4.3). The reserve is therefore more susceptible to the degrading processes characteristic of fragmented ecosystems such as changes in microclimate, changed fire regime and lack of recruitment (Metcalfe *et al*., 2003). In addition, changed fire regimes are a threat to vegetation communities as much of the old growth mallee has not been burned for some time and the fire responses of many species are unknown (refer section 4.2).

The reserve contains one plant species listed as vulnerable under the TSC Act, three regionally significant species and seven geographically significant species (refer Table 1). Regionally significant species are significant because their distribution is restricted to the Western Slopes and Plains botanical subdivisions within NSW. Geographically significant species found in the reserve are significant as they are disjunct populations or at the geographical extremes of their distribution (Porteners 2003).

Table 1: Threatened and significant plant species recorded in Quanda Nature Reserve.

Common name	Scientific name	TSC Act Status	EPBC Act Status	Significance
Cobar greenhood orchid	*Pterostylis cobarensis*	Vulnerable	Vulnerable	National
Needle wattle	*Acacia havilandiorum*			Regional
Pituri	*Duboisia hopwoodii*			Regional
Red-berried stick-plant	*Spartothamnella puberula*			Regional
Cactus pea	*Bossiaea walkeri*			Geographical
Red box	*Eucalyptus intertexta*			Geographical
Native pear	*Marsdenia australis*			Geographical
Spiny mallee pea	*Templetonia aculeata*			Geographical
Desert broombush	*Templetonia egena*			Geographical
Snap and rattle	*Eucalyptus gracilis*			Geographical
Australian boxthorn	*Lycium australe*			Geographical

Key threatening processes (KTPs) listed under the TSC Act of most relevance to native flora in this reserve are:

- clearing of native vegetation;
- removal of dead wood and dead trees;
- high frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition; and
- invasion of native plant communities by exotic perennial grasses.

Strategies for the recovery of threatened species, populations and ecological communities have been set out in a state-wide Threatened Species Priorities Action Statement (PAS). Individual recovery plans may also be prepared for threatened species to consider management needs in more detail.

Whilst comprehensive survey work for this reserve has been undertaken this was undertaken at a time of extreme drought. As such ongoing and specialist floristic surveys may benefit the understanding of communities and assist in determining or monitoring management actions.

3.3 Native animals

In 2008 a comprehensive fauna survey of Quanda Nature Reserve was undertaken which recognised the reserve as having a high native biodiversity, particularly within old growth mallee vegetation communities (Garden *et. al.* 2009). Of the 143 species identified on the reserve, there are 94 species of bird, 16 species of reptile, 5 species of amphibian and 28 species of native mammal. One species the superb parrot is listed as vulnerable at both the state (TSC Act) and federal (EPBC Act) level. An additional 8 species are listed as vulnerable within NSW, whilst the kultarr is listed as endangered in NSW (refer Table 2).

Table 2: Threatened and significant animal species recorded in Quanda Nature Reserve.

Common name	Scientific name	TSC Act Status	EPBC Act Status
Pink cockatoo	*Cacatua leadbeateri*	Vulnerable	
Superb parrot	*Polytelis swainsonii*	Vulnerable	Vulnerable
Speckled warbler	*Pyrrholaemus saggitatus*	Vulnerable	
Grey-crowned babbler	*Pomatostomus temporalis*	Vulnerable	
Gilbert's whistler	*Pachycephala inornata*	Vulnerable	
Little eagle	*Hieraaetus morphnoides*	Vulnerable	
Varied sittella	*Daphoenositta chrysoptera*	Vulnerable	
Kultarr	*Antechinomys laniger*	Endangered	
Little pied bat	*Chalinolobus picatus*	Vulnerable	
Yellow-bellied sheathtail-bat	*Saccolaimus flaviventris*	Vulnerable	

A number of key threatening processes (KTPs) are relevant to the management of native plants and animals within the planning area, particularly in relation to their isolation within the landscape. A summary of these includes:

- Loss of hollow-bearing trees – impacting upon species dependent upon hollows and mature trees for foraging substrates (e.g. varied sittella & grey-crowned babbler), shelter sites, roost sites (e.g. microbats such as the little pied bat) and nest sites (e.g. parrots and cockatoos) or a combination of these such as pink cockatoos (Pizzey and Knight, 2000).
- Predation by the feral cat *Felis catus* – in particular the kultarr and ground-nesting birds;
- Predation by the European red fox *Vulpes vulpes* - ground-dwelling and semi-arboreal mammals such as the kultarr, ground-nesting birds and freshwater turtles.
- Competition and land degradation by rabbits *Oryctolagus caniculus*;
- Competition and land degradation by unmanaged goats *Capra hircus*; and
- Competition from feral honey bees *Apis mellifera*.

The maintenance of specific habitat components is also significant in maintaining high levels of vertebrate diversity on Quanda Nature Reserve. For example the maintenance of woodlands with a grassy understorey favours threatened species such as the speckled warbler and the superb parrot which feeds on the ground in grassy woodland (Pizzey and Knight 2000). Contrastingly the grey-crowned babbler requires the maintenance of complex ground stratum such as fallen timber and leaf litter as it feeds on invertebrates found amongst fallen timber and on the trunks of trees (ASPECT north 2005) and Gilbert's whistler requires woodland with shrubby understorey as it feeds on or near the ground in shrub thickets and in tops of small trees on spiders and insects and occasionally seeds and fruits (DECC 2005a). The varied sittella contrastingly can utilise components from each of these woodland structures as it feeds on arthropods gleaned from crevices in bark, dead branches and twigs in the tree canopy.

The kultarr, importantly requires the maintenance of all of the above key habitat components and is susceptible to all key threatening processes. As a small mammal that is terrestrial and strictly nocturnal, it requires logs, stumps, saltbush, spinifex tussocks and deep cracks in the soil at the base of *Acacia* and *Eremophila* trees for shelter (Valente 1995 in NPWS 2002), within its preferred habitat is sparsely vegetated arid and semiarid plains on stony, sandy and clayey soils (NPWS 2002). The kultarr is insectivorous, and feeds on invertebrates such as spiders, crickets and cockroaches (Valente 1995 in NPWS 2002) and particularly in small remnants requires maintenance of areas of burnt and unburnt vegetation to maintain shelter and prey components of its habitat.

As a predator of a range of species of birds, reptiles and mammals, occasionally feeding on large insects and carrion the maintenance of little eagle populations will depend upon the maintenance of other species suits and requires the maintenance of large tall mature trees for suitable sites for nests (DECC 2005e).

Strategies for the recovery of threatened species and populations have been set out in a state-wide Threatened Species Priorities Action Statement (PAS). Individual recovery plans may also be prepared for threatened species to consider management needs in more detail.

A recovery plan has been prepared for the kultarr and PAS including strategies for the recovery of the pink cockatoo, superb parrot, speckled warbler, grey-crowned babbler, Gilbert's whistler, little pied bat and yellow-bellied sheathtail-bat have been developed. Recovery information for the little eagle and varied sittella is detailed in the species profiles. The most significant threat to many of the species in the reserve is the isolation of the reserve and the fragmentation of remnants external to it (refer section 4.3).

Further fauna surveys may improve understanding of species diversity and habitat associations within the reserve.

3.4 Aboriginal heritage

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.

The Quanda Nature Reserve lies within the traditional country of the Aboriginal people of the Ngiyampaa Wangaaypuwan language group. They are the people who speak Ngiyampaa the Wangaaypuwan way or people who use the word *wangaay* for 'no' (Smart *et al*. 2000).

Historically the Ngiyampaa Wangaaypuwan lived in the dry region of western NSW from the Darling-Barwon and Bogan Rivers in the north to the Lachlan River in the south (Beckett 1959; Beckett *et al*. 2003). The Ngiyampaa Wangaaypuwan are associated with the dry backcountry, and

only visited the Darling-Barwon and Bogan Rivers during times of severe drought and only at points where the soil was red (Beckett *et al*. 2003).

Aboriginal sites are places with evidence of Aboriginal occupation or that are related to other aspects of Aboriginal culture. Whilst detailed survey for Aboriginal sites have not been undertaken in Quanda Nature reserve 24 modified (scar) trees and one artefact scatter have been located. They are important as evidence of Aboriginal history and as part of the culture of local Aboriginal people and there is a high probability that the reserve contains other Aboriginal sites.

While the NPWS has legal responsibility for the protection of Aboriginal sites and places under the NPW Act, it 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.

3.5 Historic heritage

Cultural heritage comprises places and items that may have historic, scientific, aesthetic and social significance to present and future generations. The NPWS conserves the significant heritage features located in NSW parks and reserves.

Quanda Nature Reserve contains evidence of previous pastoral uses, including a homestead complex, fences, camp sites and rubbish dumps. These sites are scattered across the newer additions to the reserve. While they represent European occupation in the area, sites of this nature can be found throughout the region.

The homestead complex, Millyvale, was built sometime during the 1940s to 1950s. The site contains two houses, various out-houses and other evidence of pastoral activity, such as a sheep loading yard and an old shearing shed. Most of this has fallen into disrepair. The houses also contain asbestos and have been declared an occupational health and safety risk to anyone on the site.

The two Millyvale houses have been assessed for heritage significance (NPWS 2006), and it was concluded that the houses have no heritage value and should be removed due to the risk they pose. The Millyvale houses are currently fenced off until the existing buildings can be removed. Before plans are made to remove the buildings, they will be inspected for evidence of bat roosting sites and reassessed according to the findings.

3.6 Visitor use

Recreational use of Quanda Nature Reserve is limited to passive nature-based recreational opportunities such as birdwatching, bushwalking or nature appreciation. To ensure protection of the reserve's significant natural values public access to the reserve is only available on foot and with prior approval from the Cobar Area Office. No visitor facilities are provided. Current use is limited and largely confined to occasional visitation by groups or individuals for scientific purposes.

There are opportunities to use the reserve for education and research purposes.

4. Issues

4.1 Pests and Weeds

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

The Western Rivers Region Pest Management Strategy identifies pest species across the region's parks and details priorities for control (including actions listed in the PAS and Threat Abatement Plans (TAPs) prepared under the TSC Act). The pest management strategy also identifies where other site or pest specific plans or strategies need to be developed to provide a more detailed approach.

Within Quanda Nature Reserve 17 pest species – six pest plants, ten vertebrate pests and one invertebrate have been identified as occurring in the park. High priority pest species are listed below (refer Table 3).

Introduced plant species primarily occur in highly disturbed areas of the reserve, such as around the roads, ground tanks and the former homestead. Soil disturbance should be avoided where possible, as it provides an opportunity for weed species to invade a new site. Whilst the current weed species for Quanda Nature Reserve are listed in Table 3, weeds are not a major threat on the reserve at this time. Programs are put into place as required and are targeted specifically to problem species.

Introduced animals living on the reserve and adjoining land are of concern because they damage the environment and compete with native species. Feral predators can reduce populations of small to medium ground and arboreal native animals to below self sustaining levels.

Table 3: Weeds and pest animals recorded in Quanda Nature Reserve.

Weeds		**Pest Animals**	
Common Name	**Scientific Name**	**Common Name**	**Scientific Name**
Paterson's curse	*Echium plantagineum*[#]	European cattle	*Bos taurus*[+]
Bathurst burr	*Xanthium occidentale*[#]	Goat	*Capra hircus*[+]~
Noogoora burr	*Xanthium spinosum*[#]	Sheep (feral)	*Ovis aries*[+]
Prickly pear	*Opuntia sp.*[#]	Dog	*Canus familiaris*[+]~
Saffron thistle	*Carthamus lanatus*	Red fox	*Vulpes vulpes*[+]~
Galvanised burr	*Sclerolaena birchii*[#]	Cat	*Felis catus*[+]~
		Brown hare	*Lepus capensis*[+]
		European rabbit	*Oryctolagus cuniculus*[+]~
		House mouse	*Mus musculus*[+]
		Pig	*Sus scrofa*[+]~
		European Honey Bee	*Apis mellifera*~

[#] Declared noxious under *Noxious Weed Act 1993*
[+] Declared pest under *Rural Lands Protection Act 1998*
~ Key threatening process under TSC Act

The overriding objective of the pest management strategy is to minimise adverse impacts of introduced species on biodiversity and other park and community values whilst complying with legislative responsibilities.

4.2 Fire

The primary fire management objectives of the NPWS are to protect life and property and community assets from the adverse impacts of fire, whilst managing fire regimes to maintain and protect biodiversity and cultural heritage.

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 TSC Act. Fire can also damage cultural heritage and management facilities and can threaten neighbouring lands.

Fire management should aim to reduce the risk of fire affecting the reserve to maintain areas of old growth (i.e. long unburnt) mallee. Major landscape-scale mallee wildfires are more dependent on ephemeral herbage fuels which form dense grasslands after above-average rainfall, linking patches of perennial fuels and mallee litter (Porteners 2003). In an average or below average rainfall year, there is not usually sufficient fuel for a fire to develop to the extent where life or property is endangered or where plant and animal communities are significantly at risk. In those seasons, fire is likely to affect the reserve only if there is a direct ignition source within the mallee communities of the reserve.

The fire history of the reserve is not well known but it is believed the greater part of the reserve has not been burnt for over 50 years. The only recorded wildfire occurred in 2003 along the south-western boundary, entering from a neighbouring property and burning 9 hectares.

A separate map-based fire management strategy currently exists for Quanda Nature Reserve (OEH 2011). The fire management strategy outlines the recent fire history of the reserve, key assets within and adjoining the reserve, including sites of natural and cultural heritage value, fire management zones, and fire control advantages such as management trails and water supply points.

A prescribed burn was undertaken along the south-western boundary of the reserve in 2010. Further prescribed burns are planned. NPWS maintains cooperative arrangements with surrounding landowners and the Rural Fire Service (RFS) and is actively involved with the North West Zone Bush Fire Management Committee (BFMC). Cooperative arrangements include fire planning, fuel management and information sharing. Hazard reduction programs, ecological burning proposals and fire trail works are submitted to the BFMC.

4.3 Isolation and Fragmentation

The area surrounding Quanda Nature Reserve has been extensively cleared, which has resulted in a high loss of biodiversity and fragmentation of habitat in the region (Metcalfe *et al*. 2003). Long term conservation of biodiversity depends upon the protection, enhancement and connection of remaining habitat across the landscape, incorporating vegetation remnants on both public and private lands. Nearby vegetated areas contribute to the habitat values of the reserve and provide ecological corridors to other vegetated areas within the area. Maintaining the integrity of the remaining habitat within the reserve and, where possible, linking this to adjacent areas of vegetated, natural areas is important in ensuring long term viability of the reserve's biological values.

4.4 Climate change

Anthropogenic climate change has been listed as a key threatening process under the TSC Act and EPBC Act. In the western region of New South Wales projections of future changes in climate include: increasing temperatures; increases in summer rainfall and decreases in winter rainfall; increases in evaporation throughout the year leading to drier soil conditions; and more extreme impacts under the El Nino Southern Oscillation. The severity of drought is likely to remain the same and a minor increase in runoff is projected.

Reduced vegetation cover caused by poorer growing conditions is likely to leave many soils vulnerable to increased erosion. This risk is likely to be exacerbated by heavy downpours during

more frequent and intense storms. Such changes to rainfall and runoff have the potential to affect Aboriginal cultural heritage values in the reserve.

Hotter and drier conditions are likely to alter biodiversity and ecosystem processes across all ecosystems in the region. Effects are likely to be most intense where existing threats are being experienced. The potential effect of climate change is difficult to assess since it depends on the compounding effects of other agents of change. Pests, weeds and the occurrence of major bushfires are likely to have an increasing impact. Ecosystem processes such as nutrient cycling are likely to be affected, and the overall productivity of many ecosystems is likely to decline. Some species are likely to be reduced in numbers, contract in range and be lost from some localities altogether, while some hardier species are likely to persist. Some widespread common species are likely to be favoured.

As a vegetated remnant surrounded by grazing and cropping properties, the reserve has limited opportunities to address the effects of climate change other than adaptation. Consideration will need to be given to reducing the pressures arising from other threats to improve ecosystem resilience and help reduce the severity of the effects of climate change.

5. Management Operations And Other Uses

5.1 Management facilities and operations

There are two council roads that provide public access and run parallel to the reserve, Gilgai Road and Bourkes Road (refer map 1).

All tracks within the reserve are designated as management trails. All are in good condition and maintained on an as needs basis.

Outside the eastern boundary parallel to Eastern Boundary Fire Trail and on the southern boundary parallel to the Millyvale Fire Trail are local council fire trails. Maintenance of these trails duplicates park management trails and may facilitate unauthorised access to the reserve.

Reserve boundary fencing is poor with no boundary fence in place on the southern boundary along the Millyvale Fire Trail and sections of fencing in poor condition and in need of repair or replacement on the western boundary along Gilgai Fire Trail and on the boundaries of the eastern section of the reserve on Wilgadee, Aurora and Towabah Fire Trails. Replacement of fences along the Yanda Fire Trail along the northern boundary and Eastern Boundary Fire Trail on the eastern boundary has been undertaken in the last five years. The installation and replacement of fences to provide a stock proof boundary is required.

Incomplete boundary fencing facilitates ongoing unauthorised access to the reserve and illegal activities such as goat harvesting and kangaroo harvesting occur on a regular basis. With the completion of boundary fencing all gates accessing the reserve will be locked as a deterrent. Increased law enforcement activities will be undertaken as required.

There is currently no effective signage identifying the reserve as part of the conservation estate. This compromises the effectiveness of law enforcement activities and does not allow for recognition and appreciation of the reserve's significant natural and cultural values. The installation of identification and regulatory signage is required.

A number of dams created prior to the reserve's gazettal as a conservation reserve exist. Three of these dams (refer map 1) are maintained for fire and pest management purposes. They may be fenced in the future for pest management purposes. The remaining dams are not required for management purposes and will be allowed to rehabilitate naturally.

6. Implementation

This plan of management establishes a scheme of operations for the Quanda Nature Reserve. Implementation of this plan will be undertaken within the annual program of the NPWS Western Rivers Region.

Identified activities for implementation are listed in Table 3. Relative priorities are allocated against each activity as follows:

- **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.
- **Ongoing** is for activities that are undertaken on an annual basis or statements of management intent that will direct the management response if 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 NPW Act.

Table 3: Actions

Current Situation	Desired Outcomes	Management Response	Priority*
6.1 On-Park Ecological Conservation			
The reserve supports three vegetation communities, two of which are mallee dominated. Ten fauna and one flora species in the reserve are listed under the TSC Act (refer 3.2 and 3.3). Threats to the ecological values of the reserve include: isolation and fragmentation of habitat; fire; pests and weeds. Climate change has been identified as a key threatening process under the TSC Act. Climate change may significantly affect biodiversity by changing the population size and distribution of species, modifying species composition, and altering the geological extent of habitats and ecosystems.	Native plant and animal species and communities are conserved. Negative impacts on threatened species are stable or diminishing. The effects of climate change on natural systems are reduced.	6.1.1 Implement relevant strategies in the Priority Action Statements and recovery plans for threatened species. 6.1.2 Continue existing fire, pest and weed management programs to increase the reserve's ability to cope with future disturbances, including climate change. 6.1.3 Encourage research into appropriate indicators to help understand the effects of climate change on the reserve's biodiversity in consultation with conservation specialists.	High Ongoing Ongoing

Current Situation	Desired Outcomes	Management Response	Priority*
6.2 Cultural Heritage The reserve is located in the traditional country of the Ngiyampaa Wangaaypuwan people. Knowledge of the Aboriginal heritage values on the reserve is minimal. A number of modified trees have been identified and recorded. There is a high probability that the reserve contains other Aboriginal sites. The reserve was previously used for pastoral practices, including grazing and cropping. Examples of this land use are scattered across the newer additions of the reserve.	Aboriginal places and values are identified and protected. Aboriginal people are involved in management of the Aboriginal cultural values of the reserve. Historic features are appropriately conserved and managed. Negative impacts on Aboriginal and historic heritage values are stable or diminishing. Understanding of the cultural values of the reserve is improved.	6.2.1 Consult and involve the Nyngan Local Aboriginal Land Council, the Ngiyampaa Elders and other relevant Aboriginal community members and organisations in the management of Aboriginal sites, places and values, including interpretation of places or values. 6.2.2 Undertake an archaeological survey and cultural assessment prior to all works with the potential to impact on Aboriginal or historic sites and places. 6.2.3 Encourage further research into the Aboriginal heritage values and uses of the reserve with the Nyngan LALC and Ngiyampaa Elders. 6.2.4 Record European historical sites, assess for heritage value and, with the exception of the Millyvale houses, retain in situ but do not actively manage. 6.2.5 Inspect Millyvale houses to assess whether they are being used by bat colonies. If not, record and remove buildings in an appropriate manner. If they are, reassess the removal of the houses.	High High Medium Medium Low
6.3 Visitor Use and Services Visitor use is not promoted due to the small size of the reserve and its high ecological values. Passive, nature-based recreation occurs with prior approval from the Cobar NPWS office. Camping, fires and horse riding are not permitted in the reserve.	Visitor use is appropriate and ecologically sustainable. Negative impacts of visitors on reserve values are removed.	6.3.1 Maintain opportunities for low key nature based recreation. 6.3.2 Provide opportunities for access to the reserve for educational and research purposes.	Medium Low Ongoing

Current Situation	Desired Outcomes	Management Response	Priority*
6.4 Community Programs and Education Remnant vegetated areas on private lands can provide a valuable contribution as part of a network of wildlife corridors.	The local community is aware of the significance of the reserve and of reserve management programs.	6.4.1 Liaise with neighbours to encourage the retention and appropriate management of key habitats and corridors adjacent to the reserve.	Low
6.5 Weeds and Pest Animals A number of introduced species are found within the reserve. Threat abatement plans contain strategies to assist with the recovery of threatened species through the reduction of threats. A Conservation Risk Assessment (CRA) was prepared in February 2010 for fox ground baiting on the reserve.	Introduced plants and animals are controlled and where possible eliminated. Negative impacts of weeds and pest animals on reserve values are stable or diminishing.	6.5.1 Control introduced species in accordance with the Regional Pest Management Strategy. 6.5.2 Survey the reserve to determine the presence and extent of introduced species. 6.5.3 Seek the cooperation of neighbours in implementing weed and pest control programs and undertake control in cooperation with the Central West Livestock Health and Pest Authority and Forests NSW. 6.5.4 Monitor noxious and significant introduced weed species. Treat any new outbreaks where possible.	High Medium Medium Medium

Current Situation	Desired Outcomes	Management Response	Priority*
6.6 Fire Management Fire is a natural feature of many environments but inappropriate fire regimes can lead to loss of particular plant and animal communities. High frequency fires have been listed as a key threatening process under the TSC Act. The reserve is dominated by mallee shrubland which is sensitive to frequent fires, however the reserve does not have a history of fire ignitions. The reserve has been zoned as a Land management Zone (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. Apart from the over-riding legislative objective of protecting life and property, the primary fire management objectives for a LMZ are to conserve biodiversity and protect cultural heritage.	Life, property and natural and cultural values are protected from fire. Fire regimes are appropriate for conservation of native plant and animal communities. Negative impacts of fire on natural and cultural heritage values are stable or diminishing.	6.6.1 Prepare and implement a revised Reserve Fire Management Strategy for the reserve. 6.6.2 Participate in the North West Zone Bush Fire Management Committee. Maintain cooperative arrangements with local Rural Fire Service brigades and fire control officers and surrounding landowners in regard to fuel management and fire suppression. 6.6.3 Suppress all unplanned fires in the reserve as quickly as possible. 6.6.4 Manage the reserve to protect biodiversity in accordance with the identified fire regimes/thresholds in the fire management strategy. 6.6.6 The use of heavy machinery off tracks and use of chemicals will be avoided as far as possible.	Medium Ongoing / High High Ongoing/ High Ongoing
6.7 Management Operations And Other Uses Bogan Shire Council maintains Bourkes Road and Gilgai Road which run adjacent to the reserve. There are two shire council fire trails running parallel to reserve boundaries. These are not required to support NPWS management objectives and may facilitate unauthorised access to the reserves. NPWS maintains the management trails within the reserve. Boundary fencing for the reserve is incomplete and in places of poor standard. Straying stock occasionally enter the reserve impacting upon reserve values.	Management facilities and operations adequately serve management needs and have minimal impact upon reserve values. Infrastructure and assets are maintained.	6.7.1 Maintain the management trails (refer Map 1). Only management trails identified in this plan will be actively managed and maintained. 6.7.2 Continue to liaise with the local government authority in relation to the maintenance of trails adjacent to the reserve. 6.7.2 Gates and signs will be used to restrict unauthorised access to the reserve. 6.7.3 Construction and maintenance of boundary fences will be undertaken to exclude stock from the reserve. Fencing assistance may be provided in accordance with NPWS	Low Medium High High

Current Situation	Desired Outcomes	Management Response	Priority*
Updated signs at access points to the reserve could improve public understanding about the regulations of the reserve and discourage inappropriate and illegal activities such as goat and kangaroo harvesting. Three dams are maintained for fire and pest management purposes. Other dams are allowed to naturally rehabilitate.		policy. 6.7.4 Update information and regulatory signage at appropriate locations in the reserve. 6.7.5 Undertake additional law enforcement activities in relation to illegal goat and kangaroo harvesting and other illegal activities as required. 6.7.6 Maintain dams identified as necessary for management purposes (refer map 1). Allow other dams to rehabilitate.	High Ongoing Low

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