



NSW NATIONAL PARKS & WILDLIFE SERVICE

# Yanga National Park, Yanga State Conservation Area and Yanga Nature Reserve

Plan of Management



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**This plan of management was adopted by the Minister for Energy and Environment on 12 May 2020.**

The Yanga parks are in the traditional Country of the Wathi Wathi, Daddi Daddi, Mutthi Mutthi and Nari Nari Aboriginal peoples.

This plan of management was prepared by staff of NSW National Parks and Wildlife Service (NPWS).

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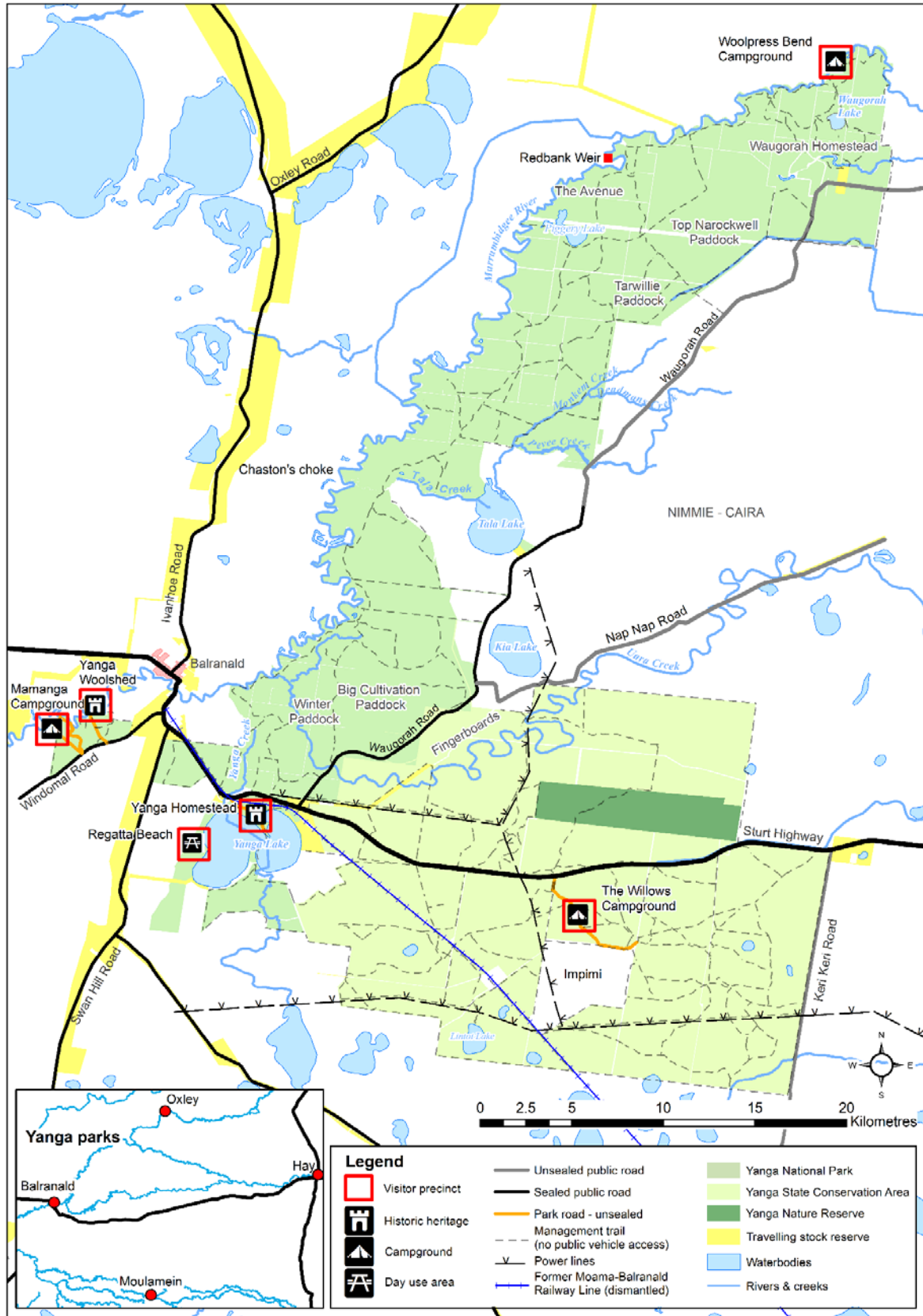


Figure 1 Location of Yanga parks

# 1. Introduction

## 1.1 Location, reservation and regional setting

Features	Description
Location	<p>Yanga National Park, Yanga State Conservation Area and Yanga Nature Reserve are collectively referred to as the ‘Yanga parks’ or ‘the parks’ in this plan. The parks are located on the floodplain of the Lower Murrumbidgee River (the ‘Lowbidgee’) at the western edge of the Riverina agricultural region, about eight kilometres outside of Balranald. The town of Hay is about 128 kilometres to the east of the parks, and the Victorian border is about 50 kilometres to the south (see Figure 1).</p> <p>The national park has 160 kilometres of the Murrumbidgee River frontage starting from a point about five kilometres east of Balranald and extending upstream almost to the Great Cumbung Swamp. A small separate portion of the national park to the south-west of Balranald, with an area of about 12 hectares, also fronts the Murrumbidgee River.</p> <p>The state conservation area straddles the Sturt Highway and extends 24 kilometres east, from Waugorah Road to Keri Keri Road (also known as Perekerten Road).</p> <p>The nature reserve lies to the north of the Sturt Highway and is bordered on three sides by the state conservation area.</p>
Area	<p>The parks have a total area of 71,711 hectares, which comprises 35,359 hectares of national park; 34,579 hectares of state conservation area; and 1773 hectares of nature reserve.</p>
Reservation date and previous tenure	<p>Yanga Nature Reserve was reserved on 28 April 1972 over lands that had been Yanga State Forest until 1969 but was Crown land held under a grazing permit at the time.</p> <p>Yanga National Park and Yanga State Conservation Area were initially reserved on 28 February 2007. This followed the purchase of Yanga Pastoral Station, a 160-year-old sheep station held under freehold title in November 2005. In its later years, Yanga Station also carried cattle and supported dryland cropping and red gum harvesting for commercial timber.</p> <p>The 2010 additions to the national park included the former Kieeta State Forest (617 hectares) and about 140 hectares from the neighbouring Kieeta Station, a working sheep property held under freehold title. During the acquisition process some land was not immediately reserved. Instead, it was vested in the Minister administering the <i>National Parks and Wildlife Act 1974</i> for the purposes of Part 11 of that Act. Land which was considered to have lesser ecological value, such as cropping land, was then sold and excluded from the parks. The reservation of the Yanga parks was finalised in 2013. On 1 July 2010, the Yanga parks were renamed as part of the Murrumbidgee Valley parks under the <i>National Park Estate (Riverina Red Gum Reservations) Act 2010</i>. The name, Yanga, was reinstated by gazette notice for each of the parks in May 2016.</p>
<b>Regional context</b>	
Biogeographic region	<p>The parks are almost entirely within the Riverina Bioregion. Less than 1% of the parks are within the Murray–Darling Depression Bioregion (Thackway &amp; Cresswell 1995). When Yanga Station was acquired in 2005, the Riverina Bioregion had the lowest level of reservation of all 17 bioregions in New South Wales (NPWS 2003). The parks represent 26.5% of the NSW reserved lands within this bioregion.</p>

Features	Description
Surrounding land use	<p>To the east, the parks are bordered by the Nimmie–Caira system, which forms part of the Lowbidgee Floodplain. Until recently much of the Nimmie–Caira supported large-scale irrigated cropping. In 2013, the Australian Government purchased 84,400 hectares of the Nimmie–Caira, together with the licensed water entitlements from 19 properties, under a major water buyback initiative for returning water to the environment in the Murray–Darling Basin. In May 2018, the NSW Government announced that the land component of Nimmie–Caira will be managed by a consortium led by The Nature Conservancy with involvement by the Nari Nari Tribal Council. The water entitlements are managed by the Commonwealth Environmental Water Holder.</p> <p>To the north, the parks are bordered by the Great Cumbung Swamp, the terminus of the Lachlan River.</p> <p>To the south and west, land use surrounding the parks includes dryland and irrigated cropping, and grazing of natural and improved pastures.</p> <p>Two small parts of Yanga Station were excluded from the sale and retained by the previous owners. These are the land on the eastern shore of Yanga Lake and the land bordering Lake Tala. There is also a 1576-hectare inholding of private land, known as Impimi, within Yanga State Conservation Area (see Figure 1).</p>
Other authorities	<p>The parks lie within the Murray River Council (93%) and Balranald Shire Council (7%) local government areas. The parks are also within the administrative areas of Balranald Local Aboriginal Land Council, Mid Murray Bush Fire Management Committee and Murray Local Land Services.</p>

## 1.2 Statement of significance

The Yanga parks are of significance for a broad range of natural, cultural and social values including:

### Landscape

The Yanga parks are uniquely located in a transition zone between landscapes formed by fluvial processes (i.e. formed by a river) to the east, and landscapes formed by aeolian processes (i.e. formed by wind) to the west. This has resulted in an unusual situation in which different landforms, vegetation associations and soil types sit side-by-side.

The transition zone also provides important evidence of long-term climatic changes including palaeochannels (ancient stream beds or riverbeds) and lunettes (crescent-shaped sand dunes). The lunette sequence at Lake Yanga is estimated to have begun forming 66,000 years ago.

Five poorly conserved NSW landscape types (known as Mitchell Landscapes) are protected within the Yanga parks. Of particular significance is the conservation of the Murrumbidgee Lakes, Swamps and Lunettes Landscape which increased by 14.5% with the parks' reservation.

### Biodiversity

The river red gum (*Eucalyptus camaldulensis*) forests are an iconic value of the parks and are part of the third-largest contiguous stand of river red gum forest in Australia. The creation of the parks initiated the first large-scale protection and conservation of river red gum in New South Wales and drew attention to the decline of river red gum at the national scale.

Other significant vegetation protected by the parks includes black box woodland, lignum shrubland, nitre goosefoot shrubland and three endangered ecological communities.

The parks are one of the most biologically diverse areas in the NSW Riverina Bioregion. They also provide habitat for 24 threatened animals and contain one of the largest known populations of the nationally endangered southern bell frog (*Litoria raniformis*).

The parks contain almost 14% of the Lowbidgee Floodplain which is listed in *A Directory of Important Wetlands in Australia* (Environment Australia 2001) and supports some of the largest waterbird breeding colonies in Australia.

## **Aboriginal heritage**

The parks are a rich cultural landscape deriving from thousands of years of Aboriginal use and occupation in the Lowbidgee by the Wathi Wathi, Mutthi Mutthi and Nari Nari peoples. Recorded Aboriginal heritage in the parks is prolific and includes burial sites, modified trees, artefacts, earth mounds, middens, spiritual sites and creation stories.

Aboriginal connection continues until the present day with many Aboriginal people being employed by Yanga Station in various roles throughout its long pastoral history. In the early 1970s a long-standing Aboriginal employee was unusually made an assistant manager and later became responsible for overseeing Aboriginal heritage on the Station.

## **Shared heritage**

Yanga Station played a major part in the history of the development of western NSW from the beginnings of European exploration through the evolution of the wool industry. The parks now present a tangible record of over 160 years of shared non-Aboriginal and Aboriginal history including exploration, colonisation, pastoralism, river navigation, overland transport, communications and water regulation.

The parks are a rich cultural landscape which contains a diverse range of historic structures, plantings and managed woodland which together demonstrate the working and social life of a large remote pastoral station. There are more than 150 standing items and many historic archaeological sites. The Yanga Woolshed site dates from 1852 and the current building is one of the best-preserved and largest example of woolsheds in western NSW. Yanga Homestead dates from 1863 and is of high technical and aesthetic value. Overall, the parks have been assessed as being of potential state heritage significance.

The moveable heritage collection associated with Yanga Station is vast and is among the finest examples of an in situ collection in public ownership.

## **Community values**

In the past, the local community enjoyed a long social history with Yanga Station and this has continued since the formation of the Yanga parks. The parks allow for interactive visitor appreciation as a vast outdoor museum and the continuation of fishing, boating and camping activities.

The Lowbidgee wetlands and riverine environment are places of great natural beauty. When filled, Yanga Lake is spectacular and represents an oasis for visitors in the vast semi-arid plains.

## **Research and education**

The Yanga parks were created for the purpose of improving the health of the river red gum forests of the Murrumbidgee River at the terminal end of an extensively farmed and irrigated



catchment. As a working example of environmental restoration in progress, the parks present valuable opportunities for education and continuing research into recovery processes, the evolving science of environmental watering and native vegetation management.

The parks also provide a valuable opportunity for understanding past climate and geomorphological processes and preparing for a hotter, drier climate in the future.

## 2. Management context

### 2.1 Legislative and policy framework

The management of national park estate in New South Wales is in the context of the legislative and policy framework of the NSW National Parks and Wildlife Service (NPWS); primarily the National Parks and Wildlife Act and Regulation, the *Biodiversity Conservation Act 2016* and NPWS policies.

Other legislation, strategies and international agreements may also apply to management of the area. In particular, the *Environmental Planning and Assessment Act 1979* may require the assessment of environmental impacts 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 historic archaeological relics. The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* may apply in relation to actions that impact 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, 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 the Yanga parks. 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

#### National parks

National parks are reserved under the National Parks and Wildlife Act to protect and conserve areas containing outstanding or representative ecosystems, natural or cultural features or landscapes or phenomena that provide opportunities for public appreciation, inspiration and sustainable visitor or tourist use and enjoyment.

Under section 30E of the National Parks and Wildlife Act, national parks are managed to:

- conserve biodiversity, maintain ecosystem functions, protect geological and geomorphological features and natural phenomena and maintain natural landscapes
- conserve places, objects, features and landscapes of cultural value
- protect the ecological integrity of one or more ecosystems for present and future generations
- promote public appreciation and understanding of the park's natural and cultural values
- provide for sustainable visitor or tourist use and enjoyment that is compatible with conservation of natural and cultural values
- provide for sustainable use (including adaptive re-use) of any buildings or structures or modified natural areas having regard to conservation of natural and cultural values
- provide for appropriate research and monitoring.

The primary purpose of national parks is to conserve nature and cultural heritage. Opportunities are provided for appropriate visitor use in a manner that does not damage conservation values.

## State conservation areas

State conservation areas are reserved under the National Parks and Wildlife Act to protect and conserve areas that:

- contain significant or representative ecosystems, landforms or natural phenomena or places of cultural significance
- are capable of providing opportunities for sustainable visitor or tourist use and enjoyment, the sustainable use of buildings and structures, or research
- are capable of providing opportunities for uses permitted under other provisions of the National Parks and Wildlife Act.

Under section 30G of the Act, state conservation areas are managed to:

- conserve biodiversity, maintain ecosystem functions, protect natural phenomena and maintain natural landscapes
- conserve places, objects and features of cultural value
- provide for the undertaking of uses permitted under other provisions of the National Parks and Wildlife Act (including uses permitted under section 47J such as mineral exploration and mining), having regard to the conservation of the natural and cultural values of the state conservation area
- provide for sustainable visitor or tourist use and enjoyment that is compatible with conservation of the area's natural and cultural values and with uses permitted in the area
- provide for sustainable use (including adaptive re-use) of any buildings or structures or modified natural areas having regard to conservation of the area's natural and cultural values and with other uses permitted in the area
- provide for appropriate research and monitoring.

Land is reserved as a state conservation area primarily where mineral values do not allow for reservation as another category. The National Parks and Wildlife Act requires a review of the classification of state conservation areas every five years in consultation with the Minister administering the *Mining Act 1992*. The review considers whether each state conservation area should or should not be reserved as either a national park or nature reserve. Reviews of the Yanga State Conservation Area's reservation status were undertaken in 2008 and 2013 and no change was made.

Subject to the outcomes of future reviews, the state conservation area may be added to Yanga National Park. Meanwhile, the management of the state conservation area will be guided by the management principles for national parks as far as possible. These requirements have been taken into account in this plan of management.

## Nature reserves

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 section 30J of the National Parks and Wildlife 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

- 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

The NSW Government acted to acquire Yanga Station with the complementary aims of adding river red gum communities to the reserve system and restoring the ecological health of river red gum ecosystems in decline in the Lowbidgee.

This plan aims to provide a balanced approach to conserving natural and cultural heritage values within the parks, at the same time as making the parks available to the public to appreciate those values. This will be achieved through the following strategies:

- using an adaptive management approach to restore and maintain the parks' key ecological values, particularly the health and condition of the river red gum communities
- applying deliberate management interventions to reverse the effects of former land uses and restore native ecosystem elements
- providing a more natural watering regime for this section of the Lowbidgee wetlands
- continuing engagement with the community, government agencies and other stakeholders
- involving the Aboriginal community in conserving and promoting Aboriginal heritage and the continuing shared history associated with the parks
- conserving and promoting the parks' rich historic heritage, in recognition of the important place that the former Yanga Station occupies in the history of the pastoral industry and of western NSW
- presenting and promoting the parks as a community asset for recreation, enjoyment and appreciation by visitors with the involvement of the local community and potential business partners
- encouraging research and monitoring that will add to existing knowledge about restoring natural and cultural values.

## 3. Values

This plan aims to conserve both the natural and cultural values of the Yanga parks. 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 this plan clear and easy to use, various aspects of natural heritage, cultural heritage, threats and ongoing use are dealt with individually, although these features are interrelated.

### 3.1 Geology, landscape and soils

The parks are underlain by the Murray Geological Basin, a shallow crustal depression which was formed during the Cenozoic era approximately 60 million years ago (Scott 1992). The basin extends into three states and covers about 300,000 square kilometres (Lawson & Webb 1998, cited in Wen, Saintilan & Ling 2011). It consists largely of marine sediments derived from the ancient seas which occupied the western half of the basin, and moved back and forth across the plains several times. At one time the sea reached as far east as Balranald, five kilometres west of the parks (Pels 1969).

These deposits reach a maximum thickness of about 500 metres in the vicinity of the parks and occur in three main layers. In order of youngest (uppermost) to oldest (lowermost) these are:

**Shepparton Formation:** The Shepparton Formation was deposited by a series of prior streams during the late Cenozoic era and early Quaternary period to depths of 50–70 metres. It consists mainly of unconsolidated to poorly consolidated yellow and brown sands and clays. These are often referred to as ‘shallow aquifers’.

**Calivil Formation:** Below the Shepparton Formation, the Calivil Formation often extends to depths greater than 150 metres. The Calivil Formation belongs to the late Miocene to Pliocene period, and mainly consists of poorly consolidated, pale grey, poorly sorted, coarse to granular quartz and conglomerate within a white kaolinitic matrix.

**Renmark Group Formation:** The Renmark Group Formation is the oldest deposit in the profile and therefore the deepest. It belongs to the Palaeocene to middle Miocene period, overlying the basaltic bedrock from the Palaeocene to Miocene. The maximum thickness is about 280 metres. The Renmark Formation is distinguished from the Calivil Formation by the presence of grey carbonaceous sand (EA Systems Pty Ltd 2008).

During the Quaternary period (approximately 2.5 million years ago to the present) the deposits were reworked to form the aeolian landscape to the west of Balranald, while the landscape to the east was formed by the system of prior streams that eroded the Murrumbidgee and Lachlan river valleys in the later Pliocene (5.3 to 2.6 million years ago) and Pleistocene times (2.4 million to 10,000 years ago) (Butler 1950 and Woolley 1978, cited in Scott 1992). The parks are therefore situated in the transition zone between landscapes formed by aeolian processes (wind activity) to the west, and fluvial processes (associated with rivers and streams) to the east. This has resulted in an unusual situation in which very different landforms, vegetation associations and soil types sit side-by-side (Benson 2008). The boundary between these systems has fluctuated over time and is important in providing landform evidence of climatic change (Mabbutt 1980, cited in Scott 1992).

The parks are characterised by river channels, floodplains, backplains, swamps, lakes, lunettes and plains associated with the Lowbidgee Floodplain. The landscape is of low relief (relatively flat) broken only by lunettes and elevated sandhills which rise gently in the landscape in contrast to the surrounding depressions. There are no rock outcrops.

The pattern of lakes, lunettes and prior stream beds is of particular scientific interest because these features are evidence of changed Quaternary environments and human history. Aboriginal burial sites are often found in the lunettes which occur as crescent-shaped sandy rises and dunes on the eastern perimeter of the parks' lakes. They are up to 15 metres high. Lunettes occur as a result of the seasonal flooding and drying out of a lake leaving a salt residue on the lake bed which helps break up the clay soil. The clay particles are then blown by uni-directional winds and deposited to form a dune (Bowler 1976, cited in Scott 1992).

The eastern shoreline of the eastern sub-basin of Yanga Lake is an easily recognisable lunette. While the most intensive lunette-building phase occurred at the peak of the last glaciation 18,000 to 16,000 years ago (Bowler 1976, cited in Scott 1992), the lowest sediments in the Yanga Lake lunette have been dated to about 66,000 years ago (Copper 2008). Sedimentation of the lake bed itself is estimated to have begun about 128,000 years ago (Copper 2008).

The Yanga parks make an important contribution to reservation of five poorly conserved landscape types (Mitchell 2002) described in Table 1.

**Table 1 Mitchell Landscapes conserved in the parks**

Mitchell Landscape % of park area	Location in parks	Description
<b>Murrumbidgee Channels and Floodplains</b>		
48%	Floodplain in the north, Top and Lower Fingerboards in the east	This landscape is dominated by grey cracking and non-cracking clays on the floodplain. Duplex soils occur in levees; deep sands with calcium material in lunettes; yellow-grey cracking clays and isolated brown and red duplex soils in eastern areas; and sandy brown soils with calcium material in prior streams.
<b>Murrumbidgee Depression Plains</b>		
37%	Mainly within Yanga SCA	This landscape includes mainly grey cracking and non-cracking clays. Other soils are sandy loams and brown soils with calcium material; deep brownish sands in lunettes and rises; and scalded yellow duplex soils on backplains.
<b>Murrumbidgee Lakes, Swamps and Lunettes</b>		
8%	Lakes, swamps and lunettes throughout the parks' beds, margins and channels	The beds, margins and channels are formed by grey cracking clays and brownish sands; lunettes are formed of deep cemented sands, loamy to sandy brown soils with calcium deposits and red duplex soils.
<b>Murrumbidgee Scalded Plains</b>		
5%	Around the north-east side of Yanga Lake and on the far eastern boundary of the state conservation area	Soils are deep grey-brown cracking clay soils high in salt.
<b>Mallee Cliffs Sandplains</b>		
2%	Big Cultivation Paddock to the north of Uara Creek	Soils are loamy to sandy solonised brown soils and red duplex soils.

## Issues

Areas of sandy soils such as lunettes and sandy rises are extremely susceptible to erosion due to former clearing of vegetation and heavy grazing by native and non-native animals. This occurs particularly during seasonal flooding which forces animals to higher ground.

Aboriginal cultural heritage is often encountered in lunettes and exposed by erosion.

Most of the soils are grey cracking clays. In dry conditions, these soils are highly friable (crumbly) and prone to slumping and erosion, particularly on river banks. Heavy grey cracking clays also have high shrink–swell potential and are poorly drained. They accept water readily when dry but after the cracks close, water moves slowly through the soils causing waterlogging and swampy conditions for months at a time. Under wet conditions, these soils impede vehicle access, creating difficulties for park operations and visitors.

The Yanga Lake lunette is being eroded by wave action and surface water overflow from the peninsula at the Yanga Homestead precinct (see Section 3.6). There are risks of slumping, damage to visitor infrastructure and exposure of Aboriginal sites.

Scalds are prone to wind erosion which is made worse during drought periods.

There are several borrow pits in the parks which previously provided gravel for surfacing trails in the local area. Most have had available gravel resources exhausted and require rehabilitation (see Section 5.1).

## Desired outcomes

- Soil erosion and damage to sensitive landscape features is minimised during management operations and other works.
- Areas where erosion is actively occurring are identified and stabilised and rehabilitated as required.

## Management response

- 3.1.1 Locate and design infrastructure, including visitor facilities, to minimise impacts on areas prone to soil and wind erosion, soil instability and degradation.
- 3.1.2 Restrict vehicle access during wet conditions where grey cracking clays occur.
- 3.1.3 Monitor areas of active erosion and apply a risk assessment approach to prioritise sites for stabilisation. Undertake erosion control works in accordance with this assessment.
- 3.1.4 Stabilise eroded areas on Yanga Homestead peninsula to protect Aboriginal cultural heritage, historic heritage and recreational assets from ongoing damage due to wind and water erosion.

## 3.2 Water and wetlands

The parks are located at the far end of the Murrumbidgee River which flows westward from the Snowy Mountains to Balranald for a distance of 1690 kilometres. The Murrumbidgee is Australia's third longest river after the Darling and the Murray; its catchment covers approximately 84,000 square kilometres or about 8% of the Murray–Darling Basin.

The terminal zone of the Murrumbidgee River forms the very flat and expansive Lowbidgee Floodplain (MDBC 2004) and contains the largest wetland complex remaining in the Murrumbidgee Valley (MDBA 2010). The Yanga parks contain 41,405 hectares or almost 14% of this floodplain, which is characterised by flood-runners, creeks, meadows of tall spike rush (*Eleocharis sphacelata*) and wetland interspersed with bodies of open water. Significant

lakes include Piggery, Little Piggery, Waugorah and Yanga lakes. Yanga Lake is one of the largest lakes in western NSW with an area of 1324 hectares.

The region experiences a semi-arid climate, with low annual rainfall (315 millimetres per year at Balranald) and a high rate of evaporation (up to 10 millimetres per day over summer). Together with relatively high temperatures, these factors result in the region having a mean annual rainfall deficit of 1075 millimetres (NRC 2009). As such, the floodplain mainly relies on over-bank flooding and groundwater recharge from high Murrumbidgee River flows that originate in the upper catchment.

The Murrumbidgee River has experienced a long history of regulation and supports 14 dams, eight large weirs and over 10,000 kilometres of irrigation canals (DLWC 2001, cited in MDBC 2004). Overall the Murrumbidgee River has the most water diverted of any river in the Murray–Darling Basin (Crabb 1997, cited in Kingsford & Thomas 2001). As almost all of the water resource development lies upstream, the changes to the native biodiversity and ecological functions of the Lowbidgee are considerable. Increasing water availability to the Lowbidgee will help arrest the decline of native ecosystems including river red gum communities and the native plants and animals they support. Developing the science and means of how water can effectively be restored to the Lowbidgee under a more natural flooding regime forms the backbone of management for the Yanga parks.

## The Lowbidgee Floodplain

The Lowbidgee Floodplain is significant not only as the Murrumbidgee River's major wetland system but as some of the most important wetland habitat in New South Wales. The Lowbidgee wetlands:

- are among the three most important wetlands in Australia for wetland birds, based on long-term monitoring of wetland birds in eastern Australia (Kingsford 1999)
- are listed in A Directory of Important Wetlands in Australia (Environment Australia 2001)
- are included in the Great Cumbung Swamp listing in the non-statutory archive of the Australian Heritage Database (formerly known as the Register of the National Estate) (northern part of wetlands only)
- play a critical role in the highly modified agricultural landscape of the Riverina (see Section 3.4)
- have abundant resources which have supported Aboriginal people in the past (see Section 3.5).

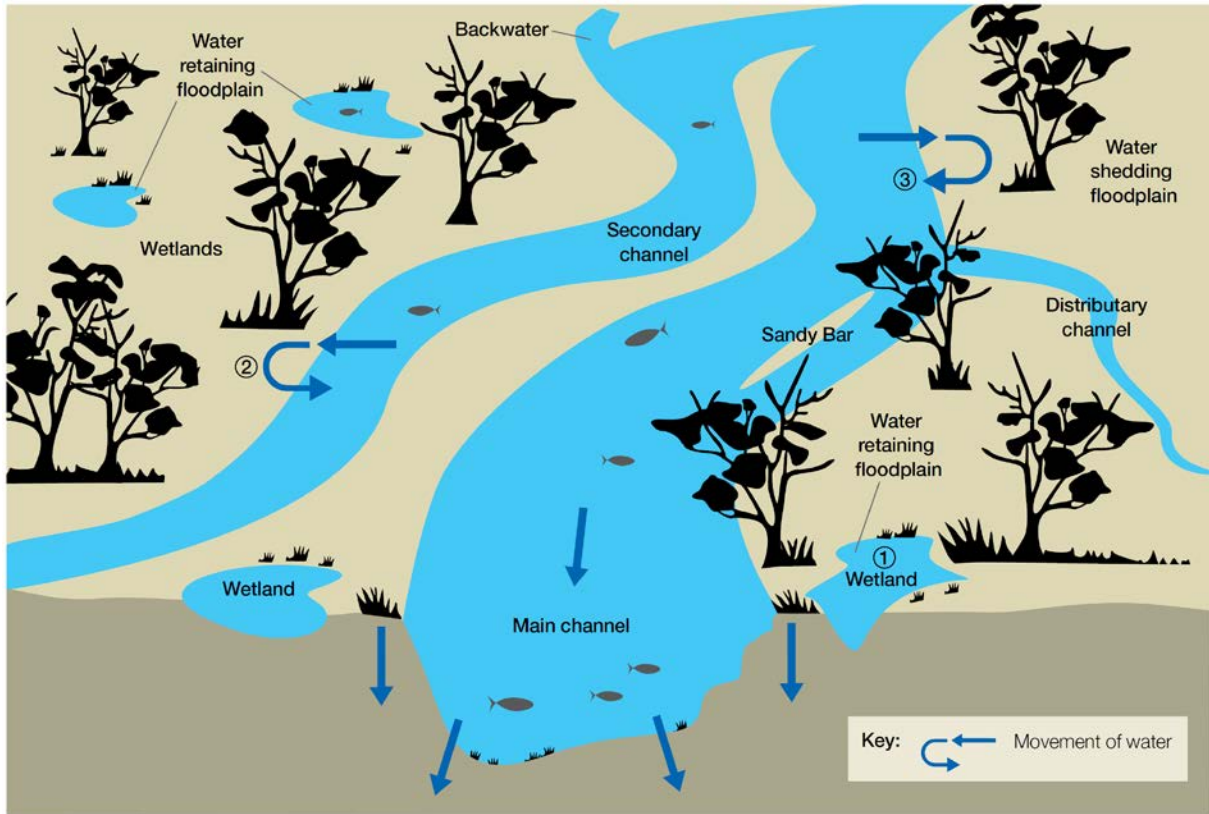
The floodplain was formed by the restriction of the Murrumbidgee River at Chaston's Cutting (see Figure 1), also known as the Chaston's or Murrumbidgee Choke, a natural bottleneck which is located roughly halfway between Redbank and Balranald weirs (Butler et al. 1973). The river channel capacity upstream of the parks at Hay is approximately 35,000 megalitres per day (ML/day). The capacity is reduced to 8500 ML/day at Chaston's Cutting and then increases to about 15,000 ML/day at Balranald Weir. During high river flows this restriction acts like the neck of a funnel, forcing water onto the floodplain via a complex system of interconnected creeks flowing east to west (Kingsford & Thomas 2004).

The floodplain ecosystem is a dynamic integrated system which relies on connectivity between the river channel and the floodplain to drive essential ecosystem services and maintain biodiversity (NRC 2009). Flooding essentially provides the means of connecting the different parts of the riverine landscape (see Figure 2). The most important ecosystem services in this landscape include:

- production of organic carbon from river red gum forest litter which is distributed across the floodplain by flooding and transferred back to the river



- delivery and distribution of water and nutrients by periodic flooding which stimulates pulses of biological activity
- provision of nursery habitat for native fish which subsequently populate the river
- filtering of sediment and pollutants by wetlands
- creation of a mosaic of natural habitats including refugia which allow for completion of essential life cycle stages for plants and animals
- intermittent control of pest plants and other organisms.



**Figure 2 Interactions between the riverine landscape and ecological processes (NRC 2009)**

The natural flooding pattern on the Lowbidgee Floodplain consists of late winter and spring inundation with large floods extending into summer. Floodwaters then recede during summer and result in a drying phase over autumn into early winter. Inland riverine floodplain forests such as river red gum forests rely on periodic inundation to retain moderate to good condition. Optimum flooding frequency for river red gum communities is generally around 1–3 years for forests and around 2–4 years for woodlands, with inundation times of between 5–7 and 2–4 months respectively (Roberts & Marston 2011, cited in Hardwick & Maguire 2012). The biodiversity of the Lowbidgee has evolved in sync with the natural flooding pattern and depends on the cycle of intermittent wetting (flooding) and drying for breeding success.

### **Altered hydrology in the Lowbidgee**

The construction of dams, weirs and other infrastructure along the Murrumbidgee has significantly altered the Lowbidgee’s hydrology over a period of some 140 years (Kingsford & Thomas 2001). The regulation of flows and diversion of water for irrigation and other purposes have changed the natural watering regime in terms of the timing, duration, extent and frequency of watering events.

The cumulative reduction in the quantity of water reaching this 'bottom end' of the river necessitated the construction of Maude and Redbank weirs in 1939–40. These weirs raised the level of the Murrumbidgee so that water could be diverted onto the Lowbidgee Floodplain for irrigation and compensate for the lack of natural over-bank flooding caused by upstream regulation structures, in particular, Burrinjuck Dam (originally built in 1928, enlarged in 1957) and Blowering Dam (completed in 1968). As of 2001, infrastructure on the Lowbidgee Floodplain included not only the two weirs but also 2145 kilometres of levee banks and about 394 kilometres of constructed channels. At that time, it was estimated the amount of water reaching the Lowbidgee Floodplain had reduced by at least 60% (Kingsford & Thomas 2001).

The impacts of reduced flows to the Lowbidgee include loss of ecosystem functions; loss of connectivity between the river and the floodplain; and changes to the composition, structure and distribution of vegetation communities.

In turn, this has meant loss of habitat and breeding opportunities for water-dependent plants and animals, especially waterbirds. By 2001 it was estimated that, together with the impact of broad land-use changes, water regulation had resulted in the loss of 58% of the original wetland area, and 44% of the remaining wetland area was degraded (Kingsford & Thomas 2001). The Millennium Drought (1997–2009) exacerbated these impacts. At the time Yanga Station was purchased in 2005, midway through the drought, the river red gum forests were observed as being 'a third healthy, a third stressed and a third dead' (R McDonnell [Regional Manager, Office of Environment and Heritage] 2010, pers. comm.).

Reduced frequency of flooding of the river red gum forests can also allow large volumes of leaf and bark matter to build-up on the floodplain. When flooding finally occurs after extended dry periods, the accumulated organic material is washed into waterways and consumed by bacteria leading to a sudden depletion of dissolved oxygen in the water (CEWO n.d.). This causes stress to aquatic organisms and can result in localised fish kills, known as blackwater events. The Lowbidgee experienced a severe blackwater event in April 2012 after the Millennium Drought. Blackwater is, however, a natural phenomenon necessary to the long-term health of river, floodplain and wetland ecosystems because it injects a large amount of carbon into the nutrient cycle. The severity of blackwater events is determined by factors such as the amount and age of leaf litter, and the occurrence of increased air and water temperatures.

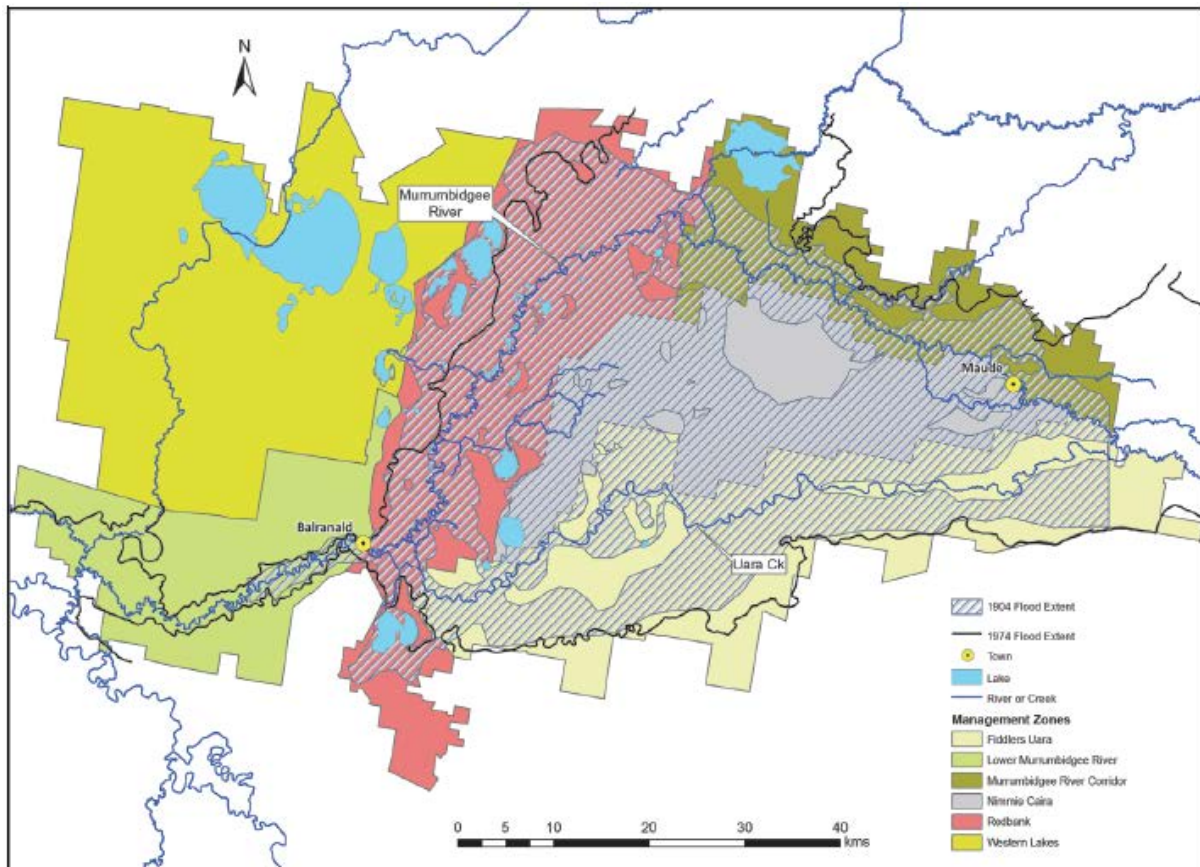
## **Altered hydrology on the parks**

As a working pastoral concern, Yanga Station had an extensive network of water management infrastructure including 110 kilometres of spreader or contour banks, 50 block banks (dams), 26 water-flow regulators and 10 bridges (Childs 2010). The spreader banks were constructed across creeks and sections of the floodplain near Top Narockwell and Tarwillie paddocks (see Figure 1) to raise floodwater levels and feed water onto elevated areas to promote timber growth and grazing. The main impact of this was that dense stands of river red gum became established in areas where red gum previously existed only as scattered individuals. Much of this younger tree growth has subsequently died as the result of no follow-up watering and now forms large stands of dead trees.

The hydrology of the parks is influenced by three interdependent watering systems of the Lowbidgee (Figure 3): Redbank, Nimmie–Caira and Fiddlers–Uara.

**Redbank South**<sup>1</sup>: This system is the main source of north–south flow in the Yanga parks and includes Piggery, Tala, Kia and Yanga lakes. (Tala and Kia lakes are not part of the parks.) Almost all of Redbank South (98%) is contained within the northern portion of the parks, covering an area of about 17,800 hectares.

Water is distributed into Redbank South primarily from Redbank Weir, but can also enter from Waugorah Creek through Nap Nap Station to the north-east, and the other two systems described below: the Nimmie–Caira floodways (via Tala Lake and Uara Creek), and the Fiddlers–Uara Creek system.



**Figure 3 Management zones identified for the purposes of the Lower Murrumbidgee Floodplain Water Plan**

The Redbank, Nimmie–Caira and Fiddlers–Uara zones are the three interconnecting systems which determine hydrology in the Yanga parks. Source: Hardwick & Maguire 2012.

Redbank South is separated from the Nimmie–Caira system to the east by a series of small blocking embankments and the raised profile of Waugorah Road.

**Nimmie–Caira:** This system was the major flow path for the Lower Murrumbidgee River Floodplain to the east between Maude and Balranald prior to regulation in the upper catchment. The natural hydrology was significantly changed with the construction of Maude Weir in 1939–1940 and irrigation of the Nimmie–Caira croplands during the 1980s.

<sup>1</sup> The Redbank system shown red in Figure 3 consists of Redbank North and Redbank South. Redbank North is located on the western bank of the Murrumbidgee River and has no direct influence on the hydrology of the parks.

Water is now distributed through the system via a combination of 'protected land' natural floodways<sup>2</sup> and constructed channel systems. The long and relatively narrow floodways extend from Maude for about 50 kilometres to the west to deliver flows to Tala Lake through Monkem and Talpee creeks. Water flows into the parks (via Woolshed Creek Regulator) and into the Murrumbidgee River (via the Tala Escape Regulator) only after Tala Lake has been almost entirely filled.

**Fiddlers–Uara creek system:** This system runs in a south-westerly direction along the southern edge of the Nimmie–Caira area. Many of the creeks in the Fiddlers–Uara system are 'discrete' waterways that become much larger and well-defined within the parks, particularly where Fiddlers Creek joins Uara Creek west of Yanga Nature Reserve. Traditionally the Fiddlers–Uara creek system provided water to the southern section of the Lower Murrumbidgee Floodplain and to natural depression storages such as Yanga Lake during high river flows. Flows are now mostly diverted away from this system into off-stream storages (for irrigated agriculture) or via earthen banks which have been installed across the creeks to retain water for livestock. The purchase of most of the Nimmie–Caira system in 2013 by the Australian Government for the purpose of improving environmental flows to the Lowbidgee is likely to result in changes to water delivery along Uara Creek.

## Environmental water planning and management for the parks

Today the Murrumbidgee is a highly modified system. Due to the scale of regulation along the river's length, flooding derived from natural rainfall will need to be supplemented by environmental water into the far distant future if the conservation values of the Lowbidgee are to recover and persist. The operational and policy environment of managing the parks is therefore influenced by catchment-scale issues. Some of these can be managed at the park scale, such as the design and management of NPWS water management structures, but others, such as long-term water availability in the catchment, cannot.

NPWS is now managing the distribution of environmental water on the Yanga parks with the overarching objective of reinstating a more natural flooding regime and arresting the decline of the river red gum communities of the Lowbidgee Floodplain. A more natural flooding regime will include intermittent wetting and drying rather than maintaining a constant supply of water to flood-dependent vegetation. It also has regard to seasonality and duration of flooding to complement the breeding cycles of waterbirds and other key species. Planning for environmental watering will therefore be based on the requirements of the key ecological values identified in the ecological risk assessment for the parks (Childs 2010):

- river red gum woodlands and forests
- black box (*Eucalyptus largiflorens*) woodlands
- tall spike rush wetlands
- egrets
- southern bell frogs.

These values were identified because of their regional, state or national significance, their ability to be used as indicator species of ecological health, and their effectiveness for long-term monitoring. This means that river red gum, black box and tall spike rush are representative of entire ecosystems, not just individual species. Similarly, egrets are representative of colonial nesting waterbirds and frogs are representative of a range of

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<sup>2</sup> The Nimmie–Caira floodways were gazetted in 1988 as 'protected lands' under the NSW *Soil Conservation Act 1938* (Hardwick & Maguire 2012) to conserve the remaining areas of Lignum Shrubland from clearing and protect the natural waterways from further development.

ecological health indicators such as water quality. See Appendix A for more detail on these key ecological values.

The risk assessment highlighted that adequate and timely environmental flows are crucial for restoring the ecological and hydrological function of the floodplain.

To assist in planning for environmental watering, a series of research projects were conducted between 2007 and 2010 under the NSW Rivers Environmental Restoration Program. The projects included inundation mapping, frog monitoring, flow gauging, hydrodynamic modelling and a wetland ecological character description. A key outcome of these projects was the development of an ecosystem response model and decision-support system for the Lowbidgee Floodplain.

Ongoing monitoring of the identified key ecological values provides information about how the environment in the parks is responding to environmental watering events. This information is combined with data collected from the Commonwealth Environmental Water Office's long-term intervention monitoring project 2014–2019 (Institute for Land, Water and Society Charles Sturt University 2017) (see Section 3.3) under an adaptive management approach to plan for future watering.

Even with this data, environmental water forecasting for the parks is complicated by a number of uncertainties including how much rainfall will be received in the catchment during late winter and spring, the degree of flooding that subsequently occurs, and what other demands will be placed on existing entitlements for environmental water. The timing of environmental watering is also dependent on the volume of water in the Murrumbidgee system, and the river levels needed to transport environmental water. For these reasons, environmental water planning needs to allow for flexibility in making decisions about how much water is needed and where it should be targeted. In the future, planning for potential environmental watering of the Nimmie–Caira is also likely to have a bearing on water planning for the parks.

Where possible, an environmental water release will be planned as a 'piggyback' event. This is where environmental water is released from Burrinjuck and Blowering dams into the Murrumbidgee River at the same time that rainfall has provided a significant inflow in tributary streams downstream of the major water storages (OEH 2015a). This simulates, to some extent, a natural high-flow event or 'fresh' which allows water to fill hundreds of lagoons, creeks and swamps as it makes its way down the river (OEH 2015a), including those which have remained dry for long periods. Although it is difficult to get the timing of a 'piggyback' event right, it can optimise the effect of a limited environmental water allocation and create a more effective watering event.

Annual planning for how environmental water should be applied takes place from March onwards each year and takes into account:

- watering over the previous year
- the condition of the environment ('antecedent' conditions)
- a forecast of available surface water based on the climate outlook provided by the Bureau of Meteorology.

This information is brought together to determine the resource availability scenario (see Table 2). The aim of the environmental water release will vary according to the resource availability scenario, as indicated in Table 3. For example, if the surface water availability is forecast as median and the antecedent conditions were median, this would mean the resource availability scenario is moderate. Under a moderate resource availability scenario, the aim of environmental watering for the year is to maintain ecological health and resilience.

**Table 2 Determining the resource availability scenario**

Surface water availability	Antecedent conditions				
	Very dry	Dry	Median	Wet	Very wet
Very low	Very dry	Very dry	Dry	Dry	n/a
Low	Very dry	Dry	Dry	Moderate	Wet
Median	Dry	Dry	Moderate	Wet	Wet
High	Dry	Moderate	Wet	Wet	Very wet
Very high	n/a	Moderate	Wet	Very wet	Very wet

Source: OEH 2015c.

**Table 3 Management outcomes for each resource availability scenario**

Resource availability scenario	Desired management outcomes
Very dry	<ul style="list-style-type: none"> <li>• Avoid irretrievable loss of, or damage to, environmental assets</li> <li>• Maintain critical refuges</li> <li>• Avoid critical loss of species, communities and ecosystems</li> <li>• Avoid irretrievable damage or catastrophic events</li> <li>• Allow drying to occur, where appropriate, but relieve severe unnaturally prolonged dry periods</li> </ul>
Dry	<ul style="list-style-type: none"> <li>• Ensure environmental assets maintain their basic functions and resilience</li> <li>• Support the survival and viability of threatened species and communities</li> <li>• Maintain environmental assets and ecosystem functions, including allowing drying to occur, consistent with natural wetting–drying cycles</li> <li>• Maintain refuges</li> </ul>
Moderate	<ul style="list-style-type: none"> <li>• Maintain ecological health and resilience</li> <li>• Promote low-lying floodplain–river connectivity</li> <li>• Support medium-flow river and floodplain functions</li> </ul>
Wet	<ul style="list-style-type: none"> <li>• Improve the health and resilience of water-dependent ecosystems</li> <li>• Support high-flow river and floodplain functions</li> <li>• Promote higher floodplain–river connectivity</li> </ul>
Very wet	<ul style="list-style-type: none"> <li>• Improve the health and resilience of water-dependent ecosystems</li> <li>• Support high-flow river and floodplain functions</li> <li>• Promote higher floodplain–river connectivity</li> </ul>

Source: MDBA 2012b.

On the basis of this information, a ‘Statement of annual environmental watering priorities’ for the Murrumbidgee Water Resource Plan Area (which includes the Lowbidgee Floodplain as a major environmental watering target) is developed prior to seeking endorsement by the Murrumbidgee Environmental Water Allowance Reference Group. This group includes representatives from the various water agencies, Riverina Local Land Services, conservation interest groups and the Aboriginal community.

A parks-specific watering plan is to be developed, using a similar methodology to the one applied for determining the annual priorities for the Murrumbidgee resource area as described. The park-based plan is intended to be a dynamic document which can be regularly updated to support an adaptive management approach to water and vegetation management for the parks.

Since the parks were established, they have received approximately six releases of environmental water (2009–2016). Observations made during and after a release, and

observations from environmental watering events in other catchments, has improved understanding of how the best environmental outcomes can be achieved from environmental water. As a result, a higher priority will be given to return flows in the middle and lower reaches of Yanga National Park downstream of Tala Creek in the future with the aim of restoring natural connectivity between the floodplain and river (J Maguire [Office of Environment and Heritage] 2015, pers. comm.). Return flows allow the rich resources that accumulate in the floodplain and its wetlands to be 'returned' to the river. It is hoped that these deliberately planned flows will improve ecological productivity and breeding success for native fish populations in particular.

## **Water delivery**

For water management purposes, the floodplain within the parks has been divided into 10 water management areas, ranging in area from 109 hectares to almost 8000 hectares (see Figure 4). The boundaries of the water management areas were defined using a hydrodynamic model and a digital elevation model which projected how water travels through the parks from specific delivery points under different water delivery scenarios (SKM 2008). The names given to each water management area reflect the main creek, wetland or water feature found there, for example, Tarwillie water management area contains Tarwillie Swamp.

The bulk of the water reaching the parks comes from the Murrumbidgee River via Redbank South (also known as 1AS) and Waugorah (1ES) regulators, which are serviced from the Redbank weirpool. Water can also be delivered from Nimmie–Caira via Monkem, Deadmans and PeeVee creeks which are all north of Tala Creek. Water can be supplied more directly and rapidly to the southern section of the parks (below Tala Creek) from the Maude Weir via the Nimmie–Caira system through Tala Lake and then the Woolshed Creek Regulator. Redbank South, Waugorah and several other regulators are owned and maintained by WaterNSW (see Section 5.2).

Within the parks, water is directed through the various water management areas by means of over 20 water management regulators owned and operated by NPWS (see Figure 4 and Section 5.1). The regulators vary in size and capacity. Some are reached by a bridge or walkway which provides access across the floodplain. The majority of the parks' regulators were installed in 2012 under NSW Rivers Environmental Restoration Program funding. Older regulators, such as Yanga Creek Regulator and Devils Creek Regulator, were already in place (on Yanga Station) but have been refurbished or upgraded to more effectively manage flows to water management areas and targeted wetland sites. A network of piezometers has also been installed for measuring groundwater depth across the Yanga Floodplain.

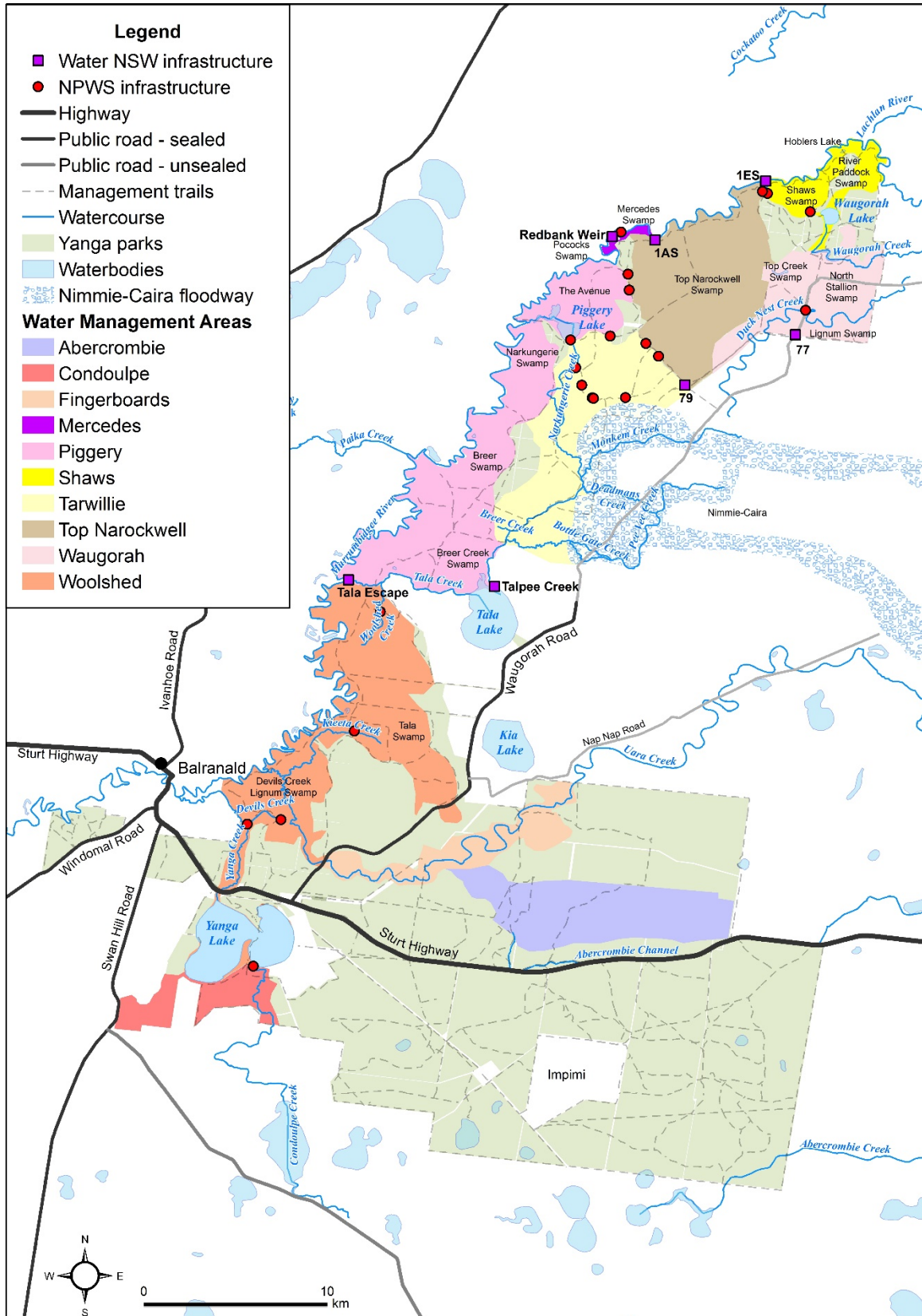


Figure 4 Hydrology and water management areas within the Yanga parks



## Water availability

The processes of obtaining and delivering water to the parks occurs within a complex regulatory framework which is continually evolving. This framework involves the Australian Government, the Murray–Darling Basin Authority and several state governments. The 2014 *Intergovernmental Agreement on Implementing Water Reform in the Murray–Darling Basin* (COAG 2013) provides for cooperation between these jurisdictions.

The Australian Government acquired water through the purchase of water entitlements from private landholders for the purpose of protecting or restoring the environmental assets of the Murray–Darling Basin. The Commonwealth Environmental Water Holder was appointed to manage this water and enable other aspects of national water reform.

At the basin level, the Murray–Darling *Basin Plan* (MDBA 2012a) seeks to coordinate water availability for its five major river catchments by setting sustainable diversion limits (SDLs) for agriculture, town water supplies and industrial uses. The SDLs represent an ‘environmentally sustainable level of take’ and will apply to both surface water and groundwater resources.

A series of water-saving and efficiency measures have been proposed for both the Yanga parks and Nimmie–Caira to assist in reducing the SDLs that will apply to the Murrumbidgee Water Resource. Water efficiency measures proposed include installation of new regulators, improvements to existing infrastructure and changes to the timing or volume of environmental water delivery. These measures are part of a Basin-wide initiative to recover water for the Basin which is being progressed by the Murray–Darling Basin Authority. Plans being developed under the *Basin Plan* will also influence water availability for the Yanga parks, including the environmental watering plan for the Basin and a long-term watering plan for the Murrumbidgee Water Resource.

At the catchment level, the Yanga parks come under the *Water Sharing Plan for the Murrumbidgee Regulated River Water Source 2003* (MDBA 2003) which was made under the NSW *Water Management Act 2000*. The plan establishes different categories of water licences, rules and licensing requirements for water users within defined areas and is administered by the NSW water management agencies. The parks were formerly part of the Lower Murrumbidgee Flood Control and Irrigation District. This district was established in 1944 under the original *Water Act 1912* (now replaced by the NSW *Water Management Act*) and was a major influence on the availability of water to the Lowbidgee Floodplain.

Until recently, Lowbidgee water users had no security of water supply and had to rely on access to ‘supplementary’ unregulated flows that were dependent on rainfall and irrigation demands upstream. The 2012 *Water Sharing Plan for the Murrumbidgee Regulated River Water Source* established a separate supplementary water licence for Lowbidgee water users. The amendment also allowed for planned environmental water and placed a limit on extractions in the Lowbidgee Flood Control and Irrigation District.

Environmental water is provided from a variety of possible sources each year:

- environmental water allowance made available under the Murrumbidgee Regulated River Water Source plan rules
- NPWS (South Redbank/Yanga) Lowbidgee supplementary access licence
- Lowbidgee supplementary licence administered by the Commonwealth Environmental Water Holder (under the *Commonwealth Water Act 2007*)
- NSW General Security – Adaptive Environmental Water administered by the Department of Planning, Industry and Environment
- Commonwealth General Security – Adaptive Environmental Water approved by the Commonwealth Environmental Water Holder.

In addition to environmental water, the parks have access to water under 10 licensed, General Security entitlements which came with the acquisition of Yanga Station. Seven of these entitlements were for irrigation and the remaining three were for supplying water for stock and domestic purposes. Water under the stock and domestic licences supplies water for staff living in the parks and cannot be traded. Any surplus General Security allocation which is not needed by the parks can be traded under the NSW Water Management Act and provides revenue for paying water licence fees and other water-related charges. From time-to-time this revenue has also been used for waterbird monitoring and water management works (see Section 3.4). The volume of water traded is determined by the price in the local market and varies significantly from year-to-year.

## Issues

River regulation and diversion has altered the hydrology of the Lowbidgee Floodplain to such an extent that long-term management interventions are needed to restore its flood-dependent ecosystems.

There are many uncertainties involved in planning for environmental water needs. Several initiatives are underway at catchment-level and basin-level and in the Nimmie–Caira which are likely to have a bearing on the availability of environmental water for the parks.

Water management infrastructure in the parks needs to be regularly maintained for the effective delivery of environmental water. Additional infrastructure may be required in future (see Sections 5.1 and 5.2).

Ongoing monitoring is needed to support environmental water planning and delivery for specific environmental outcomes.

In addition to correcting the altered hydrology in the parks by providing environmental water to benefit their natural systems, NPWS also directs water to Yanga Lake in most years to provide social and recreational benefits to the community (see Section 3.7).

Until recently, the Lowbidgee Floodplain was characterised by intense irrigation, dryland cropping and grazing. These land uses may have impacted the groundwater resource as well as surface hydrology. The role of groundwater in supporting the river red gum and other ecosystems of the Lowbidgee is not well understood. Current listed groundwater dependent ecosystems in the Lowbidgee indicate little use of groundwater, however, much more investigation is needed (Hardwick & Maguire 2012). High salinity levels have been recorded from shallow groundwater aquifers in Yanga National Park which suggests that groundwater salinity is an emerging issue.

## Desired outcomes

- A more natural watering regime is progressively established in the parks.
- Water management and delivery throughout the parks is efficient and effective and makes best use of technology and infrastructure improvements.
- Water management in the parks follows an adaptive management approach which can respond to change and accommodate the results of monitoring and research.
- A cooperative approach to water management is maintained involving relevant Commonwealth and NSW water management authorities and other water management stakeholders in the Lowbidgee.

## Management response

- 3.2.1 Develop a planning and monitoring approach to inform annual watering priorities and water delivery. Revise the monitoring regime from time-to-time to take account of new information.
- 3.2.2 Support the development of sustainable diversion limit savings projects for the parks and implement if approved.
- 3.2.3 Support research into groundwater attributes to better understand the role of groundwater in the Lowbidgee Floodplain, including the risk of increasing groundwater salinity.
- 3.2.4 Allow for the temporary trading of water from existing licensed entitlements. Revenue from water trading will be applied to environmental water planning, water delivery and associated activities in the parks.
- 3.2.5 Continue to liaise with water authorities to optimise water management for the parks.

## 3.3 Native plants

The parks contain diverse vegetation including riverine forests and wetlands, woodlands, chenopod shrublands, acacia shrublands, arid woodlands and mallee. Many of the vegetation communities in the parks are of high conservation significance. The diversity of native plant species is high, with 382 plants recorded.

The vegetation in the parks is known from a combination of surveys (Scott 1992; Benson 2006; Bowen 2010) and vegetation mapping undertaken as part of various research projects under the NSW Rivers Environmental Restoration Program (McCosker 2008; Bowen & Simpson 2012; Bowen et al. 2012). The most recent project carried out in 2012 focused on river red gum health and condition, so the information available about the vegetation communities which occur in the drier parts of the landscape is not as well developed.

There are 15 flood-dependent and 12 non-flood-dependent vegetation communities in the parks (see Appendices B(1) and B(2)). Flood-dependent vegetation occurs along the Murrumbidgee River floodplain and occupies over half the total area of the parks (59%). The non-flood-dependent vegetation communities are located mostly in the southern sections and take up 33% of the parks. Small patches also occur on lunettes and elevated rises within the floodplain.

The parks also contain 6049 hectares or 8% of cleared land. Big Cultivation and Tarwillie paddocks were used for cropping since the 1960s. Smaller cleared areas occur near Yanga Lake and in the Yanga Woolshed precinct.

## Threatened ecological communities

Three ecological communities listed as endangered under the Biodiversity Conservation Act occur within the parks:

Sandhill Pine Woodland in the Riverina, Murray Darling Depression and NSW South Western Slopes Bioregions Endangered Ecological Community (EEC)

*Acacia melvillei* Shrubland in the Riverina and Murray Darling Depression Bioregions EEC

Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray Darling Depression, Riverina and NSW South Western Slopes Bioregions EEC; also listed under the Environment Protection and Biodiversity Conservation Act as Weeping Myall Woodlands.

Each of these threatened communities has been extensively modified by clearing, logging and grazing, resulting in changed species composition and simplified community structure; most notably in the understorey and groundcover layers.

During periodic flooding of the Lowbidgee Floodplain, Sandhill Pine Woodland vegetation in the parks is placed under added grazing pressure from introduced pest animals and native herbivores seeking refuge on higher ground. The sandhills and lunettes are also favoured sites for rabbit (*Oryctolagus cuniculus*) warrens. In the past, Sandhill Pine Woodland was also cleared of the canopy species — white cypress pine (*Callitris glaucophylla*) — for use as fencing and building material on Yanga Station. With the removal of this overstorey species, the community now bears little resemblance to its natural condition but can be identified from isolated pine trees.

The parks support almost 5000 hectares of *Acacia melvillei* Shrubland EEC, primarily within the state conservation area south of the Sturt Highway. This is the largest patch of the community within a conservation reserve. Due to confusion between *A. melvillei* and *A. homalophylla* in the past, the extent of the *Acacia melvillei* Shrubland community in the Balranald area is not known (Scott 1992). Further investigation is needed to better understand its distribution.

A small area (31 hectares) of Myall Woodland EEC has been recorded but the true extent is much larger because regeneration of weeping myall (*Acacia pendula* or boree) individuals is occurring across the state conservation area. Given the long exposure to grazing that has removed the saltbush shrub layer, and the fact that the seed of saltbush species is short-lived, it is unlikely that the community will be able to substantially re-establish without active management interventions such as re-seeding.

## Threatened species

Two threatened plant species have been recorded in the parks and seven are predicted to occur (see Table 4).

**Table 4 Threatened plant species recorded or predicted to occur in the Yanga parks**

Common name	Scientific name	BC Act status	EBPC Act status
A spear-grass	<i>Austrostipa metatoris</i>	V	V
Bindweed	<i>Convolvulus tedmoorei</i>	E	
Claypan daisy	<i>Brachyscome muelleroides</i>	V	V
Lanky buttons	<i>Leptorhynchos orientalis</i>	E	
Menindee nightshade	<i>Solanum karsense</i>	V	V
Moore's burr-daisy	<i>Calotis moorei</i>	E	E
Mossgiel daisy <sup>1</sup>	<i>Brachyscome papillosa</i>	V	V
Slender darling pea	<i>Swainsona murrayana</i>	V	V
Winged peppergrass <sup>1</sup>	<i>Lepidium monoplocoides</i>	E	E

Source: BioNet (OEH 2016) and local knowledge.

Status: BC = Biodiversity Conservation Act; EPBC = Environment Protection and Biodiversity Conservation Act;  
E = endangered, V = vulnerable.

<sup>1</sup> Recorded in the Yanga parks.

Strategies for the recovery of threatened species, populations and ecological communities have been set out in a statewide *Biodiversity Conservation Program* (OEH 2017a). 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 2013b). Individual recovery plans may need to be prepared for threatened species listed under the Environment Protection and Biodiversity Conservation Act.

Individual recovery plans are prepared for nationally listed threatened species and some recovery plans were previously prepared for some species listed in New South Wales to consider management needs in more detail. There are currently no recovery plans for any of the threatened plants or ecological communities identified in the Yanga parks.

## Other significant vegetation

River red gum forest, black box woodland, lignum shrubland and chenopod shrubland are all of very high conservation significance because they have been largely depleted throughout New South Wales. The location of each of these vegetation types is determined by their geomorphic setting and the flood regime with river red gum forest occurring in the wettest, most frequently flooded parts of the Lowbidgee landscape, progressing through to chenopod shrubland in the driest, least frequently flooded part. Detailed profiles showing the relative position of these Lowbidgee vegetation types are provided in Appendix C.

The parks contain approximately 22,000 hectares of river red gum communities (forest and woodland). River red gum occurs on watercourses throughout Australia, but the largest forests are those along the major river systems of the Murray–Darling Basin. In New South Wales, 46% of the river red gum has been cleared (NRC 2009).

What remains of the river red gum forests has been extensively modified by a long history of timber harvesting and grazing since the earliest days of European settlement. Regulation of river flows since the 1930s and changes to natural flooding patterns have also resulted in significant changes to the extent, structure and health of these forests. The condition of river red gum in the Riverina Bioregion is described as poor and in decline (NRC 2009) and climate change is expected to worsen this decline under an increasingly drier climate. This situation was a major motivation behind the creation of the Yanga parks.

River red gum forests provide important refuge and foraging habitat in the cleared agricultural landscape for a broad variety of animals, especially birds and arboreal mammals. River red gum is well known for producing hollows needed by hollow-dependent mammals and nesting birds, but hollows only form in mature river red gums over 100 years old (Gibbons & Lindenmayer 1997).

River red gums are also an important source of coarse woody debris. They are vital to the ecological functioning of the broader Murrumbidgee Floodplain, including the Lowbidgee; and contribute valuable ecosystem services, especially carbon production and sequestration in the heavily cleared Riverina Bioregion. Restoring the health and condition of the river red gum communities is the overriding driver for management of natural and cultural heritage values in the parks, and river red gum has been identified as one of the key ecological values for the parks (see Appendix A).

Black box woodland occurs along the margins of river red gum forest on slightly higher parts of the floodplain than river red gum, and in intermittent creek lines which are only occasionally inundated. The understorey includes lignum (*Muehlenbeckia florulenta*) and nitre goosefoot (*Chenopodium nitrariaceum*), and in drier areas saltbush (*Atriplex* spp.) and bluebush (*Maireana* spp.) communities as well as grasslands (Hardwick & Maguire 2012).

The conservation of black box woodland is important because it provides a corridor between floodplain and dryland ecosystems. Black box woodland is poorly reserved in the Riverina Bioregion and throughout its distribution is under threat from clearing for cropping and from altered flooding regimes.

In the parks, black box woodland occurs in Yanga Nature Reserve, Fingerboards and Breer Creek Swamp. Much of this vegetation was severely degraded by a lack of water for over 20 years, due to irrigation diversions (see Section 3.2). Black box can also suffer if watering is too frequent or prolonged. Environmental watering over the past five years has shown improvement in the health of the black box woodland in the parks. This vegetation type has been identified as one of the key ecological values for the parks (see Appendix A).

The Lowbidgee Floodplain contains some of the most significant wetland habitat in New South Wales which has supported some of the largest waterbird breeding colonies in Australia (see Section 3.4). The tall spike rush wetlands are particularly important as nesting and foraging habitat for waterbirds and critical habitat for the southern bell frog. Tall spike rush wetlands include Shaw's Swamp, Mercedes Swamp, Tarwillie Swamp, The Avenue and Breer Swamp. Tall spike rush wetlands have been identified as one of the key ecological values for the parks (see Appendix A).

Lignum/nitre goosefoot shrublands are severely depleted due to clearing, burning and less abundant watering due to irrigation off-takes. Lignum occurs in natural flood-runners and depressions subject to regular flooding across the floodplain. There is a significant stand in the area between Yanga Lake and the Murrumbidgee River known as Loosemall Paddock. Where regularly inundated, lignum shrublands become dense and tall and are favoured breeding sites for colonial waterbirds. These types of lignum swamps are quite rare and the communities on the Lowbidgee Floodplain are some of the best stands in New South Wales and possibly Australia (Maher 1990).

Chenopod shrublands occur on the seldom-flooded parts of the floodplain. Because they are salt- and drought-tolerant they have been heavily depleted in western NSW by grazing stock. After long dry periods, wind erosion of dried soils worsens the effect of heavy grazing by both native and non-native animals. It is estimated that over 70% of old man saltbush (*Atriplex nummularia*) has disappeared since European settlement (Benson 2008; White, Muir & Webster 2002; Todd 2001). Most of the remaining areas have been severely degraded. Good stands are uncommon on the Hay Plains. A large stand of old man saltbush grows near Yanga Homestead and there are additional stands in the northern section of the parks. Similarly, bladder saltbush (*Atriplex vesicaria*) and black bluebush (*Maireana pyramidata*) were once common in the Riverina Bioregion but grazing has led to a rapid decline of their original extent. Since the parks were created and stock grazing ceased, the health, condition and recruitment of the chenopod shrublands have improved.

## Vegetation management

Past management practices and reduced water availability due to intensive regulation of the Murrumbidgee River have had major impacts on the health of native vegetation in the parks. The flood-dependent vegetation communities have been the most affected. The Millennium Drought (1997–2009) exacerbated these effects and resulted in widespread defoliation and dieback. In 2008, almost 75% of the river red gum communities in the parks were in poor or declining condition and only 15% were in good condition (Bowen & Simpson 2012).

Vegetation showed less complexity in the understorey, an incomplete range of age classes, a lack of recruitment, slow tree growth, canopy dieback and a scarcity of hollow-bearing trees. The most stressed river red gum areas were those downstream of Piggery Lake and upstream of Yanga Lake. Most areas of black box in the parks were also dying.

In an earlier assessment of the condition of the vegetation in the parks (McCosker 2008), non-flood-dependent communities were also found to be in poor condition. The reasons for this included drought, weed incursion and feral pests. After long dry periods, wind erosion of dried soils worsens the effect of heavy grazing by both native and non-native animals, for example in chenopod shrubland.

The key ecological values identified in the ecological risk assessment (Appendix A) are a combination of plant communities and animals: river red gum vegetation communities, black box woodlands, tall spike rush wetlands, egrets and southern bell frogs. The risk assessment showed that a majority of the potential threats to these values are directly or indirectly associated with water availability. Vegetation management and water management in the parks therefore need to be integrated under an adaptive management approach (see Section 3.2).

To reverse the impacts of past practices and restore the health of the river red gum communities, a program of deliberate management interventions will be considered. These interventions may include one or more of the following:

- Targeted delivery of environmental water to suit the needs of specific wetlands, forests, and woodlands
- Drying of some areas to discourage invasion by river red gum where it would not normally have occurred, for example, in shallow swamps which in their natural state would have an open canopy, and patches of open water which are important for waterbird foraging and nesting
- Removal or burning of invasive stands of river red gum where they impede water flow in drainage lines and open water systems
- Selective removal of young, live trees to improve the health of remaining trees by reducing competition and alleviating stress
- More-frequent wetting and drying to control the spread of the cumbungi or bulrush (*Typha* spp.) due to changed watering regimes
- Burning of dense patches of reeds (such as *Phragmites* spp.) where it is impeding delivery of environmental water and obstructing clear water habitat.

Each of these interventions is dependent on site-specific conditions.

Since the parks were created, targeted environmental watering has been introduced and is showing positive results in the condition of vegetation. In the black box woodland for example, foliage has returned and there is evidence of natural regeneration in the state conservation area and Fingerboards paddocks.

The digital elevation model prepared for understanding the flowpath of water through the parks (see Section 3.2) also determined where river red gum occurred naturally and the depth of water needed to support river red gum communities. Where spreader banks were constructed on Yanga Station to deliberately encourage the growth of river red gum for commercial timber, dense stands of even-aged trees formed instead of a range of age classes. These areas of forest are considered to be 'derived communities' because they are not naturally occurring.

The spreader banks have now been deliberately breached or completely removed to allow unimpeded flows along the floodplain and to minimise ponding. Many river red gum trees which died as a result of the Millennium Drought or the removal of spreader banks remain as dead standing timber. These dead standing trees, or stags, provide perches for raptors and habitat for arthropods (e.g. insects and spiders), hollow-nesting birds and hollow-dependent mammals. They are also an important source of dead wood which in the longer term will become coarse woody debris. NPWS will need to assess what level of coarse woody debris should be retained in non-flood-dependent communities.

Large stockpiles of timber offcuts left over after cutting of sleepers also remain in Winter, South Tala and Shaw's paddocks as well as smaller piles in various locations. These present a fire hazard and harbour pests such as rabbits. The stockpiles will be removed over time to allow these areas to regenerate.

Pending the outcome of scientific trials, ecological thinning to improve habitat values is being considered as a tool for managing red gum communities. Changes to ecosystem function and structure as a result of this process, including levels of coarse woody debris, will need to be considered and managed.

In 2016, 750 hectares of Big Cultivation Paddock was revegetated with locally indigenous native seed as part of the Commonwealth Government's *20 Million Trees Program*. In 2017, a further 1170 hectares were planted through a combination of direct seeding and tubestock in Big Cultivation Paddock, South Breeding Plain Paddock and on the western side of Yanga Lake. Each of these areas were previously heavily grazed or cleared for cropping and it is hoped this active revegetation will improve the ecological values of these areas.

The outcomes of this project will be monitored to inform possible future revegetation programs in the parks.

A proposed vegetation monitoring strategy to assess the progress of restoration activities in the river red gum communities (Bowen & Simpson 2012) requires:

- remapping the extent of vegetation communities every five years
- re-sampling fixed reference plots every five years
- seasonal monitoring of the responses to targeted environmental flows of wetlands and other flood-dependent vegetation communities.

The Long Term Intervention Monitoring Project is also providing data about ecological responses to the use of environmental water in the Murrumbidgee River system (Institute for Land, Water and Society Charles Sturt University 2017). (The Yanga parks receive environmental water from several sources including the Commonwealth Environmental Water Holder – see Section 3.2.). The monitoring carried out so far has concentrated on aquatic animals, birds, vegetation and ecosystem productivity parameters such as carbon and nutrients in the aquatic, riparian, wetland and floodplain environments.

Monitoring the recovery of non-flood-dependent vegetation is also needed. In parts of the state conservation area where sheep grazed constantly or large numbers of sheep gathered, the more palatable species of native vegetation communities were largely eaten out. The native seedbank may be completely absent in some of these places, for example in holding paddocks around shearing sheds. In less heavily impacted areas, NPWS expects that communities which include species such as dillon bush (*Nitraria billardierei*), cotton bush (*Maireana aphylla*) and bladder saltbush will start to reappear now that sheep are no longer present.

## Issues

Much of the native vegetation in the parks is severely degraded following changes in the natural watering regime, activities associated with agricultural use over a long period and the effects of the Millennium Drought.

There are a few degraded areas previously cleared of native vegetation to make way for cropping, such as Big Cultivation Paddock. In others, woodland was thinned or partially cleared before 1965 for use as firewood and building materials, such as the black oak – western rosewood woodland in the state conservation area.

Although some native species have started to appear after wet conditions, natural regeneration in the prevailing semi-arid climate is very slow. Active management interventions may be needed to restore the health and condition of both flood-dependent and non-flood-dependent vegetation communities.

Vegetation survey and mapping is not complete for all vegetation types. The current vegetation mapping for the parks is based on aerial photography captured during the Millennium Drought. Bare and almost bare patches are shown and some communities were



difficult to identify. In addition, the vegetation mapping has not been aligned to the NSW plant community type classification.

Threatened plant species in addition to those already recorded for the parks are likely to occur and may be detected through further survey.

Stockpiles of timber offcuts could yield timber for use in repairs to park buildings and as firewood in park campgrounds. They could also provide domestic firewood for the local community in the short to medium term.

## Desired outcomes

- Vegetation is restored to good ecological health and condition under an adaptive management regime.
- Knowledge of the plant communities and species occurring in the Yanga parks continues to improve.
- Threats to significant plant communities and species are minimised.
- The data obtained from monitoring is used to inform ongoing management as required under an adaptive management approach.

## Management response

- 3.3.1 Consider a range of deliberate management interventions to improve the ecological health of degraded river red gum, threatened communities and other significant vegetation, and where warranted, implement management interventions commensurate with available funds.
- 3.3.2 Review existing vegetation mapping and align it with NSW master plant community types.
- 3.3.3 Implement relevant strategies in the *Saving our Species* program and recovery plans for threatened species, populations and ecological communities in the parks.
- 3.3.4 Support targeted surveys for identifying threatened plant species and for monitoring the threatened communities in the parks.
- 3.3.5 Allow timber from landscape restoration works and from existing stockpiles to be used for domestic firewood under an NPWS-approved program.
- 3.3.6 Investigate whether the removal of dead standing timber in non-flood-dependent communities would result in net environmental benefit.
- 3.3.7 Manage previously cleared areas with regard to fire, weeds and feral pests to encourage natural revegetation, and support initiatives for active revegetation where proposed.
- 3.3.8 Implement a vegetation monitoring regime to inform future vegetation management and environmental water planning. Monitoring will include river red gum, black box communities and tall spike rush in accordance with the ecological risk assessment, and potentially also one or more indicator species for non-flood-dependent communities.

## 3.4 Native animals

The parks support a high diversity of native animals, on account of the rich variety of habitats and refuge they provide within the highly disturbed agricultural landscape. A total of 265 species of native animals have been recorded, including 198 birds, 25 mammals, 21 reptiles,

12 amphibians and nine freshwater fish. Of these, 25 species are listed as threatened and seven are listed in international migratory bird agreements (see Table 5).

**Table 5 Threatened and significant animal species recorded in the Yanga parks**

Common name	Scientific name	BC Act status	EPBC Act status
<b>Fish</b>			
Silver perch	<i>Bidyanus bidyanus</i>	V <sup>1</sup>	CE
<b>Frogs</b>			
Sloane's froglet	<i>Crinia sloanei</i>	V	
Southern bell frog	<i>Litoria raniformis</i>	E	V
<b>Migratory birds</b>			
Australian painted snipe	<i>Rostratula australis</i>	E	E
Black-tailed godwit	<i>Limosa limosa</i>	V	M
Fork-tailed swift	<i>Apus pacificus</i>		M
Greenshank	<i>Tringa nebularia</i>		M
Latham's snipe	<i>Gallinago hardwickii</i>		M
Marsh sandpiper	<i>Tringa stagnatilis</i>		M
Rainbow bee-eater	<i>Merops ornatus</i>		M
Sharp-tailed sandpiper	<i>Calidris acuminata</i>		M
White-bellied sea-eagle	<i>Haliaeetus leucogaster</i>	V	
<b>Other birds</b>			
Australasian bittern	<i>Botaurus poiciloptilus</i>	E	E
Barking owl	<i>Ninox connivens</i>	V	
Black falcon	<i>Falco subniger</i>	V	
Blue-billed duck	<i>Oxyura australis</i>	V	
Brown treecreeper	<i>Climacteris picumnus victoriae</i>	V	
Bush stone-curlew	<i>Burhinus grallarius</i>	E	
Diamond firetail	<i>Stagonopleura guttata</i>	V	
Freckled duck	<i>Stictonetta naevosa</i>	V	
Grey-crowned babbler	<i>Pomatostomus temporalis temporalis</i>	V	
Hooded robin	<i>Melanodryas ulpeste cucullata</i>	V	
Little eagle	<i>Hieraaetus morphnoides</i>	V	
Pink cockatoo	<i>Lophochroa leadbeateri</i>	V	
Redthroat	<i>Pyrrholaemus brunneus</i>	V	
Regent parrot (eastern subspecies)	<i>Polytelis anthopeplus monarchoides</i>	E	V
Spotted harrier	<i>Circus assimilis</i>	V	
Square-tailed kite	<i>Lophoictinia isura</i>	V	
Varied sittella	<i>Daphoenositta chrysoptera</i>	V	

Common name	Scientific name	BC Act status	EPBC Act status
White-fronted chat	<i>Epthianura albigrons</i>	V	
<b>Mammals</b>			
Southern myotis	<i>Myotis macropus</i>	V	

Source: BioNet (OEH 2016).

Status: BC = Biodiversity Conservation Act; EPBC = Environment Protection and Biodiversity Conservation Act; CE = Critically Endangered; E = Endangered; V = Vulnerable; M = Migratory.

<sup>1</sup> Not listed under the Biodiversity Conservation Act; status is given under the NSW *Fisheries Management Act 1994*.

## Birds

**Waterbirds** make up a significant component of the native animals on the parks (Kingsford 1999; Kingsford et al. 2013). A total of 64 waterbird species from 14 families have been recorded across the parks and surrounding floodplain (Bales 1999; Kingsford & Porter 2006; Magrath 1992; Maher 1990, 2006; Pressey et al. 1984; Spencer et al. 2011). This diversity is an indication of the complexity and diversity of habitat available (Kingsford et al. 2013).

The river red gum forested wetlands in the parks offer the combination of open water, shallow-water feeding habitat and dense aquatic vegetation favoured by many waterbird species for breeding, including the eastern great egret (*Ardea modesta*), cattle egret (*Ardea ibis*), Australasian bittern, Australian painted snipe, royal spoonbill (*Platalea regia*), Australasian darter (*Anhinga novaehollandiae*), glossy ibis (*Plegadis falcinellus*) and straw-necked ibis (*Threskiornis spinicollis*). Regularly used wetland rookery sites include Waugorah Lake, Tarwillie, The Avenue and Piggery (based on OEH colony monitoring 2008–2018). The black box woodlands and Nimmie–Caira lignum swamps to the east of the parks also contribute important feeding and nesting resources for many waterbird species.

Breeding by waterbirds in inland wetland systems depends on a range of factors including a stable depth of water and the presence of open water as well as suitable foraging and nesting resources. Colonial nesting waterbirds such as egrets (Ardeidae), ibis and spoonbills (Threskiornithidae) and cormorants (Phalacrocoracidae) require at least three months continuous flooding to ensure successful breeding and fledging of chicks. As many as 43 waterbird species were confirmed to be breeding within the Lowbidgee wetlands in 1989 (Maher 1990) but loss of wetland due to river regulation and control of floodwaters has contributed to massive declines in many species (Kingsford & Thomas 2001). Between 1983 and 2000, waterbird numbers were down by more than 80% and the Lowbidgee ecosystem was described as suffering ecological collapse (Kingsford & Thomas 2001).

Efforts to restore wetland function in the parks through environmental watering over the past few years and the breaking of the decade-long Millennium Drought in 2009 have seen renewed breeding occurring. Colonial waterbird breeding events not only contribute to the biodiversity of the Lowbidgee but provide an important indication of ecological productivity. Breeding events in the parks are being monitored to gauge whether recovery is occurring and to help in determining optimal conditions for individual species.

Egrets have been selected as a key ecological value in the ecological risk assessment (Childs 2010) because they are representative of colonial nesting waterbirds and an important biological indicator of wetland health (see Appendix A).

The parks support many of the **woodland and grassland bird species** common to the Riverina and the Hay Plains. Among the most common are yellow rosella (*Platycercus elegans flaveolus*), blue bonnet (*Northiella haematogaster*), red-rumped parrot (*Psephotus haematonotus*), sacred kingfisher (*Todiramphus sanctus*), spiny-cheeked honeyeater (*Acanthagenys rufogularis*), red-capped robin (*Petroica goodenovii*), black-faced

cuckoo-shrike (*Coracina novaehollandiae*), pied butcherbird (*Cracticus nigrogularis*) and emu (*Dromaius novaehollandiae*). A variety of raptors also occur in the parks, including the threatened square-tailed kite, barking owl and little eagle.

**Threatened bird species** include the rarely seen bush stone-curlew and the regent parrot (eastern subspecies). The regent parrot is at the easternmost extent of its range in the parks. Likely habitat includes areas of river red gum forest where mature hollow-bearing trees occur within a relatively short distance of the mallee woodlands on the western side of the Murrumbidgee River. Potential nesting sites may include Yanga Creek wetlands, Breer Swamp, Piggery Lake and adjoining The Avenue and Tarwillie Swamp.

Of the other threatened birds recorded, pink cockatoo and grey-crowned babbler commonly occur in black box and belah (*Casuarina cristata*) woodlands around The Willows, Oakhampton and Ten Mile paddocks. The diamond firetail finch has been observed in woodlands adjacent to the Murrumbidgee River near the Yanga Woolshed and Mamanga Campground.

## Mammals

The red gum forested wetlands are favoured habitat for micro-bats and 14 species have been recorded (Blakey 2016). This includes the first records of the large forest bat (*Vespadelus ulpestee*), Gould's long-eared bat (*Nyctophilus gouldi*) and threatened southern myotis on the Lower Murrumbidgee River (Pennay 2009).

Other mammal species occurring on the parks include echidna (*Tachyglossus aculeatus*), fat-tailed dunnart (*Sminthopsis crassicaudata*), common dunnart (*Sminthopsis murina*), water-rat (*Hydromys chrysogaster*) and common brushtail possum (*Trichosurus vulpecular*).

Extinctions of small mammal species have occurred across Australia with the introduction of non-native predators and the loss and alteration of habitat across the landscape (Dickman et al. 1993). It is likely that many of the small mammals now rare or absent from the heavily disturbed agricultural landscape would have occurred in the Lowbidgee in the past (Bales 1999). Species thought to have occurred previously include the numbat (*Myrmecobius fasciatus*), red-tailed phascogale (*Phascogale calura*), bilby (*Macrotis lagotis*), pig-footed bandicoot (*Chaeropus ecaudatus*), burrowing bettong (*Bettongia lesueur*), brush-tailed bettong (*Bettongia ulpestee*), eastern hare-wallaby (*Lagorchestes leporides*), bridled nailtail wallaby (*Onychogalea fraenata*), lesser stick-nest rat (*Leporillus apicalis*), greater stick-nest rat (*Leporillus conditor*), Mitchell's hopping-mouse (*Notomys mitchellii*), and Gould's mouse (*Pseudomys gouldii*) (Bales 1999).

The park also supports large numbers of red kangaroos (*Macropus rufus*), eastern grey kangaroos (*Macropus giganteus*) and western grey kangaroos (*Macropus fuliginosus*) which take advantage of ground tanks installed previously on Yanga Station. Grazing by these macropods adds to the impacts of rabbits on regenerating native woodland and shrubland communities (see Section 4.1). Grazing pressure from both native and non-native animals increases during floods when large numbers of herbivores are driven to higher ground. This contributes to erosion of lunettes and sandy rises.

## Amphibians and reptiles

The parks support a diversity of amphibians with 12 species recorded. The dominant species are the barking marsh frog (*Limnodynastes fletcheri*) and the spotted marsh frog (*L. tasmaniensis*) (Wassens et al. 2014a). The most notable species is the threatened southern bell frog, which has been selected as a key ecological value in the ecological risk assessment prepared for the parks (see Appendix A). This species is also being monitored under the Commonwealth Environmental Water Office Long Term Intervention Monitoring Project (Institute for Land, Water and Society Charles Sturt University 2017; Wassens et al.

2014b). It was once widespread and abundant throughout south-east Australia (Wassens et al. 2008), but over the past two decades has undergone severe declines throughout its range. The Lowbidgee contains the largest known population of southern bell frogs in New South Wales and is potentially the northern extremity of the species' range (Wassens et al. 2008).

The southern bell frog favours a mosaic of permanent and ephemeral waterbodies which flood in the spring of most years. Within the parks it occupies the edges of still or slow-flowing river red gum swamps which are dominated by emergent vegetation such as tall spike rush and water primrose (*Ludwigia peploides* subsp. *Montevidensis*). Populations have been detected at Mercedes Swamp, The Avenue, Piggery Lake and Twin (or Two) Bridges Swamp. There are important sites in the Nimmie–Caira as well, and together with the sites in the park, these areas contribute to permanent refuge habitat for southern bell frogs during dry periods and drought.

Surveys in the parks have recorded 21 reptile species but anecdotal reports of incidental sightings indicate the number is likely to be higher (Bales 1999; Maher 1990, 2006). The most commonly encountered reptiles within the parks are the eastern brown snake (*Pseudonaja textilis*), shingle-back (*Tiliqua rugosa*), bearded dragon (*Pogona barbata*), lace monitor (*Varanus varius*) and tree dtella (*Gehyra ulpeste*).

The three species of freshwater turtle known from the Murrumbidgee catchment occur in the parks, namely the eastern snake-necked turtle (*Chelodina longicollis*), Macquarie River turtle (*Emydura macquarii*) and broad-shelled turtle (*Chelodina expansa*) (Wassens et al. 2014b). Turtles are known to be a long-lived species with generally low reproductive success (Rizkalla & Swihart 2006, cited in Wassens et al. 2014b), but knowledge of the turtles' habitat requirements is poor. Turtles are among the species being monitored in the Lowbidgee under the Commonwealth Environmental Water Office Long Term Intervention Monitoring Project (Institute for Land, Water and Society Charles Sturt University 2017; Wassens et al. 2014a; Wassens et al. 2014b) as an indicator of ecological responses to environmental watering of wetlands. Monitoring so far has found that turtles favour temporary wetlands located next to the Murrumbidgee River or lagoons which are mostly permanent.

## Freshwater fish

The waterways flowing through the parks are part of an endangered ecological community listed under the *Fisheries Management Act 1994*: the Aquatic Ecological Community in the Natural Drainage System of the Lower Murray River Catchment (Wen, Saintilan & Ling 2011). This community includes the Murrumbidgee River downstream of Burrinjuck Dam and incorporates the Lowbidgee Floodplain. The community is threatened by modification of natural flows, introduced fish species (see Section 4.1), cold water pollution from dams, degradation of riparian vegetation, agricultural practices and overfishing (DPI 2007).

Historically, 21 native fish species have been recorded in the catchment but fish communities are now considered to be severely degraded (Gilligan 2005, cited in Hardwicke & Maguire 2012). Many factors have contributed to this, but most notably the changes to natural flooding regimes have disrupted the cues that trigger spawning by native fish species, such as seasonal increases in temperature and duration of inundation. In addition, water management structures in floodways, creeks and channels prevent the movement of fish across the Lowbidgee Floodplain (Gilligan 2005, cited in Hardwicke & Maguire 2012). The installation and operation of in-stream structures and other mechanisms that alter natural flow regimes of rivers and streams has been listed as a key threatening process under the Fisheries Management Act (FSC 2002).

Nine native fish species have been recorded in the vicinity of the parks (Spencer & Wassens 2010), including Australian smelt (*Retropinna semoni*), bony bream (*Nematalosa erebi*), carp

gudgeon (*Hypseleotris* spp.), Murray–Darling rainbowfish (*Melanotaenia fluviatilis*), golden perch (*Macquaria ambigua*) and unspotted hardyheads (*Craterocephalus stercusmuscarum fulvus*). Survey sites within the parks included Mercedes Swamp, Piggery Lake, Twin Bridges Swamp, Waugorah Lake and 1AS Regulator Channel. Other fish species recorded within the Murrumbidgee River near Balranald in the past include Murray hardyhead (*Craterocephalus fluviatilis*) and freshwater catfish (*Tandanus tandanus*), but these species are now caught infrequently. The silver perch is the only threatened fish species recorded in the Lowbidgee.

Water management planning now being carried out in the parks is seeking to restore connectivity between wetlands and the river channel to create conditions which are conducive to the life cycle needs of native fish. Return flows are being undertaken to allow water to flow into the park via Yanga and Tala Escape regulators during high flows which will capture drifting larvae of large-bodied native fish during spring. Tala and Yanga lakes have the potential to be important nursery habitats for large-bodied native fish, particularly flow pulse specialists such as golden perch and silver perch. The recruitment success for such species can be enhanced by flows that inundate and transport drifting larvae to off-channel habitat which have greater productivity than the main river channel (Ellis et al. 2015; Sharpe 2011; Lyon et al. 2010). It is then important to provide reconnection flows to facilitate the movement of maturing juveniles back to the main river so they can complete their life cycle (Ellis et al. 2015; Jones & Stuart 2008).

Monitoring of fish after specific environmental watering events has shown some increases in abundance of some native fish species (Wassens et al. 2014b).

## Recovery plans and actions

As for plants, strategies for the recovery of threatened animal species are set out in a statewide *Biodiversity Conservation Program* (OEH 2017a) and are currently prioritised and implemented through the *Saving our Species* program (OEH 2013b). Individual recovery plans are prepared for nationally listed threatened species and some recovery plans were previously prepared for some species listed in New South Wales to consider management needs in more detail. National and NSW recovery plans and a NSW management plan have been developed for the southern bell frog (Clemann & Gillespie 2012; DEC 2005b; Spencer et al. 2012).

## Issues

Changes in the natural watering regime and previous activities associated with agriculture and forestry have reduced wetland area in the parks and led to the decline of many waterbird species.

Many native aquatic species formerly found in the Murrumbidgee catchment are in decline due in large part to the modification of natural flows and loss of connectivity between different habitats on the floodplain (see Section 3.2).

Kangaroos contribute to grazing pressure from pest animals on elevated areas of the floodplain during flooding which can accelerate erosion (see Section 4.1).

## Desired outcomes

- Foraging and breeding habitat for waterbirds is restored and optimised.
- The requirements of native aquatic species are incorporated into water management planning.
- Key threatening processes and other negative impacts on animal species in the parks are minimised.

## Management response

- 3.4.1 Implement relevant actions and strategies in the national recovery plan and the NSW management plan for the southern bell frog in the Murrumbidgee catchment.
- 3.4.2 Implement relevant actions and strategies in the *Biodiversity Conservation Program* for threatened animals occurring in the parks.
- 3.4.3 Support and encourage native animal surveys across all habitats in the parks, giving priority to improving existing knowledge of threatened species in the parks.
- 3.4.4 Monitor key ecological values including egrets and southern bell frogs in accordance with the ecological risk assessment. Support and contribute to monitoring of other species where possible.
- 3.4.5 Incorporate the needs of significant animal species and results of monitoring into water management planning as part of an adaptive management approach.
- 3.4.6 Monitor the impact of grazing pressure from both native and non-native animals, including impacts on elevated areas of the floodplain, and undertake appropriate management action.
- 3.4.7 Restrict public access to bird breeding habitats during breeding events, but allow access for research, monitoring and park management operations.

## 3.5 Aboriginal heritage

### Country for Aboriginal people

The Yanga parks lie within the traditional Country of four Aboriginal groups: Wathi Wathi, Daddi Daddi, Mutthi Mutthi and Nari Nari. There are many different spellings for these group names and different interpretations in the Aboriginal community about where group boundaries fall.

Research by a linguist who has studied Aboriginal languages in south-west New South Wales (Hercus 1989) suggests Wathi Wathi Country takes in the north of the parks along the Murrumbidgee River corridor, including Yanga Lake and Tala Lake. Nari Nari Country is to the north-east of Wathi Wathi Country and extends beyond Hay. The Mutthi Mutthi People were focused around the lower end of the Murrumbidgee near the junction of the Murrumbidgee and Murray rivers. The boundary of the Daddi Daddi Country sits between Mutthi Mutthi Country (around Balranald) and Wathi Wathi Country on the Murray River (Uncle Jack Long, Mutthi Mutthi Elder, pers. Comm.). The boundaries in this area are complicated because of the small size of language groups along the Murray River and Lower Murrumbidgee, and the lack of research into the area as a whole (Pardoe & Martin 2001).

Today, Aboriginal people in the Yanga area are represented by the Balranald Local Aboriginal Land Council and a number of other organisations.

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 Country are inseparable and need to be managed in an integrated manner across the landscape.

While commonly understood to be of Aboriginal origin, the naming of Yanga is unclear. Participants in an oral history project recalled being told it meant 'Mother Earth' in an Aboriginal language (Gapps 2007). In 1846 George Augustus Robinson, the Protector of Aborigines in the Port Phillip District (now the state of Victoria), referred to a group of

Aboriginal people he met during a trip through the area as 'Walgerre, Tala, Yanga and other blacks present' (Clark 2000, cited in Pardoe & Martin 2001). During the same trip when meeting with an 'assemblage of tribes' Robinson referred to Lake Yanga as *Garngher*.

In pre-contact times, the Murrumbidgee Floodplain supported large numbers of Aboriginal people (Gott 2008). Early European explorers found that more and more people were to be seen as they progressed downstream, and groups in the vicinity of the Murrumbidgee–Lachlan confluence were as large as 120 people (Charles Sturt, writing in 1833, cited in Pardoe & Martin 2001).

Aboriginal life centred on the resource-rich wetlands of the river red gum forests (Tonkin Zulaikha Greer Architects 2013) though the prolific record of both occupation and cooking mounds confirms that Aboriginal people lived in different places at different times of the year (Pardoe & Martin 2001). The plains were used mainly in winter when surface water remained from winter rainfall or floodwaters pushed out from the rivers along creeks which were normally dry (Pardoe & Martin 2001). Floods were times of plenty and enhanced mobility (Tonkin Zulaikha Greer Architects 2013).

The river red gum forests and freshwater lakes supplied an abundance of food and raw materials for daily life (Gott 2008). Foods included fish, waterbirds and eggs, yabbies, mussels, turtles, possums, kangaroos, emus, echidnas, goannas, lizards, cumbungi (bulrush), reeds, waterlily (*Nymphaeaceae* spp.), yams, nardoo (*Marsilea drummondii*), dandelion (*Taraxacum officinale*), angled pigface (*Carpobrotus aequilaterus*) and sowthistle (*Sonchus* spp.) and lerp, a source of sugar from psyllid insect larvae living on river red gums and other eucalypts (Bodenheimer 1951). More than 150 plant species from both flood-dependent and non-flood-dependent vegetation communities are known to have been harvested. As the vegetation has changed considerably since non-Aboriginal people came to live there, some of these species may have disappeared, others may exist only as relicts and some may have increased in extent (Gott 2008). Other resources included fibres for weaving baskets and making string and nets; bark for canoes, shields and shelter; reeds for spears; timber for wooden tools and coolamons; and plant medicines.

The most common staple food was the rhizome of cumbungi (Gott 2008) because it was available all year round. In the past, cumbungi would have been found all over the floodplain where water was retained after floods, and would have been able to survive for several years between floods. Cumbungi stands were burnt in winter to open them to the light and add ash as a fertiliser. In the spring the young aerial shoots were eaten raw. As well as having a high starch content, the cumbungi rhizome provided strong fibres for making nets.

Yanga Station employed many Aboriginal people as stockmen and other workers including people from The Island, an Aboriginal reserve near Balranald. The Aboriginal Protection Board first records Aboriginal people being employed on the Station in 1891 (Tonkin Zulaikha Greer Architects 2013) and, over its long history, they were an essential component of the Station's workforce. Until the 1960s it was a common sight to see Aboriginal camps along quiet stretches of the Murrumbidgee River within Yanga Station (Gapps 2007). In the early 1970s a long-standing Aboriginal employee was made assistant manager and later tasked to oversee Aboriginal heritage on the Station. This unusual step is likely to have resulted in the survival of more Aboriginal sites than in other comparable properties (Tonkin Zulaikha Greer Architects 2013). Aboriginal people continued to live and work on the Station until acquisition by the NSW Government.

## Community engagement

While the NSW Government has legal responsibility for the protection of Aboriginal cultural heritage sites and places, NPWS acknowledges the right of Aboriginal people to make decisions about their own heritage.



At the time the parks were acquired, NPWS engaged members of local Aboriginal groups to undertake cultural heritage surveys. NPWS will continue to consult with local Aboriginal groups and encourage opportunities for Aboriginal people to be involved in managing Aboriginal sites, places and related issues, and in promoting and presenting Aboriginal culture and history.

NPWS acknowledges that access to the parks is important for Aboriginal people as part of obligations to look after Country and to pass on knowledge to the next generation. Members of the local Aboriginal community groups are keen to hold gatherings and undertake cultural activities in the parks. These activities could include cultural camps, collecting reeds and cumbungi for making baskets, collecting old man weed (*Centipeda cunninghamii*) for medicinal use or gathering nardoo and other food plants. Gathering of resources from the parks will need prior approval and will need to be managed to a sustainable level. There are areas in the north of the parks that would provide a suitable level of privacy for these activities. Men's and women's activities could be held on separate occasions.

Consideration is also being given to use of a building in the Yanga Homestead precinct (see Section 3.7) for an Aboriginal cultural resources centre. This could be a place for meetings, weaving and toolmaking and displays. The community has also requested that a keeping place be established in the parks for the storage and safekeeping of cultural heritage items. An unused building could be adapted for these purposes.

Another important aspect of caring for Country is access to water in the form of cultural flows. Cultural flows have been defined as 'water entitlements that are legally and beneficially owned by the Indigenous Nations of a sufficient and adequate quantity and quality to improve the spiritual, cultural, environmental, social and economic conditions of those Indigenous Nations' (AIATSIS 2009). A cultural flow recognises that 'the right to take water is an essential part of the historical and contemporary lives of Indigenous Nations. Indigenous rights to waters are part of a holistic system of land and water management'.

The first cultural water allocation in New South Wales was made by the former Murrumbidgee Catchment Management Authority under the *Water Sharing Plan for the Murrumbidgee Regulated River*. A cultural watering plan for the Murrumbidgee has subsequently been developed by Riverina Local Land Services in consultation with its Aboriginal Advisory Committee.

NPWS supports the principles of cultural flows and will seek to work with the local Aboriginal community regarding any cultural flow allocation for the Lowbidgee. A cultural flow will be considered along with ecological objectives in the environmental water management plan to be prepared for the Yanga parks (see Section 3.2).

## **Records of Aboriginal cultural heritage**

Aboriginal sites are places with both tangible (physical) and non-tangible (non-physical) evidence of Aboriginal use and occupation. They are important as evidence of Aboriginal history and as part of the culture of local Aboriginal people. The Yanga parks and surrounding area contain a rich record of Aboriginal occupation in the form of modified trees, ring trees (see below), middens, mounds, burials, dreaming sites and other occupation sites.

The parks are part of the extensive Lowbidgee Aboriginal cultural landscape. There have been several surveys of Aboriginal cultural heritage in the local region, including:

- NPWS Sites of Significance Program in the Balranald area in the 1970s and 1980s
- a women's sites survey in 1994 (Edmonds, cited in Tonkin Zulaikha Greer Architects 2013)
- Murrumbidgee Province Aboriginal Cultural Heritage Study (Pardoe & Martin 2001)

- an archaeological research, characterisation and predictive modelling project on the Lowbidgee and Lower Lachlan rivers wetlands under the NSW Rivers Environmental Restoration Program (Martin 2010).

Several surveys of Aboriginal cultural heritage have been carried out in the parks and many areas have been identified as significant sites. The *Aboriginal Heritage Information Management System* (AHIMS) database, currently contains about 270 records for the Yanga parks. Inconsistencies in terminology, bias towards some site types and variation in the purpose and coverage of these studies makes comparison between them difficult (Tonkin Zulaikha Greer Architects 2013). In addition, AHIMS records for some surveys are incomplete and some parts of the parks have not been surveyed at all. It is certain that many more unrecorded sites exist in the parks.

Pelican Point forms the southern peninsula which separates the two basins of Yanga Lake and contains a major shell midden. It also features prominently in stories for many Aboriginal groups of the Murray–Darling Basin. The stories reinforce aspects of tribal lore and are passed from generation to generation.

Another site which is important for its wealth of Aboriginal cultural heritage is on the southern border of Yanga State Conservation Area. This location recorded the largest number of sites other than modified trees and the largest number of hearths, shell middens, earth mounds and artefact scatters (Tonkin Zulaikha Greer Architects 2013). Lintot Lake is at the terminal end of Condoupe Creek and receives overflow only when other upstream waterbodies overflow. It is possible the lake has not held water regularly for a very long time so there is potential for Aboriginal heritage to be of a considerable age (Tonkin Zulaikha Greer Architects 2013).

Modified trees are by far the most numerous type of Aboriginal cultural heritage sites recorded, reflecting the heavy use of river red gum and black box by Aboriginal people. The scars on these modified trees range from small holes for accessing grubs, honey, eggs or small animals, to long scars for canoes. Several ring trees have also been recorded. This is where two or more branches of a young tree were tied into a circular shape which, as it grew, became a ring. The purpose of these trees may have been to provide permanent markers, perhaps for ceremonial use (Martin 2010).

Mounds are prolific on the Murrumbidgee Floodplain but only 27 have been recorded in the parks. Mounds are the most common and visible archaeological features present (Pardoe & Martin 2001) and provide useful information about past Aboriginal life over long periods. They derive from cooking ovens, plant processing and habitation sites and may occur with middens, oven complexes (which have no mounded material) and burials. As well as ash and bone fragments, mounds often contain ‘heat retainers’, which are balls of riverine grey cracking clay (Martin 2010) used in the absence of stone for cooking.

Eighteen Aboriginal burial sites have been recorded in the parks. In addition to these, a well-known historical account and series of sketches of graves at Lake Tala exists from 1846, observed by George Robinson (Chief Protector of Aborigines in Victoria from 1839–49). Many of the burial sites in the parks are in mounds or sandy rises. A unique aspect of the Lowbidgee and Lower Lachlan is that many burials are also located on the flat plains away from high ground (Tonkin Zulaikha Greer Architects 2013).

Stone artefacts have also been recorded in the parks but are relatively few due to stone being a scarce commodity on the Murrumbidgee Floodplain. Stone tools and grinding stones have been brought in from a distance. The only rock outcrop on the Murrumbidgee River occurs on the downstream side of Balranald (where a fish trap survives). The most common stone material in the archaeological record for the Lowbidgee is silcrete. The nearest sources are at Euston, approximately 90 kilometres to the west, and Lake Mungo, approximately 145 kilometres to the north-west (Martin 2010). Quartzite and quartz are present but were rarely used for toolmaking (Martin 2010).

## Issues

Local Aboriginal people want involvement in the management and promotion of Yanga parks.

Aboriginal heritage values and the long history of Aboriginal people living and working on Yanga Station tend to be overshadowed by historic heritage values. Interpretation activities and materials should include Aboriginal involvement and more Aboriginal content.

The records of Aboriginal sites and places in AHIMS need to be revised to address incorrect terminology, duplication and other issues.

Burial sites in sandy areas are at risk of disturbance by rabbits and rabbit control operations.

Past surveys have focused on certain site types or landscape features. Some parts of the parks have not been surveyed for Aboriginal cultural heritage.

## Desired outcomes

- Aboriginal people continue to access Country and are involved in co-management activities on the parks.
- Aboriginal places and values are identified and protected, and negative impacts on them are minimised.
- The community's understanding and appreciation of the Aboriginal cultural landscape is enhanced through increased education and interpretation.
- Aboriginal cultural material is repatriated and returned to Country.
- Consideration is given to a cultural water flow to benefit Aboriginal values in the parks.

## Management response

- 3.5.1 Engage with representatives from local interested Aboriginal groups to facilitate participation and involvement in park management.
- 3.5.2 Monitor Aboriginal cultural heritage sites in sensitive locations, including sandy rises and areas prone to erosion, and carry out stabilising works as required in consultation with the Aboriginal community.
- 3.5.3 Work with the Aboriginal community to support opportunities for Aboriginal people to access Country within the parks through culture camps, employment opportunities, collection of natural resources for cultural use and other activities.
- 3.5.4 Subject to obtaining approval under the National Parks and Wildlife Act, allow Aboriginal people to collect natural resources in the parks for cultural purposes.
- 3.5.5 Collect oral history from Aboriginal people who have past connections with Yanga Station for use in a balanced interpretation of the parks.
- 3.5.6 Support the Aboriginal community to investigate options for an Aboriginal gathering place in the north of the parks for culture camps and similar purposes.
- 3.5.7 Permit the establishment of an Aboriginal cultural resources centre in an existing building in one of the visitor precincts of the parks in consultation with the Aboriginal community. This centre will provide a focus for activities involving the Aboriginal community and interpretation of the parks' Aboriginal values.
- 3.5.8 Support surveys of Aboriginal cultural heritage in the parks, giving priority to areas where surveys have not yet been carried out.
- 3.5.9 Maintain a current and accurate record of Aboriginal cultural heritage in the parks by updating and revising NPWS database records.

- 3.5.10 Undertake an appropriate level of cultural assessment as part of planning for any works in the parks which have the potential to impact Aboriginal values.
- 3.5.11 Consult with the Aboriginal community to explore cultural water flow options for the Yanga parks.

## 3.6 Shared heritage

Heritage places and landscapes are made up of living stories as well as connections to the past that individuals and communities have inherited and wish to conserve for current and future generations, and can include natural resources, objects, customs and traditions. Cultural heritage comprises places and items that may have historical, scientific, cultural, social, archaeological, architectural, natural or aesthetic significance. NPWS conserves the significant heritage features of the parks and reserves that it manages. *The Burra Charter* (Australia ICOMOS 2013) and associated practice notes provides guidance for the conservation and management of places of cultural significance.

The Yanga parks comprise a cultural landscape, meaning they have been shaped by thousands of years of human occupation. The parks have links with both a rich Aboriginal history and with the first European pioneers of western New South Wales in the early 19th century. Yanga Station was at the heart of the developing wool industry and became one of the Riverina's largest pastoral properties. It has left behind a tangible record of the development of exploration, pastoralism, transport and communication over 160 years.

A conservation management plan has been prepared to inform the conservation of this rich legacy of historic heritage (Tonkin Zulaikha Greer Architects 2013). The conservation management plan was informed by conservation management strategies prepared for individual key buildings and structures (High Ground Consulting 2006/2007) and the Yanga Oral History Project (Gapps 2007).

### Settlement and land use

The first non-Aboriginal people to visit the lower Murrumbidgee and Lachlan rivers included the explorers Charles Sturt in 1829–30, and Surveyor General Thomas Mitchell in 1835 as part of the quest for pasture and land suitable for settlement. It was not long after that squatters and agents for city-based investors arrived to take advantage of the rich river country (Tonkin Zulaikha Greer Architects 2013).

Yanga Station derived from the Nap Nap, Tala and Yanga runs. Nap Nap was the first of these to be taken up near Waugorah Creek in 1845 by a squatter, George Hobler. Over 70 years or so, the runs were merged and dissected as squatters, selectors and then leaseholders vied to occupy the well-watered riverfront land for ever-increasing flocks of sheep. Located in the western Riverina, Yanga Station was in the thick of a growing wool industry. At its height in 1887, Yanga occupied 416,000 hectares and carried 151,700 sheep and over 2000 cattle. The rapid build-up of sheep and dramatically high stocking rates were to prove unsustainable throughout the Western Division. The combination of the loss of native pasture, drought and rabbit infestation by the 1890s ultimately led to environmental devastation on a broad scale. The early settlers also had an optimistic view of the carrying capacity of the land (Condon 2002).

Yanga Station changed hands several times and station owners witnessed the subdivision of surrounding lands into smaller holdings. An attempt to compulsorily break up the Station under the government's Soldier Settlement Scheme for soldiers returning from the First World War was abandoned. Most of the blocks sold on Yanga Station were re-acquired, excluding Impimi. Arthur Sims and Arthur Cooper bought Yanga Station in 1919 and formed Yanga Pty Ltd. This private company persisted until being acquired by the NSW Government in 2005, and in its last 86 years was owned by three generations of the Black family.

With an area of some 76,000 hectares (188,000 acres) Yanga Station was said to be the largest holding held in a single freehold title in New South Wales (Yanga Pty Ltd website, cited in DEC 2005a). After sheep, harvesting of red gum timber was the next biggest activity and grew to become a substantial enterprise (Tonkin Zulaikha Greer Architects 2013). In 2005 Yanga was running 12,000 sheep and 1400 cattle.

The history of Yanga Station parallels the development of early transport and technology in western NSW. The mail coach route established between Sydney and Adelaide in the 1860s passed close to Scotts Sandhill just outside the national park boundary (Tonkin Zulaikha Greer Architects 2013). Paddle-steamer transport commenced in the 1850s and by 1880 was used to ship the wool clip from Yanga Station. Two boat wrecks, at Tala Creek and Woolpress Bend, dating from the late 19th or early 20th century preserve the history of the riverboat period.

In the early 20th century the growing railway network took over from river transport. The Moama–Balranald line was constructed through the south-west corner of Yanga Station between 1923 and 1926. Sidings were constructed on the north side of Yanga Lake and at Impimi and are still visible today (see Section 5.2). It is not known when freight transport ceased on this line but passenger services were withdrawn in November 1975.

The 1920s saw several technological innovations on Yanga Station including electric lighting, a refrigeration plant and telephone system. Yanga Station owners also witnessed the evolution of water management as the early pastoralists sought to manage the Murrumbidgee River landscape to their advantage through extremes of flood and drought. Water management measures started to appear in the Lowbidgee from the late 1850s onwards (Eastburn, cited in Tonkin Zulaikha Greer Architects 2013). Tanks, dams, bridges and embankments are shown on maps of ‘Yangar Holding’ dated 1886 and flood lines were recorded as early as 1894. Wells and windmills were installed in the drier sandplain country in the south-east of Yanga Station in 1912 and the first in-stream regulator was constructed on Yanga Creek to control water in Yanga Lake in 1913.

## **Built heritage**

Historic heritage structures are distributed throughout the parks reflecting the history and evolution of Yanga Station and human responses to the opportunities and difficulties with the landscape and climate, particularly with water. Surviving structures range from basic slab huts, wells and timber fences to more elaborate woolsheds, shearers’ quarters and homesteads. Of the pastoral properties held within national parks, few have the same range and extent of pastoral structures as Yanga Station (Tonkin Zulaikha Greer Architects 2013). There are also numerous historical archaeological sites of former buildings and structures.

The oldest historic heritage sites in the parks include the site of Hobler’s Hut at Waugorah (1848) and the site of the first head station at Kieeta (1850s). There are few above-ground remains at these sites but they still hold considerable archaeological significance.

The standing historic heritage of the parks has a high degree of authenticity. This is attributed to long ownership by the Cooper–Sims partnership from 1919 and then the Black family and their deliberate efforts to look after cultural heritage values on the property. The two main historic groupings are the Yanga Homestead and Yanga Woolshed.

**Yanga Homestead precinct** was the headquarters of a large pastoral operation. The current Homestead is the third known ‘head station’ homestead for Yanga Station. The first homestead was constructed at Kieeta in the 1850s before being relocated to the junction of Yanga Creek and Yanga Lake in about 1860 and then to the current site in 1863.

All of the facilities needed to support daily and seasonal life on a remote, 19th century country property are present in the precinct, centred on the Homestead itself. They include late 19th century stables, carriage house and smithy, laundry, the Cook’s Cottage, staff

quarters, storerooms and sheds, a slaughter room and a meat safe. The Homestead and grounds offer stunning views of the lake and are an important part of Yanga's overall heritage significance. They include working areas such as stockyards, an orchard and vegetable gardens, as well as rose gardens and a tennis court.

The Homestead was built from cypress pine felled on the west side of Yanga Lake and is an exceptional example of drop-log construction (Tonkin Zulaikha Greer Architects 2013). With its fine joinery and wide verandas, the design and construction of the Homestead have been described as having high technical and aesthetic value. The family quarters of the Homestead were updated in the 1950s but the Homestead as a whole retains its authenticity. The Homestead and its outbuildings, yards and gardens are mostly in good to reasonable condition. A few buildings, including the carriage shed, blacksmith shop and stables, have suffered some localised damage and deterioration. The carriage shed and blacksmith shop were restored in 2015.

The Yanga Homestead precinct is a natural focus for understanding the operational and social history of Yanga Station and is now presented as one of the key visitor sites in the parks offering a range of interpretative material and regular tours.

**Yanga Woolshed precinct** lies some five kilometres west of Yanga Homestead precinct in a separate section of the national park off Windomal Road. The riverbend location on the Murrumbidgee River with a steep bank and deep water allowed ease of transport for wool bales to Echuca via paddle-steamer. This site was subject to flooding and is bounded by an early 20th century, man-made earthen bank which links the river bank to higher ground to the east.

Yanga Woolshed is an example of a linear woolshed designed for sheep to enter from one direction and wool to leave from the other. It is well-built, in excellent condition and of high aesthetic value (Tonkin Zulaikha Greer Architects 2013). An earlier, smaller woolshed built in about 1876 was burnt down in 1896 during the Shearers' Strike (Tonkin Zulaikha Greer Architects 2013) and the current Woolshed was built in the early 1910s. Yanga Woolshed is an impressive structure supported by large, sawn red gum posts, 112 by 15 metres in area, and covering almost 1700 square metres. It originally accommodated 40 blade shearing stands together with sweating pens, catching pens and a wool room, all under cover. A series of external sheep sorting and drenching yards adjoin the shed on its eastern side.

The precinct also features shearers' quarters, cookhouse and mess, stables, managers' housing and holding yards which were all characteristic of a large woolshed complex. The buildings range from large timber-framed early 20th century halls to smaller cottages. The shearers' quarters and cookhouse, completed in 1911, differ from the other local buildings. They were designed by Melbourne architects and feature an unusual and rare large size proprietary block, different to modern concrete blocks in both size and material. The blocks are made of an unusual aggregate that appears to be broken rock, with a weak cement-like binder (Tonkin Zulaikha Greer Architects 2013). There are also extensive archaeological deposits in the precinct surviving as evidence of previous buildings and activities.

The Woolshed is in good condition despite some termite and storm damage that has been repaired. The condition of the other buildings in the complex varies. Some buildings are in reasonable condition but need minor repairs and maintenance. Others, particularly the concrete block buildings, are in poor condition and need extensive repairs to reverse their deterioration.

As the centre of shearing operations for Yanga Station, the Yanga Woolshed, like the Homestead precinct, provides an important focus for visitors and extensive interpretation displays have been installed. The last shearing on Yanga Station took place in 2005 and a group photograph of the last shearing now hangs in the Woolshed.

## **Moveable heritage**

The collection of moveable heritage items acquired with Yanga Station is one of the most intact collections available in public ownership (Tonkin Zulaikha Greer Architects 2013). The collection includes items as diverse as shearing records, drays and sulkies, furniture, household linen, bales of wool and farm machinery. The collection is culturally significant in its own right because it records the daily life and times of over 160 years of a large sheep farming property in western NSW (OHM Consultants 2008).

The management of moveable heritage is guided by the Moveable Heritage Management Plan and Inventory (OHM Consultants 2008).

The majority of the collection is on display in the Yanga Homestead precinct and Yanga Woolshed precinct. Some materials, such as paper and fabric, are especially vulnerable to atmospheric damage and attack by insects or mice and require specific care to maintain them in good order. There is also a risk that visitors may damage or remove displayed items.

NPWS will adapt some unused buildings in the Homestead precinct of Yanga National Park for the preservation, storage and management of the moveable heritage collection.

NPWS also holds an extensive collection of Station archives including manager's diaries, ledgers, letters, maps and other documents. These records have been itemised but require more detailed archiving. The protection and archive project will also mean that these significant paper records can be stored appropriately.

## **Significance**

The conservation management plan (CMP) (Tonkin Zulaikha Greer Architects 2013) assessed the heritage significance of the Yanga parks and found they meet all seven of the Heritage Council of NSW criteria for listing on the State Heritage Register. The CMP also considers that Yanga may demonstrate historical significance and rarity at a national level. The decision to list some parts or all of the Yanga parks on the State Heritage Register rests with the NSW Heritage Council.

The assessment of heritage significance in the CMP highlights the long history of Yanga Station and is a combination of the biodiversity, Aboriginal cultural heritage and historic heritage values of the parks. It is considered likely that the parks would be successful if nominated for state heritage listing.

The Yanga parks include over 150 individual historic structures and buildings. While most of those which demonstrate high heritage significance are in good condition, some are not. The impact of ageing and other natural processes means that some historic heritage structures in the parks have deteriorated to a point where repair and reconstruction is not recommended by the CMP. These structures will therefore be managed as ruins. This decision is based on the CMP's assessment of the contribution the structure makes to the overall heritage significance of the parks. Historic heritage structures which are to be managed as ruins will be monitored to ensure they do not pose a safety risk.

## **Adaptive re-use**

The National Parks and Wildlife Act provides for adaptive re-use of existing buildings and structures in parks, including historic heritage, provided any proposed modification and use is carried out in a sustainable manner, is consistent with the conservation of the natural and cultural values of the land, and is compatible with the retention of the cultural significance of the buildings and structures. A range of uses for historic heritage buildings and structures on the Yanga parks may be considered appropriate in providing greater diversity and flexibility of use, improved public access and in ensuring conservation outcomes for buildings and structures.

The adaptive re-use provisions of the National Parks and Wildlife Act require that building work and modifications are sympathetic to the original fabric of the building and maintain the integrity of the historic heritage values. Proposals for adaptive re-use will be guided by the Yanga CMP and will be subject to feasibility and environmental impact assessment. Several historic heritage buildings in the Homestead precinct are currently being adaptively re-used, including the Singlemen's Quarters as a NPWS office, the Cook's Cottage as an exhibition venue, and several outbuildings for storage (see Section 5.1).

There are additional opportunities for adaptive re-use in the Homestead and Woolshed precincts provided interiors and items of moveable heritage are appropriately protected. The CMP considers that the Yanga Homestead and its collection of moveable heritage items is too significant and fragile to be used for high volume activities such as commercial accommodation or as a reception centre on a continuing basis (Tonkin Zulaikha Greer Architects 2013). However, parts of the Homestead and outbuildings could be restored to provide for caretaker accommodation, catering and dining, or gift shop. Some buildings in the Woolshed precinct, including the shearers' mess hall, are suitable for short-term accommodation for individuals, groups, re-enactments and shearing demonstrations (see Section 3.7).

## **Issues**

Many of the historic heritage buildings in the Homestead and Woolshed precincts need continual maintenance to address poor drainage, subsidence, fire hazard, pests and other causes of decay. If not addressed, these issues can cause structural deterioration and compromise heritage values.

Maintenance and upkeep of historic heritage requires specialist input and without regular maintenance can be costly and time consuming.

As an extensive outdoor museum, some historic heritage structures and items of moveable heritage are at risk of deterioration and interference by visitors. The vast moveable heritage collection needs to be appropriately curated and stored for future posterity.

## **Desired outcomes**

- The parks are managed as a cultural landscape, which includes both historic and Aboriginal cultural heritage.
- The Yanga parks are listed on the State Heritage Register.
- Historic heritage values are managed in accordance with their assessed level of heritage significance. Maintenance and any other changes to historic heritage items in the parks follow best practice for historic heritage management.
- The community's knowledge and appreciation of historic heritage significance is enhanced through increased access, education and interpretation.

## **Management response**

- 3.6.1 Support the listing of the Yanga parks on the State Heritage Register.
- 3.6.2 Use the Yanga Conservation Management Plan as a guide to historic heritage management and investment.
- 3.6.3 Leave archaeological sites undisturbed in situ except for approved research in accordance with a permit issued under the National Parks and Wildlife Act or the Heritage Act.



- 3.6.4 Monitor the impact of visitors on historic heritage throughout the parks and modify visitor access as required to protect historic heritage values.
- 3.6.5 Implement the Moveable Heritage Management Plan and Inventory, including archiving the moveable heritage collection (including paper records), and establishing an appropriate storage facility to protect those items which are not on display.
- 3.6.6 Monitor introduced plantings and manage them to avoid adverse impacts on historic and natural heritage values. Historic cultural plantings which are assessed as having little or no significance and are weeds may be removed and replaced with more appropriate species which fulfil a similar role in that location.
- 3.6.7 Investigate options for adaptive re-use of parts of the Yanga Homestead precinct for caretaker accommodation, catering and dining, a cafe or gift shop.
- 3.6.8 Investigate options for adaptive re-use of buildings in the Yanga Woolshed precinct for short-term accommodation for schools or other groups, re-enactments and shearing demonstrations.
- 3.6.9 Investigate options for adaptive re-use of Redgum Cottage by the local Aboriginal community for cultural activities, meetings, display of Aboriginal heritage items and similar activities.

### 3.7 Visitor use

NPWS parks and reserves provide a range of opportunities for recreation and tourism including opportunities for relaxation and renewal as well as appropriate active pursuits. Visitor opportunities provided in the natural and undeveloped settings afforded by the parks system are mostly those at the low-key end of the spectrum. NPWS aims to ensure that visitors enjoy, experience and appreciate the parks at the same time as conserving and protecting park values.

Planning for visitor use of the parks to date has focused on low-key activities including both self-guided and guided activities. The parks provide diverse opportunities for visitors in a pastoral setting which includes old station buildings, Aboriginal cultural heritage and the majestic red gum forests and wetlands of the Murrumbidgee River. The Yanga Homestead and Yanga Woolshed are of great interest as evidence of former outback station life. Most visitor activity to date has been concentrated at these historic heritage visitor sites and at Yanga Lake. Providing visitor experiences linked to the wealth of Aboriginal cultural heritage and natural values in the wetlands in the north of the parks is a potential future opportunity.

The parks receive 16,000 to 20,000 visitors on average each year. Peak visitation occurs in the cooler months, generally March to November. The most popular visitor activities in the parks are looking through the historic heritage buildings, fishing, swimming and waterskiing, camping, nature appreciation and birdwatching.

The parks are located in the Riverina Murray Tourism Zone and are en route to other iconic outback parks such as Mungo, Willandra Lakes and Sturt national parks. Being geographically well placed to offer experiences to visitors coming from both Victoria and New South Wales, the parks are also part of the cross-border Murray Regional Tourism organisation. In 2014 the Yanga parks won the Inland Tourism Award for Heritage and Cultural Tourism and received the silver award in the NSW Tourism Awards.

A large proportion of visitors to the region come to visit friends and relatives. Local residents are therefore encouraged to be 'ambassadors' for the parks and the wider region to maximise this market. About 75% of visitors to the park come from Melbourne or regional Victoria and the balance is from other States. In view of this visitor profile, it is essential that NPWS conducts park promotion beyond state borders as well as in New South Wales. It is

also recognised that autumn, winter and spring are the key seasons for visitors as they tend to avoid the sometimes extreme heat of summer.

The filling of Yanga Lake, after a decade of being dry, and the improving condition of the Lowbidgee wetlands will continue to be major drawcards to the parks. NPWS is looking to form stronger partnerships with regional tourism stakeholders and encourage commercial (private sector) tourism operators to take up the many opportunities for diverse visitor experiences within the parks.

## Existing visitor facilities and experiences

Visitation to NPWS parks provides opportunities for people to connect to the landscape and increases advocacy for the ongoing protection and conservation of parks. Visitation in the parks does, however, need to be carefully managed as visitors can have a negative impact on natural and cultural values. The nature of potential visitor impacts depends on the type, frequency and interaction of activities, visitor numbers and behaviour, site capacity and durability, and the sensitivity of the site's natural and cultural values. The sensitive wetland systems in the north of the parks must be avoided at certain times due to flooding and bird nesting events. Aboriginal cultural heritage, archaeological sites and historic heritage buildings and structures located throughout the parks need to be accessed appropriately and protected from overuse.

Road access to the parks is via the Sturt Highway, Windomal Road and Waugorah Road. The main visitor precincts are reached via unsealed park roads (as shown on Figure 1) which are suitable for two-wheel drive vehicles in dry weather. During extended rainfall, park roads can be impassable.

Visitor facilities have been developed in six main visitor precincts under the Yanga Visitation Establishment Plan (DECC 2008b). The Yanga Homestead (see Figure 5), Yanga Woolshed (see Figure 6), Mamanga Campground and Regatta Beach precincts are all within easy driving distance (2–4 kilometres) of the Sturt Highway and within 10 kilometres of Balranald. The Willows precinct is further east and set in a more secluded woodland location in contrast to the other river and lakeside precincts. The Woolpress Bend precinct is about 60 kilometres north of the Sturt Highway and can be accessed by appointment only because the entry road may be closed due to flooding of the Murrumbidgee River and adjacent wetland areas. The experiences and facilities available in each of the precincts are shown in Table 6. Self-drive tag-along tours accompanied by NPWS staff or approved commercial tour operators are also available in the northern wetlands.

**Table 6 Visitor experiences and facilities**

Precinct	Experiences	Facilities
Yanga Homestead	Self-guided audio tours and guided tours of the Homestead Multimedia interpretation display in Cook's Cottage Birdwatching overlooking Yanga Lake Occasional events e.g. Devonshire teas, movie screenings, festivals Educational activities in school holidays	NPWS Office Parking for cars and coaches Toilet Viewing platform with fixed bird scope Bird hide and walking track on Yanga Lake foreshore
Regatta Beach	Fishing Boating Waterskiing Picnicking	Boat ramp Car/trailer parking Gas barbecues Picnic table shelter

Precinct	Experiences	Facilities
		Toilet
Yanga Woolshed	Self-guided audio tours of the Woolshed Interpretation display Picnicking Occasional planned community events Educational activities in school holidays	Picnic tables Gas barbecues Car/coach parking Toilet
Mamanga Campground	Camping Picnicking Fishing Swimming Kayaking Birdwatching and other nature appreciation	13 tent/caravan sites Picnic tables Wood barbecues Visitor information Toilet
The Willows Campground	Camping Picnicking Historic heritage appreciation Birdwatching and other nature appreciation	11 tent/caravan sites Picnic tables Gas and wood barbecues Visitor information Toilet
Woolpress Bend Campground	Camping (with prior booking) Fishing Swimming Kayaking Birdwatching and other nature appreciation	3 large group campsites Picnic tables Wood barbecues Visitor information Toilet

Camping in the river red gum forests is very popular. At present, camping fees are not charged at any of the campgrounds but may be introduced in the future to assist with maintaining the facilities. Rubbish bins are provided at the campgrounds and day use areas but may be phased out in the future.

Outside the declared bushfire danger period, fires are permitted in the fireplaces provided. Collecting firewood in the park is not permitted but limited amounts of firewood are supplied for campers, sourced from timber offcuts left over from forestry operations by the former Yanga Station owners. Firewood will be provided at the campgrounds until such time as existing stockpiled resources are depleted.

## Horse riding

Horses were historically used on Yanga Station to manage sheep, monitor boundaries and for transport. Despite this historical activity there is little demand for horse riding as a recreational activity today. Giving consideration to this low-demand, horse riding by individuals or groups may be allowed in the parks by consent, subject to conditions, to allow levels of use and potential impacts to be monitored.

## Cycling

In accordance with NPWS policy and the *Sustainable Mountain Biking Strategy* (OEH 2011b) cycling is permitted on park roads and management trails.

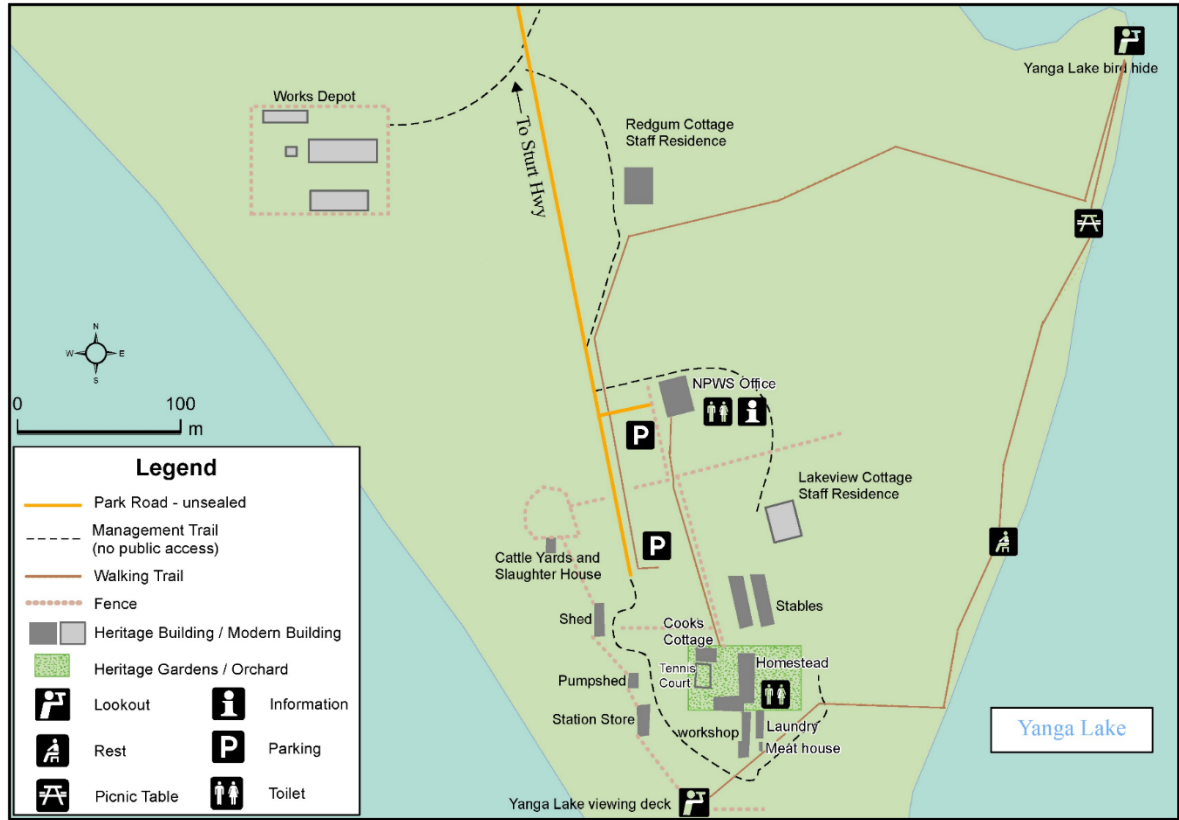


Figure 5 Yanga Homestead precinct

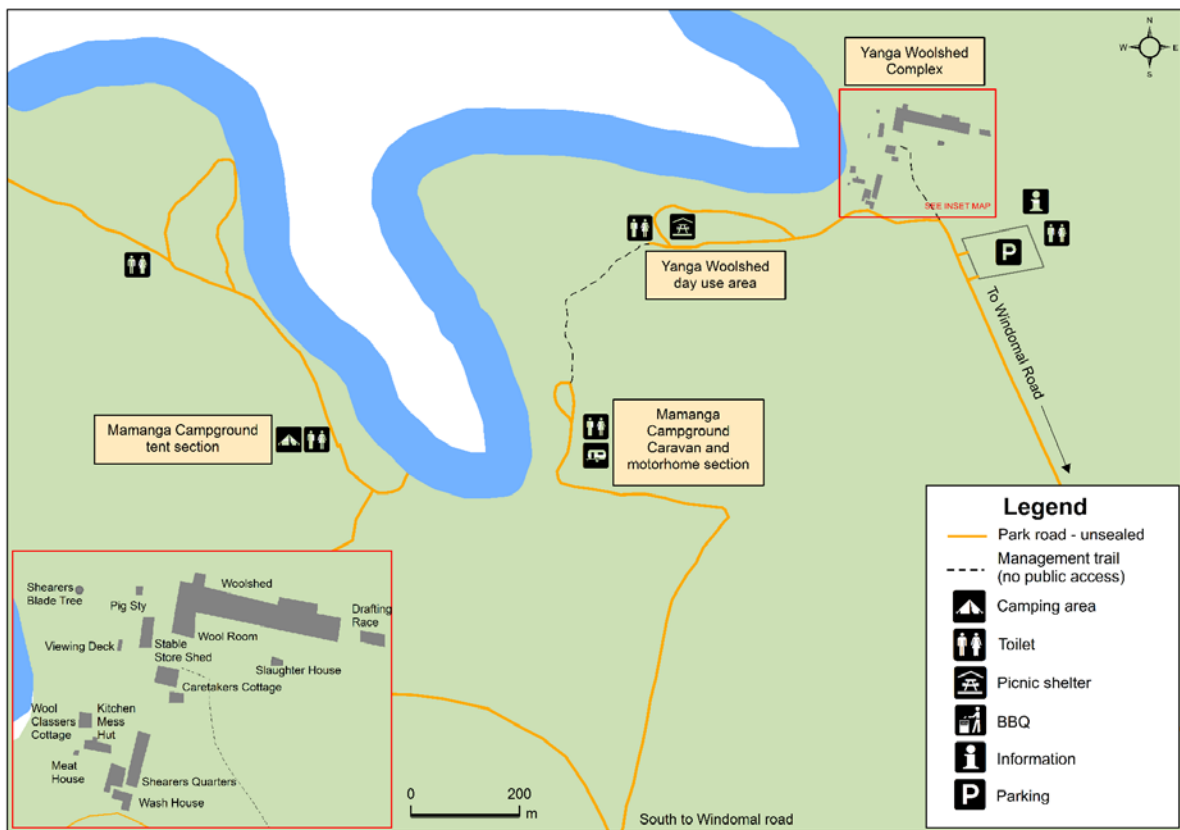


Figure 6 Yanga Woolshed and Mamanga Campground precincts

## Potential additional visitor facilities and experiences

Several additional visitor experiences may be developed as described in Table 7. The proposed activities would supplement existing experiences and include those parts of the parks which are currently not open to the public, in particular the northern floodplain and southern parts of the state conservation area. Where possible, existing management trails would form the basis of the proposed new experiences so as to minimise environmental and cultural impacts. Access for visitors to these areas would continue to be managed due to the constraints posed by water, pest and fire management, flooding and seasonal breeding by waterbirds.

**Table 7 Potential additional recreational experiences**

Experience	Location	Facilities proposed to be provided	Considerations
Canoeing and birdwatching	Yanga Lake	Boat launching site for non-motorised craft on Yanga Lake near existing bird hide	Hardening of launch site for shoreline protection
Birdwatching	Piggery Lake and Little Piggery Lake	Bird hide 2 boardwalks linking to walking track Picnic area Toilet	With NPWS staff or approved guide Waterbird nesting events Flooding Fluctuating water levels (coordination with water management)
½-day canoe trips	Northern sections of Murrumbidgee River	Hardened launch sites	With NPWS staff or approved guide Steep banks Flood-free access for boat launching Fluctuating water levels (coordination with water management) Waterbird nesting events
2-day canoe safari	Murrumbidgee River from Redbank Weir to Yanga Woolshed (100 km)	No facilities proposed Bush camping allowed at appropriate sites along the river	With NPWS staff or approved guide May require additional day/campsite over 100 km distance Steep banks Flood-free access for boat launching Fluctuating water levels (coordination with water management) Waterbird nesting events
Boat trip to the wetlands and fishing	Murrumbidgee River from Yanga Woolshed to the northern parts of the national park	Boat ramp at Yanga Woolshed	Fluctuating water levels (coordination with water management) Waterbird nesting events

Experience	Location	Facilities proposed to be provided	Considerations
Bushwalking	Woolpress Bend	None – use existing management trails	Fluctuating water levels (coordination with water management) Flooding
Bushwalking and cycling	Northern track – Woolpress Bend to Yanga Woolshed	None – use existing management trails	Shared route for walkers and recreational cyclists
	Piggery Lake Loop	New dual-use (walking and cycling) track	Flood-free route and siting of potential bird hide
	Yanga Lake Circuit	Part existing management trails, part new track	Aboriginal cultural heritage Erodible soils
	Yanga Homestead – Woolshed Link	None – use existing management trails	Link to Sturt Highway
	Yanga Woolshed – Balranald Link	New dual-use (walking and cycling) track	Partnership with Balranald Council

## Yanga Lake

Since filling in 2010 after the breaking of the Millennium Drought, Yanga Lake has again become a popular focus for visitors to the parks, especially those who live locally. The boat ramp and facilities at Regatta Beach were upgraded to cater for regular use by the local community. A NSW Maritime Boating Plan is in place for the lake (RMS 2011). Under the plan, the eastern sub-basin is zoned for passive boating with an 8-knot speed limit. Waterskiing and open boating are confined to the western sub-basin. ‘No boating’ exclusion zones are in force over the northern and southern shores of the western sub-basin of the lake due to submerged tree hazards.

Yanga Lake has experienced blue-green algae outbreaks on several occasions since refilling in 2010. These outbreaks are attributed to an influx of nutrients which have built up in the catchment over a long period of time combined with elevated water temperatures in warm weather. When blue-green algae concentrations reach a certain level the water is considered unsafe for human consumption, stock watering and recreation and the lake is closed to water sports. The trigger levels are determined by the National Health and Medical Research Council.

Blue-green algae outbreaks have also been recorded along the Murrumbidgee River within the parks (DPI – Water 2016). Outbreaks are monitored by the Murrumbidgee Regional Algal Coordinating Committee, which issues a weekly report during the algae season from November to March. Monitoring stations are located throughout the Murrumbidgee River catchment and include 10 stations in Yanga Lake and two stations at Redbank Weir.

While control of nutrient levels at a catchment level is the most effective strategic approach to controlling blue-green algae, other short-term management strategies are also under consideration. NPWS will continue to work with other stakeholders to resolve blue-green algae issues.

NPWS acknowledges the intrinsic aesthetic value of Yanga Lake when full and that there is significant community interest and investment in continued use of the lake for water recreation. However, the water management objectives for the parks have, as their first priority, the restoration of the river red gum communities of the Lowbidgee Floodplain (see

Section 3.2). As such, water management efforts will be applied to ensure the lake is filled to an appropriate level (between 3 and 4 metres) in most years unless reduced water availability renders this impossible.

## Recreational fishing

All fishing activities in NSW waters are regulated under the Fisheries Management Act. Recreational fishing must be in accordance with licence conditions specified by the relevant regulatory authority. The Murrumbidgee River, Yanga Lake and other waterbodies within the parks offer opportunities for recreational fishing for a variety of species including Murray cod (*Maccullochella peelii*) and golden perch (*Macquaria ambigua*). All recreational fishing within the parks must be carried out in accordance with the *NSW Recreational Freshwater Fishing Guide 2016–2017* (DPI 2015). This guide outlines the following:

- responsible fishing and safety practices
- bag limits
- size limits
- tackle and bait restrictions
- catch and release requirements
- seasonal closures.

To help protect native animals such as turtles and water-rats, all nets and traps must adhere to the regulations stipulated in the guide.

## Group activities (commercial and non-commercial)

Group activities can provide opportunities for people who would otherwise not be able to experience the parks, and can promote environmental and cultural understanding and support for conservation. Group activities can also provide opportunities for commercial tour operators to partner with NPWS in providing enjoyable visitor experiences. Large groups can, however, restrict opportunities for independent visitors.

Consent must be obtained from NPWS before conducting events and functions involving 20 or more people. Events and functions are to be conducted in accordance with the NPWS *Events, Functions and Venues Policy* (OEH 2017b) and must not impact other park users or park neighbours. The maximum number of participants for group activities is determined by NPWS on the basis of the location and activity proposed.

NPWS currently provides a variety of group activities under the Discovery program which are very popular. An alternative education-focused program may be developed in the future (see also Section 3.8). Other popular activities include the guided tour of Yanga Homestead, car-based tag-along tours to the northern parts of the parks during school holidays, children's activities and outdoor movies.

The historic heritage buildings and gardens in the Homestead and Woolshed precincts are popular for private functions such as weddings, family reunions and conventions. Larger events such as the annual five Rivers Outback Festival are also held in the parks from time-to-time and are important to maintaining an ongoing relationship with the local Balranald community. All activities must be consistent with the management principles of the parks and be compatible with their natural and cultural heritage values. These activities are permissible subject to a consent issued under the National Parks and Wildlife Act and in accordance with the NPWS *Events, Functions and Venues Policy*.

Commercial tourism increases the opportunity for public participation in nature-based activities and provides opportunities for professional instruction in the safety and minimal

impact aspects of various recreational pursuits. All commercial tourism activities in the parks must be licensed under the National Parks and Wildlife Act.

NPWS values opportunities to work in partnership with other tourism providers both locally and further afield. There is significant potential for more private sector involvement in providing visitor experiences beyond the four registered commercial tour operators which currently offer guided tours in the parks under licence. In addition to the experiences listed in Table 6 and Table 7, the Riverina Outback Destination Zone Plan will allow for enhanced commercial (private sector) tourism opportunities.

NPWS will consider proposals for new visitor experiences developed and delivered by commercial tourism operators which satisfy the following criteria:

- proposals support the existing natural and cultural heritage condition of the parks and the surrounding locality or facilitate planned improvements
- proposals demonstrate they are compatible with the conservation of natural and cultural values in the parks
- proposals incorporate sustainability in planning, design, construction and ongoing operation
- proposals involving built structures or facilities are appropriate to the park setting, are unobtrusive and sympathetic to the landscape.

## Issues

There is an existing strong/moderate level of visitation to the parks.

Blue-green algae outbreaks cause Yanga Lake to be closed to immersion water sports on occasion.

Use of Yanga Lake for water sports and water-based activities will be constrained if there is insufficient water available.

Unsealed park roads which provide access to the visitor precincts can quickly become impassable due to wet weather and must be closed to visitors. This problem is worst in the north of the parks.

During wet periods the Mamanga and Woolpress Bend campgrounds can be closed for extended periods of time.

Visitor use in the parks needs to be monitored to ensure that sensitive natural and cultural heritage values are adequately preserved and protected.

## Desired outcomes

- Visitor use of the parks is ecologically sustainable and promotes awareness and conservation of park values.
- Visitor experiences in the parks are integrated with other tourism initiatives and opportunities for commercial tourism are realised.
- Visitor activities are permitted in the vicinity of waterbird rookeries only under supervision approved by NPWS.
- Trail bike riding and adventure activities are not allowed in the parks.

## Management response

- 3.7.1 Develop the visitor experiences and facilities listed in Table 7 subject to favourable feasibility and cost–benefit assessment, and completion of environmental and heritage impact assessment and approvals. Additional visitor experiences to those



listed in Table 7 which do not require the construction of built facilities and/or trails may also be developed.

- 3.7.2 Encourage partnerships with commercial (private sector) operators to deliver new and enhanced visitor experiences.
- 3.7.3 Monitor the social and environmental impacts of recreation activities including group activities. Visitor sites may be closed for rehabilitation where adverse impacts are identified.
- 3.7.4 Allow public vehicle access on the park roads shown on Figure 1 and within the visitor precincts shown on Figures 5 and 6.
- 3.7.5 Introduce a permit system for controlled public vehicular access to Woolpress Bend Campground and other parts of the parks not accessible via the park road network.
- 3.7.6 Allow cycling on all park roads and designated management trails, and on the proposed dual-use tracks once constructed.
- 3.7.7 Permit horse riding on park roads and management trails by consent where appropriate, in accordance with conditions.
- 3.7.8 Investigate the potential for developing Aboriginal cultural tourism opportunities in consultation with the Aboriginal community.
- 3.7.9 Consent may be granted for use of the Homestead and Woolshed precincts and other locations in the parks for group activities. Groups of 20 or more people, whether commercial or non-commercial, need to obtain prior consent from NPWS.
- 3.7.10 Working dogs, working horses and sheep are temporarily allowed in the parks as part of approved tourism activities such as shearing demonstrations and historic re-enactments, provided all animals are under the control of a handler.

### **3.8 Information, education and research**

The parks hold social significance for a variety of people whose history is linked to Yanga Station, including Aboriginal people, the local community, past Station workers and their descendants. The interpretation of the parks is built in part from the experiences of these people and enables their history to live on. Retaining the name Yanga and the traditional names for paddocks and localities in the parks is part of acknowledging this history.

Key themes for interpreting the parks were identified in the Yanga Visitation Establishment Plan (DECC 2008b) and extensive interpretive signage was provided for opening the parks to the public in May 2009. A multimedia display in Cook's Cottage near the Yanga Homestead includes recordings and footage from the Yanga Oral History Project (Gapps 2007) as well as displays of moveable heritage items. Additional interpretative material and signage has been installed in all visitor precincts. The audiovisual devices at the Woolshed play the sounds of the annual shearing in action and 'bring the Woolshed to life'.

The Yanga Conservation Management Plan (Tonkin Zulaikha Greer Architects 2013) provides a more in-depth analysis of themes for interpreting the parks, and suggests the parks should be presented and interpreted for visitors as an outdoor museum, where visitors can move around at their own pace.

The NPWS office at the Homestead precinct provides information to visitors about access, tours and activities in the parks. The presence of staff at the park also provides an important contact point for visitors as the parks are moderately remote from other NPWS parks and visitor centres. This is supplemented by information on the NPWS visitor website. A Discovery ranger is also based at Yanga National Park to oversee the preparation and delivery of education programs and visitor activities for the parks. There is scope for more educational visits and for developing more educational resources.

NPWS will continue to scope new opportunities for making the parks available for enjoyment by all members of the public. This may include improved accessibility for people with disabilities and the use of new technologies. The parks will also be promoted using a variety of mechanisms to reach a wider audience.

The parks present valuable opportunities for research into a wide range of biodiversity and cultural heritage values and the opportunity to follow the progress of an adaptive management program aimed at reversing the decline of the river red gum health and condition in the Lowbidgee. Potential also exists for research into new subject areas including climate change, geomorphology and ethnobotany. Since acquisition, the parks have been visited by a large number of researchers, and NPWS has ongoing involvement with research being carried out by The University of NSW and Charles Sturt University. NPWS relies on the outcomes of these partnerships to continually add to knowledge about the Lowbidgee environment and appropriate management responses for its restoration under an adaptive management approach.

## **Community involvement**

A volunteer group 'Friends of Yanga' provides valuable assistance in maintaining the Yanga Homestead gardens and orchard. There is potential for other volunteer groups to carry out minor maintenance and assist in monitoring and recording. Members of the local community are also valued for their stories and information, and interviews with several people were recorded for the Yanga Oral History Project (Gapps 2007).

The community's long social history with Yanga Station is also recognised through special events, beginning with the launch of Yanga National Park in May 2009. Other events have included those associated with NAIDOC Week, Balranald's five Rivers Outback Festival and Yanga Alive Community Festival. Events such as these are recognised as important opportunities for the public to engage with the Yanga parks and with NPWS staff.

The Yanga Community Working Group was established as a means of maintaining links with the local community and assisting NPWS with the preparation of this plan of management. Members included representatives of Aboriginal communities, adjoining property owners, special interest groups, state government agencies and Balranald Shire and Murray River councils.

## **Signage**

Visitors can approach the parks from the south, east or west and can first encounter the parks at the Woolshed precinct, the Homestead precinct or at Regatta Beach. It has therefore been important to provide orientation signage in addition to Tourist Attraction Signposting Assessment Committee signposting.

Regulatory, directional and interpretative signage is provided throughout the parks. Although signs are placed out of the floodway where possible, they must be checked for damage after major storms and flooding events.

## **Issues**

The interpretation and signage in the parks concentrates on pastoralism and European heritage. Values such as Aboriginal cultural heritage and biodiversity are not included to the same extent.

## **Desired outcomes**

- Visitors are well-informed about natural and cultural heritage values and recreational opportunities in the parks.
- Community appreciation of and support for park values is developed and maintained.
- Members of the local community are involved in developing and delivering educational and interpretive activities and information.

## **Management responses**

- 3.8.1 Provide education and interpretive information for the parks in consultation with local schools, business partners and the Aboriginal community.
- 3.8.2 Develop marketing and promotional material for the parks which includes consideration of the Victorian visitor market.
- 3.8.3 Encourage universities and other research bodies to continue carrying out research relevant to adaptive management of the parks.
- 3.8.4 Promote volunteer opportunities in the parks in consultation with the local community.

## 4. Threats

### 4.1 Pests

Pest species are organisms that have negative health, environmental, economic and social impacts. Commonly they are introduced species. Pests can have impacts across the range of park values, including impacts on biodiversity, cultural heritage, catchment and scenic values. Pest species can have significant impacts on biodiversity in three main ways: through modification of species richness, species abundance and species composition. These impacts can have detrimental results for sensitive ecosystems such as those in the parks.

The *Biosecurity Act 2015* and its regulations provide specific legal requirements for the response, management and control of biosecurity risks, including weeds and pest animals. These requirements apply equally to public and privately owned land. Under this framework, Local Land Services has prepared regional strategic weed management plans and regional strategic pest animal management plans for each of its 11 regions, including Riverina Region (Riverina LLS 2017, 2018).

The Local Land Services' plans identify priority weeds and pest animals in each of the regions, plus the appropriate management response for the region (i.e. prevention/alert, eradication, containment or asset protection).

NPWS prepares regional pest management strategies which identify the operations and control actions undertaken by NPWS to meet the priorities from regional strategic pest and weed management plans. This also includes other important programs such as the *Biodiversity Conservation Program* (see Sections 3.3 and 3.4). The overriding objective of the NPWS regional pest management strategies is to minimise adverse impacts of introduced species on biodiversity and other park and community values while complying with legislative responsibilities. These strategies are regularly updated. Reactive programs may also be undertaken in cooperation with neighbouring land managers, in response to emerging issues.

Pest species that are also key threatening processes may be managed under the *Biodiversity Conservation Program* where it includes key threatening processes strategies. The *Saving our Species* program has developed targeted strategies for managing key threatening processes using the best available information to minimise current and future impacts of key threatening processes on priority biodiversity values, including threatened species and ecological integrity.

The pest animals and plants occurring in the parks are considered 'landscape pests' because they occur widely across riverine environments. The shape of the national park along the floodplain facilitates the unregulated movement of pest animals between the park and neighbouring properties as they travel between open and vegetated country. On the Lowbidgee Floodplain, floodwaters readily facilitate the spread of weeds, but regular inundation of the wetlands and floodplain can also assist in seasonal weed control. Continued effort is needed to maintain control over weeds in this environment.

Major pests of concern in the parks are listed in Table 8. These are currently targeted in priority regional pest programs. However, priorities may change over time as pests are brought under control, or as new threats emerge.

**Table 8** Prioritised regional pest management programs

Pest	Value at risk
<b>Pest plants</b>	
Spiny burrgrass ( <i>Cenchrus longispinus</i> )	Sandhill Pine Woodland EEC Grassy woodland communities
African boxthorn ( <i>Lycium ferocissimum</i> ) <sup>1, 2</sup>	Ephemeral lake, waterbirds, red gums surrounding lake Grassy woodland communities
Tamarisk ( <i>Tamarix ramosissima</i> ) <sup>2</sup>	Yanga Lake and ephemeral wetlands
Tree of heaven ( <i>Ailanthus altissima</i> )	
<b>Pest animals<sup>3</sup></b>	
European rabbit ( <i>Oryctolagus cuniculus</i> ) <sup>4</sup>	Sandhill Pine Woodland EEC
Feral pig ( <i>Sus scrofa</i> ) <sup>4</sup>	Wetlands, migratory wetland birds and southern bell frog
Red fox ( <i>vulpes vulpes</i> ) <sup>4</sup>	
Fallow deer ( <i>Dama dama</i> )	Forest and woodland, southern bell frog and migratory wetland birds
Red deer ( <i>Cervus elaphus</i> )	Forest and woodland, southern bell frog and migratory wetland birds
European carp ( <i>Cyprinus carpio</i> ) <sup>5</sup>	Aquatic and ephemeral systems, native fish and southern bell frogs
<sup>1</sup>	State-level priority weed under the <i>Biosecurity Act 2015</i> .
<sup>2</sup>	Declared Weed of National Significance.
<sup>3</sup>	All pests listed here are regional priority pest animals (Riverina LLS 2018).
<sup>4</sup>	Declared pest under the Local Land Services Act 2013.
<sup>5</sup>	Declared noxious fish under the <i>Fisheries Management Act 1994</i> .

## Weeds

Weed mapping carried out in the parks in 2009 found that the weed species of most concern were spiny burrgrass, African boxthorn, tamarisk and tree of heaven. The **tamarisk** infestation in the bed of Yanga Lake was treated and subsequently flooded when the Millennium Drought broke and is no longer of concern. The tree of heaven infestation at Waugorah and the tamarisk infestation at Yanga Lake have both been treated effectively but continue to be monitored.

**Spiny burrgrass** occurs in previously cultivated areas, notably Big Cultivation Paddock and the western side of Yanga Lake. Spiny burrgrass is being actively treated and the infestations are shrinking in area over time as control programs and competition with other species continue. **African boxthorn** is more common in the southern half of the parks, but populations are greatly reduced due to ongoing programs.

**Horehound** (*Marrubium vulgare*) infestations occur at many sites along the river and in sheep encampments throughout the parks. Although unpalatable to stock, horehound burrs attach to the wool of sheep and would have been readily dispersed on Yanga Station. Biological controls for horehound include horehound plume moth (*Pterophorus spilodactylus*) and horehound clearwing moth (*Chamaesphexia mysiniiformis*). They can be relatively

successful in controlling the extent and infestation density of this weed as part of an integrated pest strategy.

**Other weeds** such as Noogoora burr (*Xanthium occidentale*), Bathurst burr (*Xanthium spinosum*), Paterson's curse (*Echium plantagineum*), khaki weed (*Alternanthera pungens*), and bindii (*Soliva pterosperma*) are being addressed regularly in areas of high visitation due to their preference for disturbed sites, the ability of visitors to inadvertently spread weeds and as a number of these are a nuisance to visitors. All weed infestations are monitored to allow prompt action as needed.

There are several **new and emerging weeds** in the Lowbidgee and Riverina landscapes that could potentially cause concern for the parks if they become established. These include boneseed (*Chrysanthemoides monilifera* subsp. *monilifera*), mesquite (*Prosopis* spp.), parthenium weed (*Parthenium hysterophorus*), sagittaria (*Sagittaria platyphylla*) and a suite of aquatic weeds that may occur within the wetlands of the national park.

## Pest animals

Since colonisation, many animal species have been introduced into Australia from other countries. They include goats, foxes, deer, rabbits, pigs, cats, dogs and horses. Several of these species have been listed as key threatening processes under the Biodiversity Conservation Act.

Introduced predators such as foxes and feral cats can decimate prey populations and, in combination with other factors, are believed to have caused the extinction of many native species (Lunney 2001).

Introduced herbivores can cause extensive damage to native vegetation and soils through grazing, trampling and digging. They may also compete with native herbivores for food, and further degrade the environment by providing an abundant food source for other pests. For example, rabbits can support high densities of feral cats and foxes which in turn suppress native prey.

As well as damaging the natural environment, pest animals can degrade sites of cultural significance, for example by increasing the rate of lunette erosion where Aboriginal cultural heritage is often found. In addition, pest animals can pose a major threat to agriculture, for example by killing, harassing or competing with livestock, spreading disease and contributing to soil erosion. Pest animals can affect aquatic as well as terrestrial ecosystems.

The parks have a long history of pest animal impacts and present a number of complex challenges for pest animal control. The species discussed here are the focus of control programs.

**Feral pigs** have a long history of occupying the wetland forests and woodland in the parks and adjoining properties. The establishment of environmental watering to the parks has promoted conditions favoured by pigs and has resulted in a large increase in pig numbers. Artificial water points such as ground tanks and channels also enable pigs to occupy the drier woodland areas in the southern parts of the parks.

The impact of feral pigs on conservation values is substantial, especially in wetlands. Their foraging, wallowing and digging habits cause considerable damage to soils, roots, ground plants, waterbird nesting habitat, culturally important plants and archaeological sites. Areas disturbed by feral pigs are at risk from subsequent weed invasion and soil erosion. Pigs are also a potential host of diseases transmittable to animals and humans, such as leptospirosis and brucellosis. The presence of pig populations is also known to encourage illegal hunting activity in the parks.

Predation, habitat degradation, competition and disease transmission by feral pigs is listed as a key threatening process under both the Biodiversity Conservation Act (NSW SC 2004a)

and the Environment Protection and Biodiversity Conservation Act (TSSC 2001a). A threat abatement plan has been prepared under the Environment Protection and Biodiversity Conservation Act which sets out a national framework for addressing this threatening process (DEH 2005).

Pigs are controlled in the parks by baiting, trapping, ground shooting and by occasional aerial shooting. Extensive flooding enhances conditions for pigs and reduces access for pig control. However, during high floods pigs can be successfully controlled when isolated on high ground.

As with pigs, the increase in watering of the parks has led to an increase in **feral deer** in the riverine forests and woodlands. Feral deer include both red deer and fallow deer and numbers have grown to form a secure population. These animals are thought to have originated from former deer farms on private land in the area. Monitoring and control programs by aerial shooting have reduced numbers of deer and will need to continue to maintain control of this pest. Herbivory and environmental degradation caused by feral deer is listed as a key threatening process under the Biodiversity Conservation Act (NSW SC 2005).

**European rabbits** are widespread on the lighter soils in the southern and eastern parts of the parks and on the isolated sandhills within the forested wetlands. They are also numerous around the NPWS office building and elsewhere in the Homestead precinct where gardens are regularly watered.

Rabbits can have both a severe short-term and long-term impact on vegetation by grazing on seedlings of regenerating trees, shrubs and ground layer vegetation. In dry periods, rabbits may ringbark established plants. Rabbits also burrow in sandy soils, disturbing cultural heritage such as Aboriginal burials and oven mounds. Rabbit activity also has the potential to cause structural damage to historic heritage buildings (such as burrows undermining foundations). Competition and grazing by feral rabbits is listed as a key threatening process under the Biodiversity Conservation Act (NSW SC 2002) and the Environment Protection and Biodiversity Conservation Act (TSSC 2000a).

After acquisition, rabbit warrens in the parks were mapped and a comprehensive control program introduced. Control is ongoing using a variety of methods, including warren ripping, fumigating and baiting, depending on the landscape context. In visitor areas and culturally sensitive areas, warrens are best treated by fumigation, baiting or percussive methods rather than ripping.

**Red foxes** occur in the parks and surrounding area. They are known to suppress native animal populations, particularly medium-sized ground-dwelling and semi-arboreal mammals, ground-nesting birds and freshwater turtles. Foxes have also been implicated in the spread of a number of weed species and are known to prey on domestic stock, including lambs and poultry (OEH 2012). Foxes are a declared pest throughout New South Wales under the *Local Land Services Act 2013*.

Predation by the European red fox has been declared a key threatening process under the Biodiversity Conservation Act (NSW SC 1998) and is also listed as a threatening process under the Environment Protection and Biodiversity Conservation Act (TSSC 2000b). The NSW fox threat abatement plan (OEH 2011a) has the primary objective of establishing long-term control programs to protect priority threatened native animal species and populations. Foxes are being controlled at priority sites across New South Wales to protect biodiversity.

A comprehensive fox baiting program has been established in the parks to reduce fox numbers. This program is carried out in cooperation with neighbouring landowners and is designed to coincide with lambing times and fox breeding cycles. The number of baits taken in each program is monitored and the activity recorded to inform understanding of fox distribution, activity and ongoing management. This has meant that over the years since the

program commenced the number of bait stations has progressively been reduced from 650 to 200.

**Feral goats** have considerable impacts on conservation values. They graze native plants, compete with native animals for shelter, spread weeds, trample vegetation and damage Aboriginal heritage sites. Congregations of goats in favoured locations can result in erosion and impacts on amenity. Competition and habitat degradation by feral goats has been listed as a key threatening process under the Biodiversity Conservation Act (NSW SC 2004b). Competition and land degradation by feral or unmanaged goats is also listed as a key threatening process under the Environment Protection and Biodiversity Conservation Act (DoE 2009; TSSC 2004) and a threat abatement plan for unmanaged goats has been prepared (DEWHA 2008).

Feral goats have only been found in small numbers in isolated patches across the park. Control has been achieved by occasional ground and aerial shooting with continued site monitoring.

**European carp** are widespread in the waters of the Murray–Darling Basin and have contributed to the degradation of many Australian natural aquatic ecosystems. They inhabit still or slowly flowing waters at low altitudes, especially in areas where there is abundant aquatic vegetation. Carp easily reproduce, displacing a range of native aquatic species. They graze on and uproot aquatic plants used by other species, feed on aquatic invertebrates, decrease water quality and may increase the likelihood of algal blooms. Carp are listed as a noxious fish under the Fisheries Management Act.

There are two options for reducing carp numbers in the parks. Carp removal should be undertaken at targeted sites where access to the waterway is available and where any impacts on cultural and natural values can be managed appropriately. The most suitable areas for carp removal are adjacent and downstream of regulators as large numbers of carp will move upstream to these locations and congregate for breeding and spawning events. Yanga Lake is also potentially a key area for removing carp, however, fluctuating water levels and vegetative debris on the lake bed can hamper effective removal.

The removal of carp from waterbodies can only be carried out by a commercial operator using an approved fish trap and under a licence issued by the relevant regulatory authority to operate in the inland restricted fishery. This activity is also subject to NPWS policy and environmental assessment processes (see Section 5.2).

In addition to removing carp, screens can be used to reduce immigration of carp during flooding events. There has been some success with the use of screens at regulators in other river red gum parks including those in the Murray Valley. Biological controls are also under investigation and may prove worthwhile in future.

The **Australian plague locust** (*Chortoicetes terminifera*) is a native insect, capable of forming extremely large populations which cause considerable damage to cropping and grazing lands. The plague locust is a declared pest in New South Wales (DAWR 2017). The proximity of the park to large cereal-growing areas means there is a high risk of plague locust infestation. To date only a small number of infestations have affected the parks.

Under the Local Land Services Act all land managers, including NPWS, are responsible for locust control on their land. NPWS has an environment risk assessment protocol in place to ensure that control methods for plague locusts also take account of potential impacts on native animals and their habitat. Locust control is achieved with a biological control agent to avoid adverse impacts on breeding ground-nesting birds which rely on invertebrates as a component of their diet.

## Desired outcomes

- Pest plants and animals are controlled and where possible eradicated from the parks.



- Pest plants and animals are periodically mapped to record their distribution, abundance and impacts.
- Negative impacts of pest animals, weeds, pathogens and diseases on park values are minimised.
- Pests and weeds are managed strategically in collaboration with adjoining landowners and other stakeholders.

## Management response

- 4.1.1 Manage pest species in accordance with pest management strategies relevant to the parks. The highest priorities are protecting threatened ecological communities, wetland and river red gum habitat, migratory waterbirds and threatened species.
- 4.1.2 Monitor regularly to determine the presence and extent of pest species to inform pest control operations and revision of the pest management strategy.
- 4.1.3 Implement integrated weed and pest animal control programs in cooperation with neighbouring landowners and other stakeholders including Local Land Services, Landcare groups and local councils.
- 4.1.4 Investigate options for control of carp including the use of water management infrastructure, harvesting and biological controls.
- 4.1.5 Assess the potential for impacts on waterbirds during nesting events before undertaking any pest animal and weed control or monitoring operations, including ground and aerial shooting and carp removal.

## 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 Biodiversity Conservation Act (NSW SC 2000b).

The fire history of the former Yanga Station is only partially known and includes accidental fires which started near sawmill operations in river red gum vegetation to the north of the parks. Yearly prescribed burning was carried out by the previous landholders to reduce the extent of reed beds in river red gum areas so as to increase waterflow from the Redbank Regulator for deliberate flooding of land further south and east. This regular burning was also used to increase grazing areas for stock. Apart from these instances, there is no anecdotal or recorded history of large-scale fires occurring across Yanga Station.

In this landscape, ignitions are generally caused by lightning strikes in the form of dry lightning storms that occur frequently in the summer months. Since acquisition, five wildfire ignitions in the parks have resulted in three fires of approximately 11 hectares, less than three hectares and less than one hectare respectively.

The forested wetlands on the western perimeter of the parks and the Murrumbidgee River itself greatly reduce the potential for fires entering from or escaping into neighbouring farming properties. There is perhaps greater potential for fires to enter the parks from the

east and south, but this is rated as low risk because the trend for fires in the region is to run from west to east.

Terrain across the Yanga parks is almost flat, with occasional rises. Approximately 29% of the parks is dominated by river red gum vegetation. Regular flooding of the red gum forests and wetlands in the parks may lead to growth of *Phragmites* reed beds which have potential for high-intensity fires when dry. Within this habitat type, reed swamps can also carry a high-intensity fire when dry. Because river red gum is a fire-sensitive species and is killed by high-intensity fire, prescribed burning in red gum areas, including reed beds, must be carefully planned. For example, reed beds that pose the most risk should be targeted and only a portion of the reed bed area should be burnt at any one time.

Burning must also be scheduled to cause the least possible disruption to life cycle processes, particularly endangered and migratory species. Reed bed areas should be burnt when the vegetation is still partially submerged or there is sufficient soil moisture to protect the rhizomes of the plants, and allow for vegetation recovery. Prescribed burning can be conducted when the soil is dry, but this must be immediately followed by a programmed flooding event.

Deliberate flooding of additional areas on Yanga Station produced artificial locked stands of river red gum. Through a combination of drought and the introduction of a more natural flooding regime for the parks, most of these stands have subsequently died. Consideration may be given to removing excess timber by burning (see Section 3.3).

Approximately 34% of the parks are covered in vegetation dominated by chenopod species and another 17% is black box vegetation with a chenopod understorey. Fire should be avoided where chenopod species occur. Wildfires in these communities will be suppressed, where possible, by firefighting efforts. Hazard reduction in these areas should be mostly mechanical, and restricted to asset protection zones and strategic fire advantage zones. Fires for ecological purposes are not required for these vegetation types.

In the semi-arid woodlands (i.e. black box, belah/rosewood [*Dysoxylum* sp.] and lignum) and arid shrublands (i.e. chenopod vegetation, prickly wattle [*Acacia victoriae*] and saltbush), fuel loads are dependent on seasonal conditions, with grass fuels high after above-average rainfall. In average conditions, the belah woodlands will not carry fire and have a much lower fire potential. Yarran and red mallee woodlands have fire intensities that range from moderate to high depending on ephemeral growth. Unless weather conditions are extreme, low ground fuels during normal years will only allow for patchy fires. The spike rush sedgeland in wetland areas will not carry fire unless there are high ephemeral fuel loads.

Those vegetation communities that contain acacia or mallee species, lignum shrublands, belah/rosewood and grassland areas are communities that may benefit from prescribed burning regimes. Most of these communities in the parks are long unburnt and some of these communities are very restricted in their size and extent. Therefore, consideration may be given to a mosaic approach for prescribed burning which allows for gaps in both space and time, a mix of small and larger areas, scattered and variable time between fires. It is also important to leave some areas of each vegetation type unburnt. Prescribed burning must also include assessment of post-fire recovery and responses specific to each vegetation community. Prescribed burning has been carried out in the parks but in wet years has been hampered by extensive flooding and the high moisture content of resultant growth.

A fire management strategy which defines the fire management approach for the parks has been prepared (OEH 2015b). The strategy outlines recent fire history, key assets within and adjoining the parks, 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 parks' vegetation communities. The majority of the parks are designated as land management zones under the strategy while asset protection zones are identified

around historic heritage buildings, Aboriginal cultural heritage items and other sensitive values. Strategic fire advantage zones are also identified.

An ongoing fire protection action for the parks is the maintenance of a network of boundary and internal trails for fire protection and access. Regulators and other water management structures have been designed to allow access by fire response vehicles into forested wetland areas.

NPWS maintains cooperative arrangements with surrounding landowners and the Rural Fire Service (RFS) and is actively involved with the Mid Murray 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 reported to the bushfire management committee. NPWS implements a park-wide solid fuel fire ban in consultation with the bush fire management committee fire danger period, usually between 1 October and 31 March (depending on the fire season) aimed at reducing bushfire ignitions from campfires.

In the past, fire was an integral part of managing Country for Aboriginal people. Fire was used for hunting, promoting habitat and useful species, keeping paths of travel open and for the protection of culturally important sites. Aboriginal people are keen for traditional burning practices to be recognised. More information is needed about traditional burning practices in the Lowbidgee which could then be assessed in relation to the requirements of native animals and plants where known.

## **Desired outcomes**

- Negative impacts of fire on life, property, cultural heritage values and the environment are minimised.
- Fire regimes are appropriate for conservation of native plant and animal communities.
- The potential for spread of bushfires on, from or into the parks is minimised.

## **Management response**

- 4.2.1 Implement the fire management strategy for the Yanga parks.
- 4.2.2 Participate in the Mid Murray Bush Fire Management Committee. Maintain cooperative arrangements with local RFS brigades and other fire authorities and surrounding landowners in regard to fuel management and fire suppression.
- 4.2.3 Manage the parks to protect biodiversity values in accordance with the identified fire regimes in the fire management strategy.
- 4.2.4 Monitor the ability of native plants to recover between fires and review regimes where relevant.
- 4.2.5 Rehabilitate areas disturbed by fire suppression operations as soon as practicable after a fire event.

## **4.3 Climate change**

Human-induced climate change is listed as a key threatening process under the Biodiversity Conservation Act (NSW SC 2000a) and habitat loss caused by human-induced greenhouse gas emissions is listed under the Environment Protection and Biodiversity Conservation Act (TSSC 2001b).

The latest information on projected changes to climate are from the NSW and ACT Regional Climate Modelling (NARClIM) Project (OEH 2014a). The climate projections for 2020–39 are

described as ‘near future’ (or as 2030) and projections for 2060–79 are described as ‘far future’ (or as 2070). The snapshot shown in Table 9 is for the Murray Murrumbidgee Region which includes the Yanga parks.

**Table 9 Murray Murrumbidgee climate change snapshot**

Projected temperature changes	
Maximum temperatures are projected to <b>increase</b> in the near future by 0.4–1.0°C	Maximum temperatures are projected to <b>increase</b> in the far future by 1.6–2.5°C
Minimum temperatures are projected to <b>increase</b> in the near future by 0.4–0.8°C	Minimum temperatures are projected to <b>increase</b> in the far future by 1.3–2.4°C
The number of hot days (i.e. > 35°C) will <b>increase</b>	The number of cold nights (i.e. < 2°C) will <b>decrease</b>
Projected rainfall changes	
Rainfall is projected to <b>decrease</b> in spring	Rainfall is projected to <b>increase</b> in summer and autumn
Projected Forest Fire Danger Index changes	
Average fire weather days are projected to <b>increase</b> in summer and spring in the near future	Severe fire weather days are projected to <b>increase</b> in summer and spring in the far future

Source: OEH 2014a.

The region is presently characterised by winter-dominated rainfall and low rainfall in summer. The *NSW Climate Impact Profile* (DECCW 2010) prepared for the Riverina Murray Region predicts that by 2050 the region’s climate will be hotter and the impact of the El Niño – Southern Oscillation is likely to become more severe. Total annual rainfall will be reduced and a shift to summer-dominated rainfall is likely. Droughts are likely to become more severe and flooding behaviour is likely to change. Predicted physical responses from climate change include an increase in evaporation, drier soil conditions and poorer conditions for plant growth. These changes could result in reduced fuel availability and a decrease in the frequency of wildfire, however, they could be countered by an increase in the number of very high to extreme fire danger days per year. The average annual Forest Fire Danger Index under the present climate has been calculated as 9.4 which indicates low to moderate fire weather but this is predicted to increase under climate change (OEH 2014a). It is also acknowledged that fire frequency in the region is already highly variable (DECCW 2010).

A more likely impact of soil drying and reduced vegetation cover will be the increased vulnerability of many soils to sheet, rill and gully erosion. This could be exacerbated by increased summer rain with more intense storms. Wind erosion is also likely to increase. This could mean that Aboriginal mounds and burial sites in lunettes become more vulnerable to exposure and erosion. A hotter, drier climate would also have an impact on the old timbers of historic heritage buildings and see a greater loss of modified trees.

The combined effect of higher temperatures, changes in the volume and seasonal occurrence of rainfall, and decreases in river flows will have impacts on all natural systems in the region. This is especially the case for the riverine, floodplain and wetland ecosystems of the Lowbidgee which are already under stress from the combined effects of water regulation, drought, land clearing and cumulative vegetation loss. Increased aridity will result in a decline in nutrient cycling and overall ecosystem productivity and therefore entire food webs are likely to be affected.

The reintroduction of a more natural watering regime is a key initiative aimed at preparing the Yanga parks for climate change. It is part of a broader suite of efforts being applied

across the Murray–Darling Basin which include the legislation of water sharing rules, water buyback programs and the restoration of environmental flows.

Climate change may also significantly affect biodiversity by changing the size of populations and the distribution of species, modifying species composition, and altering the geographical extent of habitats and ecosystems. The potential impacts of climate change are difficult to assess since they depend on the compounding effects of other pressures, particularly habitat loss and fragmentation. Species most at risk are those unable to migrate or adapt, particularly those with small population sizes or with slow growth rates.

The Lowbidgee wetlands are known to provide refuge habitat during drought for southern bell frogs (Wassens et al. 2008, cited in Hardwick & Maguire 2012). Over the last few years the watering events in the Yanga parks have shown signs of definite ecological benefits including restoration of dried-out areas of lignum and black box, maintenance of a stable water level needed for waterbird breeding, and floodways once dominated by common reed are supporting more diverse vegetation. The significance of the wetlands of the Yanga parks as refugia for aquatic species is likely to increase under a drying climate. However, the role of floodplain ecosystems in building resilience is not yet well understood (Selwood et al. 2015).

In order to understand the implications of changing climate and to build resilience in the parks, NPWS will continue monitoring the key ecological values identified for the parks (see Sections 3.3 and 3.4) and work with other stakeholders on the Lowbidgee in an adaptive management approach which can respond to climate change and its effects.

## **Desired outcomes**

- Monitoring of the key ecological values of the parks provides information for understanding and preparing for climate change.
- The resilience of the parks to the effects of climate change is enhanced.

## **Management response**

- 4.3.1 Continue existing fire, pest and weed management programs to contribute to ecosystem health and the ability of the parks to cope with climate change.
- 4.3.2 Continue monitoring the key ecological values and other appropriate indicators to prepare for the effects of climate change.
- 4.3.3 Support research which adds to understanding of the specific effects of climate change on natural and cultural values in the parks.
- 4.3.4 Ensure water management and vegetation management is integrated under an adaptive management framework to contribute to the creation of permanent refuge habitat in the parks.

## 5. Management operations and other uses

### 5.1 NPWS-managed assets

#### Houses

Many of the houses previously used by workers on Yanga Station are used to accommodate NPWS staff in accordance with the NPWS *Staff Housing Policy* (DECC 2008a). These include:

- Lakeview Homestead
- Redgum Cottage
- Palm Cottage
- Middle Cottage
- Lakeside Cottage
- Oakhampton Cottage
- Irrigation Cottage Oakhampton
- Irrigation House
- Waugorah Homestead
- Redbank House.

At times, vacant houses such as Lakeview Homestead, Redgum Cottage and Redbank House are available for short-term use by researchers and visiting staff. Redgum Cottage is under consideration as a place for Aboriginal activities or a cultural centre (see Section 3.5).

There may be potential in future for commercial leasing of some houses as accommodation or office space for commercial operators as part of a tourism venture. Commercial leasing of housing stock in the parks for visitor use is also under consideration but is severely constrained by the need to provide security in a remote location, and the cost of upgrading infrastructure for use by the public. The adaptive re-use of houses in the parks for accommodation would only occur where investment is supported by demand.

#### Workshops

The main workshop for the parks is located adjacent to the Yanga Homestead precinct. Native plants have been used to screen the compound so it does not detract from the aesthetics of nearby historic heritage buildings. Another workshop located near Waugorah Homestead stores equipment and allows for repairs of machinery in the north of the parks.

#### Management trails

An extensive network of about 200 kilometres of unsealed management trails provides access throughout the parks for management operations in addition to the park roads (see Section 3.7). This network facilitates water management across the floodplain and incorporates causeways, culverts and bridges. Significant rainfall events and flooding can render large sections of the parks inaccessible for weeks at a time, cutting off access to infrastructure, visitor facilities and staff housing. As many of the trails are constructed to four-wheel-drive standard, particularly in the northern sections of the parks, trails are closed from time-to-time to prevent damage and ensure staff safety.

Some of the trails originally formed on Yanga Station are surplus to NPWS needs. Therefore the trail network will be rationalised and some trails closed. Other than the visitor facilities proposed in Table 7 no new park roads or management trails will be constructed in the parks.

Locked gates are necessary in some sections of the parks to restrict unauthorised access on management trails and other illegal activities which degrade park values, interrupt park operations and pose a safety risk to visitors and staff. In some instances, access is allowed to more remote areas of the parks under a licence, for example, for commercial fishing.

In the event that additional recreational opportunities are developed in future, in the northern floodplain or other areas which are currently accessible by management trails only (such as those listed in Table 7), an appropriate system for permitting controlled visitor access will be developed (see Section 3.7).

## **Borrow pits**

Gravel is required for ongoing maintenance of roads, trails and other facilities in the parks. Sourcing gravel from within the parks avoids the high cost of freighting gravel from other locations and removes the risk of introducing external pathogens and weeds.

There are three registered borrow pits at Condoulpe, Oakhampton and Waugorah which previously provided gravel for surfacing trails in the parks. The Condoulpe pit, located to the south of Lintot Lake in Yanga State Conservation Area, is the only pit with a sizeable amount of gravel remaining. Once this is exhausted, and unless a new gravel resource can be identified within the parks, all road surfacing materials will need to be sourced from outside the parks and the borrow pit rehabilitated.

Other exhausted pits which need to be rehabilitated include Bradburys (near Yanga Woolshed precinct), Parkers (West, Middle and East), Holts and Holts Middle, and South Breeding Plains.

A new potential source of gravel has been identified in the north of the parks in Big Cultivation Paddock. This will need to be assessed through NPWS environmental and cultural impact assessment processes and approval sought from the relevant regulatory authority.

## **Fencing**

As much of the area now forming the Yanga parks was formerly a sheep station, extensive lengths of fencing were in place at the time of reservation.

The internal fencing needed for managing stock on Yanga Station was surplus to NPWS needs. In places, these fences were in disrepair or impeded surface water flow or the movement of native animals. In recognition of the historic heritage value of the fencing and its usefulness for interpreting the parks' pastoral history, NPWS has removed the wire and posts but retained fence-end assemblies and gateways.

NPWS has an ongoing need to ensure that effective boundary fencing is in place to prevent stock from neighbouring properties straying into the park. Maintenance of this fencing needs to occur in consultation with neighbouring landowners. In some boundary locations, where excluding stock is not a necessity, fencing may be removed or not replaced over time.

## **Water management infrastructure**

NPWS owns and manages an extensive array of water management infrastructure in the parks, including networks of regulators, water-depth gauges and piezometers. Other items of in-channel water management infrastructure are owned and operated by WaterNSW (see

Section 5.2). The placement and operation of this infrastructure is determined by the water management program (see Section 3.2). Key water management infrastructure in the parks is shown in Figure 4 and listed north to south in Table 10.

Other water management infrastructure also present in the parks includes residual earthen structures such as spreader banks, fixed crest sills and ground tanks. The spreader banks are no longer needed and have been breached to reduce their impedance of water flows. Ground tanks in the state conservation area are being maintained as a source of water for pest control and firefighting.

**Table 10 Key water management infrastructure owned and managed by NPWS**

Infrastructure	
River Paddock Regulator	Grisdale’s Regulator
Waugorah Lake Regulator	Tarwillie Regulator
Shaw’s Regulator	Tarwillie Swamp sills
Bruton’s Bridge Regulator	Woolshed Creek Regulator
Curry’s Regulator	Woodcutters Bridge
McCabe’s Gap Regulator	Glenhaven Bridge
Mercedes Swamp Regulator	Carter’s Bank Regulator
Twin Bridges Regulator North	Yanga Creek Regulator
Twin Bridges Regulator South	Devils Creek Regulator
Piggery Bridge Regulator	Fingerboards Bridges
Piggery Lake Regulator	Condoulpe Regulator

In general, ongoing maintenance required will be minimal, but regulators, approach roads, bridges and walkways can be damaged by floodwaters or during storm events. All NPWS-owned water management infrastructure must be kept in working order and access maintained to allow for ongoing monitoring of water levels and water delivery. Under an adaptive management approach, existing water management infrastructure may also need to be modified from time-to-time.

Additional infrastructure may also be required in future, for example, to manage water from Nimmie–Caira. The majority of additional infrastructure works will be needed off-river to repair damage, hold water on ecological assets or change how water is directed to ecological assets during dry times. Expected infrastructure works are listed in Table 11.

**Table 11 Proposed additional water management infrastructure works (NPWS-owned)**

Infrastructure works	Reason	Locations
Replacement of regulator gates (and earthbank restoration where necessary)	Existing gates are not watertight and associated earthen banks have been damaged by floodwaters or delivery of environmental water	Twin Bridges, South Bridge and North Bridge, Carter’s Bank, Bruton’s Bridge, Piggery Bridge, Shaws Swamp
Completion of fixed crest sills	To maintain a stable water depth for nesting waterbirds	Around the edge of Tarwillie Swamp
Bank repairs and structural upgrades	To seal breaches in existing structures and maintain a stable water depth for nesting waterbirds	Jillies Bank, Hamptons Bank, Snake Bank, Grisdale’s Bank, Buster’s Bank at Tarwillie Swamp



Infrastructure works	Reason	Locations
Bank stabilisation including construction of rock causeways or crossings (and/or box culverts where necessary)	To ensure access while Tala Lake is surcharging	Woolshed and Piggery Water Management Areas in three sections: Southern (River Talpee), Middle (River Smythes and River Breer), and Narkungerie
Installation of box culverts and new regulator	To replace existing pipes	Bronzewing Drive

## Abercrombie water pipeline

NPWS is a member of the Abercrombie Pumping Association consisting of seven landholders. A new underground pipeline was constructed in 2017 and replaced an open channel system which drew irrigation, stock and domestic water from the Murrumbidgee River at Pevensey, 20 kilometres downstream from Hay. The Abercrombie channel system entered the Yanga parks near the far eastern boundary of the state conservation area where the park intersects the Stuart Highway. Under the new pipeline scheme, water enters the parks upstream of Balranald Weir via a new pump house (Yanga River Pump Station) built near the Yanga Woolshed (RPS 2014).

The pipeline supplies stock and domestic entitlement water to the Woolshed and Yanga Homestead precincts, residences previously serviced by the open channel system, and 30 strategically located, sealed water tanks required for park management such as fire control and pest management. Several tanks along the route of the old open channel scheme are surplus to NPWS requirements and will be decommissioned and rehabilitated.

The closed pipe system has significant advantages over the open channel system including reducing water lost from evaporation and reduced maintenance costs. Removal of the old system may also reduce the occurrence of pest animals in the state conservation area. The route for the pipeline was determined to avoid damaging regionally significant vegetation and in consultation with the Aboriginal community, to avoid damaging Aboriginal heritage.

Easements are required over land within the parks in favour of the Abercrombie Pumping Association along the route of the pipeline, and to allow extension of the power supply to the pump station (see Section 5.2). As part of the Abercrombie Pumping Association, NPWS will be party to the operating agreement for the pipeline.

## Desired outcomes

- Park management infrastructure meets management needs and has minimal impact on park values.
- Water management infrastructure is well maintained and managed to gain the greatest ecological benefit and keep operating costs to a minimum.
- Staff housing and infrastructure in the parks is routinely maintained and managed consistent with legislative and park management requirements.

## Management response

- 5.1.1 Review the function and future potential of vacant houses in the parks in consultation with relevant stakeholders.
- 5.1.2 Continue to make houses and cottages available for staff accommodation or other rental in accordance with the NPWS *Staff Housing Policy*.

- 5.1.3 Review the management trail network and maintain management trails required to meet the needs of park operations and staff housing. Close trails surplus to operational needs and allow to revegetate. Realignment of existing trails may occur to improve NPWS vehicle access or to reduce impacts on natural and cultural values. No new trails may be constructed.
- 5.1.4 Investigate the potential of the gravel source in Big Cultivation Paddock to provide gravel for road and trail maintenance in the parks. Subject to the outcome of this investigation, pursue approval to extract gravel in accordance with NPWS environmental and cultural impact assessment processes and relevant regulatory requirements.
- 5.1.5 Review boundary fencing to determine priorities for replacement in consultation with neighbouring landowners. Provide assistance under the NPWS *Boundary Fencing Policy* and establish boundary fencing agreements as required.
- 5.1.6 Maintain NPWS-owned water management infrastructure in working order and in consultation with other water management authorities where required.
- 5.1.7 Develop additional water management infrastructure as required, as funding permits (including the infrastructure works listed in Table 11).
- 5.1.8 Seek the granting of an easement over park land where the Abercrombie pipeline has been constructed. Decommission or rehabilitate irrigation channels and ground tanks in the parks which are made redundant by the completion of the Abercrombie pipeline as appropriate.
- 5.1.9 Assess exhausted borrow pits for natural revegetation and rehabilitate them as appropriate.

## 5.2 Non-NPWS uses and operations

### Water management infrastructure

WaterNSW owns several major water management structures in the parks including: Redbank Weir, 1AS (Redbank South) Regulator, 1ES (Waugorah) Regulator, Woolshed Creek Regulator on Tala Creek, Tala Escape Regulator and Talpee Creek Regulator on the north side of Tala Lake (see Figure 4). NPWS operates these regulators under licence and works closely with WaterNSW to coordinate water delivery to the parks from these entry points.

A series of banks which block return points to the river and retain water in the parks are also owned by WaterNSW. These structures are currently maintained by WaterNSW but there is no formal management agreement in place.

The Yanga Lake Regulator is another significant structure possibly owned by WaterNSW. It is located outside the boundary of the parks within the travelling stock reserve on the north-west side of Yanga Lake. NPWS holds a licence to operate the regulator which came with acquisition of Yanga Station.

This regulator is a major structure built between 1913 and 1920 (Tonkin Zulaikha Greer Architects 2013) from concrete and timber as part of early management efforts to manage floodwaters of the Murrumbidgee. Its purpose was to hold water in Yanga Lake primarily for stock and domestic use but with the added benefit of supporting water sports on the lake. Though outside the parks, the structure was included in the Yanga Conservation Management Plan and has been assessed as having a high level of historic heritage value (Tonkin Zulaikha Greer Architects 2013).

The regulator is in a state of moderate disrepair and is hazardous to operate. Engineering advice obtained by NPWS in 2010 found the structure was inadequate from an operational point of view and structurally unsafe. It was estimated that replacement of the regulator with a modern structure would cost in the order of \$1–3 million.

At the time of its construction, the Yanga Lake Regulator was important for delivering and holding flows in Yanga Lake but this role has now changed. The regulator on Devils Creek now directs flows from Redbank and the Lowbidgee Floodplain to Yanga Lake, while the regulator on Yanga Creek directs flows from the Murrumbidgee River. These two other regulators are part of the broader water management system being developed by NPWS to restore river red gum ecosystems. They ensure that water does not back up along Yanga Creek and cause prolonged flooding of stands of river red gum along the creek, as well as mitigating against the distribution of blackwater after drier periods. With these two regulators in place, the need for Yanga Lake Regulator has been superseded.

Minor works are needed in order to protect the historic heritage values of the Yanga Lake Regulator and reduce risk to the public. An interpretative sign could also be installed at the site to inform visitors of the role played by the regulator in past management of Yanga Station and could be a point of interest if a walking track were established between the Woolshed and Yanga Homestead (see Table 7).

## **Private property access**

The large inholding, Impimi, is accessed through Yanga State Conservation Area via an unmarked road from the Sturt Highway. The corridor of this road is kept as unreserved land, which is vested in the Minister for Energy and Environment for the purposes of Part 11 of the National Parks and Wildlife Act, to allow continuation of current access arrangements.

These Part 11 lands do not form part of the reserved area of the park but their management is subject to this plan and the National Parks and Wildlife Regulation.

Under the regulation it is an offence to take an animal onto any road, including public roads, traversing a park or reserve without approval. However, a plan of management can identify roads for the transit of pets and livestock provided there are no alternative routes that do not transit the park.

## **Waugorah Road**

Waugorah Road is a public road maintained by Murray River Council which provides essential access to the north of the parks for park management activities and for private properties located north-east of Yanga National Park. It provides the only route of access for staff who live at Waugorah, and for visitors to Woolpress Bend Campground which are both about 60 kilometres from the junction with the Sturt Highway. The northern half of Waugorah Road is unsealed and can become hazardous during extended rainfall.

There are three bridges along Waugorah Road that are in disrepair and in need of replacement. The closure of the existing timber bridge over Waugorah Creek has necessitated use of an alternative road to Woolpress Bend. This alternative road is constructed to a four-wheel-drive standard only and is closed when water is being delivered to the parks or during rain events. Timing of the replacement of the three bridges by Murray River Council is not known.

## **Crown roads**

There are many kilometres of Crown roads throughout the Yanga parks. Crown roads are roads declared under the *Roads Act 1993* and are not gazetted as part of the Yanga parks.

Within the Yanga parks, these roads are not physically formed but exist only as 'paper roads'. The need for these roads will be assessed as part of the cross-agency statewide program to reduce the number of Crown roads in New South Wales. Where it is found that these roads are not needed to provide access to or within the parks, road closures may be considered and the land added to the parks.

## **Travelling stock reserves**

Several sections of the parks are adjoined by travelling stock reserves including those adjacent to Windomal Road, Swan Hill Road and each side of the Sturt Highway / Waugorah Road intersection (see Figure 1). Additional travelling stock reserves are located on the south-west and north-east edges of Yanga Lake, and within the state conservation area adjoining Uara Paddock. These reserves have not been leased for grazing by adjoining owners or used for moving stock in many years.

Travelling stock reserves are Crown land managed by Local Land Services. Local Land Services is undertaking a statewide review of travelling stock reserves to determine their future ownership and management arrangements, which could include transfer to other agencies, local councils or Aboriginal land councils.

Travelling stock reserves can contribute to the conservation of native vegetation and habitat values in agricultural landscapes by protecting the seedbank of native species and retaining canopy trees. However, where heavily used, continuous grazing of travelling stock reserves can erode their conservation values. There may be potential for future additions to the parks from these lands on the completion of the review.

## **Former railway**

In the south of the parks there is a railway reserve on Crown land vested in VicTrack under the *Border Railways Act 1922*. The reserve follows the route of the former Moama–Balranald railway line which enters the state conservation area on its southern boundary and passes between the Yanga Homestead precinct and the Sturt Highway (see Figure 1). This corridor is 59 hectares in area and is leased by NPWS from VicTrack.

Little evidence of the railway now exists other than the cleared corridor, the siding to the north of Yanga Lake and the siding to the west of Impimi. Although there was never any station building erected, the railway route and siding are identified as having historic heritage value and the history of the railway is included in interpretation for visitors to the parks (see Section 3.8). There may be potential to include visits to parts of the former railway route in guided tours.

Fencing along the boundary between the railway reserve and the rest of the parks is in very poor condition. Weeds are more prevalent in the reserve due to the railway clearing. NPWS carries out weed spraying at times to prevent the spread of weeds from the railway reserve into the parks.

## **Transmission lines**

Several powerlines traverse the Yanga parks, providing power to areas within the parks and also to nearby communities (see Figure 1). Transmission lines and associated management generate impacts from clearing or trimming of vegetation, use of herbicides and the maintenance of access trails, as well as the visual impact of the lines and towers.

A TransGrid 220-kilovolt transmission line runs east–west through the southernmost section of the state conservation area to Balranald, for a distance of approximately 21 kilometres. This transmission line is covered by a formal easement and is subject to a statewide

agreement between TransGrid and NPWS which allows for inspection and maintenance of existing transmission lines and infrastructure.

The lines providing power to the parks are owned and operated by Essential Energy including:

- a 22-kilovolt line traversing the Woolshed precinct and providing power to the Woolshed
- a 22-kilovolt line servicing Yanga Homestead
- a 19.1-kilovolt network of lines servicing The Willows precinct and staff residences.

These power lines are not covered by a formal easement but an easement is to be granted over the new Yanga River Pump Station associated with the underground pipeline. No other access or maintenance agreement exists with Essential Energy but the company must comply with the National Parks and Wildlife Act and Regulation when carrying out any maintenance or replacement work. NPWS consent will be required for certain works.

## **NPWS licences**

NPWS has two licences over two small parcels of Crown land. Licence number 404172 has an area of 67.27 hectares and is near the Waugorah Homestead, surrounded by national park. Licence number 404168 has an area of 15.57 hectares and is near the intersection of Waugorah Road and the Sturt Highway, on the boundary of the national park and the state conservation area. The licences were originally issued to the previous owners for grazing purposes.

Both of these parcels are now being managed for conservation purposes as if they were reserved as part of the parks. The preferred outcome is for these licences to be cancelled and the land added to the parks.

## **Hayshed use**

NPWS currently lets two large haysheds along the Yanga Woolshed access road for use by a neighbouring landowner. This has been a long-standing arrangement and is expected to continue, as long as this storage is surplus to NPWS operational needs.

## **Beekeeping**

Historically several beekeepers were known to place their hives in river red gum forests and black box woodlands along the Murrumbidgee River on Yanga Station and in the former Kieeta State Forest. There were no beekeeping permits in place over the state forest at the time of its reservation as park and no authorisations for beekeeping on Yanga Station were transferred to NPWS at the time of purchase.

Honeybees are known to impact native biota and therefore can be incompatible with conservation objectives (DEE 2018). The NPWS *Beekeeping Policy* (NPWS 2016) allows for the keeping of bees on lands reserved under the National Parks and Wildlife Act under licence for the continuation of existing interests only. Therefore, beekeeping is not now permissible in the Yanga parks.

## **Commercial fishing**

Yanga Lake and the Murrumbidgee River are used for commercial fishing in Yanga National Park. Commercial fishing is restricted to yabbies (*Cherax destructor*) and European carp. Commercial fishers are required to obtain an access agreement from NPWS and meet other relevant regulatory requirements.

Yanga Lake is generally more accessible for commercial fishing but parts of the lake are declared a no boating zone. All boating and fishing activities in Yanga Lake must comply with the relevant regulatory requirements. This includes the RMS Murrumbidgee regional boating map (RMS 2011) and any regulatory signage.

## **Mining**

Yanga State Conservation Area is underlain by sediments of the Murray Basin and has potential for mineral sands and petroleum, including gas, but the potential is poorly tested (OEH 2014b). Testing for coal seam gas was carried out in 2003–04 but was inconclusive. The area is also underlain at depth by basement rocks with untested potential for gold and base metal mineralisation.

There are presently no exploration or mining titles over Yanga State Conservation Area.

## **Signage**

NPWS does not support commercial signage in parks and there are several outdated signs along the Sturt Highway boundary which need to be removed. A billboard next to the Swan Hill Road inside the boundary of Yanga National Park, which existed at the time of the park's reservation, is currently leased to Balranald Shire Council. The sign promotes the parks and Balranald and is subject to an access agreement issued under the National Parks and Wildlife Act. This arrangement will be reviewed on completion of the agreement.

## **Desired outcomes**

- Non-NPWS uses and activities are managed to minimise impacts on park values and infrastructure.
- Agreements are in place between NPWS and other agencies to coordinate access and maintenance arrangements for all non-NPWS assets.
- Commercial fishing activities are licensed under the Fisheries Management Act and comply with the NPWS Professional Fishing Access Policy and the NSW Maritime Boating Plan for Yanga Lake.

## **Management response**

- 5.2.1 Work with Water NSW and other relevant stakeholders to improve the safety and interpretation of Yanga Lake Regulator.
- 5.2.2 Support other water managers in the operation and maintenance of non-NPWS water management infrastructure.
- 5.2.3 Allow pets and livestock to be transported through the parks to private property and other lands that are only accessible on roads which traverse the parks, as long as the animals remain fully within the vehicle at all times.
- 5.2.4 Work cooperatively with Murray River Council to ensure roads and other essential infrastructure is maintained and accessible.
- 5.2.5 Investigate options for adding excess Crown lands to the parks including Crown roads which are not needed for access purposes and travelling stock reserves which are not needed for stock grazing.
- 5.2.6 Consult with VicTrack about the management of the disused railway reserve that traverses Yanga National Park and Yanga State Conservation Area so as to contribute to protection of park values.

- 5.2.7 Continue to liaise with electricity providers regarding access to, and maintenance of, existing powerlines within the parks. Seek the granting of the easement required for the Yanga River Pump Station on Yanga National Park adjoining the Murrumbidgee River.
- 5.2.8 Seek extinguishment of Crown licences (numbers 404172 and 404168) and investigate options for adding these lands to the parks.
- 5.2.9 Monitor the commercial fishing activities approved in the parks to ensure adverse impacts on natural and cultural values are minimised.
- 5.2.10 Beekeeping is not permissible in the Yanga parks.

## 6. Implementation

This plan of management establishes a scheme of operations for the Yanga parks.

Identified activities for implementation are listed in Table 12. Relative priorities are allocated against each activity as follows:

**High priority** activities are imperative to achieve 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 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 12 List of management responses**

Plan reference	Management response	Priority
<b>Geology, landscape and soils</b>		
3.1.1	Locate and design infrastructure, including visitor facilities, to minimise impacts on areas prone to soil and wind erosion, soil instability and degradation.	Ongoing
3.1.2	Restrict vehicle access during wet conditions where grey cracking clays occur.	Ongoing
3.1.3	Monitor areas of active erosion and apply a risk assessment approach to prioritise sites for stabilisation. Undertake erosion control works in accordance with this assessment.	Ongoing
3.1.4	Stabilise eroded areas on Yanga Homestead peninsula to protect Aboriginal cultural heritage, historic heritage and recreational assets from ongoing damage due to wind and water erosion.	High
<b>Hydrology and wetlands</b>		
3.2.1	Develop a planning and monitoring approach to inform annual watering priorities and water delivery. Revise the monitoring regime from time-to-time to take account of new information.	High
3.2.2	Support the development of sustainable diversion limit savings projects for the parks and implement if approved.	High
3.2.3	Support research into groundwater attributes to better understand the role of groundwater in the Lowbidgee Floodplain, including the risk of increasing groundwater salinity.	High
3.2.4	Allow for the temporary trading of water from existing licensed entitlements. Revenue from water trading will be applied to environmental water planning, water delivery and associated activities in the parks.	Ongoing
3.2.5	Continue to liaise with water authorities to optimise water management for the parks.	Ongoing



Plan reference	Management response	Priority
<b>Native plants</b>		
3.3.1	Consider a range of deliberate management interventions to improve the ecological health of degraded river red gum, threatened communities and other significant vegetation, and where warranted, implement management interventions commensurate with available funds.	High
3.3.2	Review existing vegetation mapping and align it with NSW master plant community types.	Low
3.3.3	Implement relevant strategies in the <i>Saving Our Species</i> program and recovery plans for threatened species, populations and ecological communities in the parks.	Ongoing
3.3.4	Support targeted surveys for identifying threatened plant species and for monitoring threatened communities in the parks.	Medium
3.3.5	Allow timber from landscape restoration works and from existing stockpiles to be used for domestic firewood under an NPWS-approved program.	Low
3.3.6	Investigate whether the removal of dead standing timber in non-flood-dependent communities would result in net environmental benefit.	Medium
3.3.7	Manage previously cleared areas with regard to fire, weeds and feral pests to encourage natural revegetation, and support initiatives for active revegetation where proposed.	Medium
3.3.8	Implement a vegetation monitoring regime to inform future vegetation management and environmental water planning. Monitoring will include river red gum, black box communities and tall spike rush in accordance with the ecological risk assessment, and potentially also one or more indicator species for non-flood-dependent communities.	High
<b>Native animals</b>		
3.4.1	Implement relevant actions and strategies in the national recovery plan and the NSW management plan for the southern bell frog in the Murrumbidgee catchment.	High
3.4.2	Implement relevant actions and strategies in the <i>Biodiversity Conservation Program</i> for threatened animals occurring in the parks.	High
3.4.3	Support and encourage native animal surveys across all habitats in the parks, giving priority to improving existing knowledge of threatened species in the parks.	Medium
3.4.4	Monitor key ecological values including egrets and southern bell frogs in accordance with the ecological risk assessment. Support and contribute to monitoring of other species where possible.	High
3.4.5	Incorporate the needs of significant animal species and results of monitoring into water management planning as part of an adaptive management approach.	High
3.4.6	Monitor the impact of grazing pressure from both native and non-native animals, including impacts on elevated areas of the floodplain, and undertake appropriate management action.	Medium
3.4.7	Restrict public access to bird breeding habitats during breeding events, but allow access for research, monitoring and park management operations.	High
<b>Aboriginal heritage</b>		

Plan reference	Management response	Priority
3.5.1	Engage with representatives from local interested Aboriginal groups to facilitate participation and involvement in park management.	High
3.5.2	Monitor Aboriginal cultural heritage sites in sensitive locations, including sandy rises and areas prone to erosion, and carry out stabilising works as required in consultation with the Aboriginal community.	
3.5.3	Work with the Aboriginal community to support opportunities for Aboriginal people to access Country within the parks through culture camps, employment opportunities, collection of natural resources for cultural use and other activities.	Ongoing
3.5.4	Subject to obtaining approval under the National Parks and Wildlife Act, allow Aboriginal people to collect natural resources in the parks for cultural purposes.	Ongoing
3.5.5	Collect oral history from Aboriginal people who have past connections with Yanga Station for use in a balanced interpretation of the parks.	Low
3.5.6	Support the Aboriginal community to investigate options for an Aboriginal gathering place in the north of the parks for culture camps and similar purposes.	Medium
3.5.7	Permit the establishment of an Aboriginal cultural resources centre in an existing building in one of the visitor precincts of the parks in consultation with the Aboriginal community. This centre will provide a focus for activities involving the Aboriginal community and interpretation of the parks' Aboriginal values.	Low
3.5.8	Support surveys of Aboriginal cultural heritage in the parks, giving priority to areas where surveys have not yet been carried out.	Medium
3.5.9	Maintain a current and accurate record of Aboriginal cultural heritage in the parks by updating and revising NPWS database records.	High
3.5.10	Undertake an appropriate level of cultural assessment as part of planning for any works in the parks which have the potential to impact Aboriginal values.	Ongoing
3.5.11	Consult with the Aboriginal community to explore cultural water flow options for the Yanga parks.	Medium
<b>Shared heritage</b>		
3.6.1	Support the listing of the Yanga parks on the State Heritage Register.	High
3.6.2	Use the Yanga Conservation Management Plan to guide historic heritage management and investment.	High
3.6.3	Leave archaeological sites undisturbed in situ except for approved research in accordance with a permit issued under the National Parks and Wildlife Act or the Heritage Act.	Ongoing
3.6.4	Monitor the impact of visitors on historic heritage throughout the parks and modify visitor access as required to protect historic heritage values.	Ongoing
3.6.5	Implement the Moveable Heritage Management Plan and Inventory, including archiving the moveable heritage collection (including paper records), and establishing an appropriate storage facility to protect those items which are not on display.	Medium
3.6.6	Monitor introduced plantings and manage them to avoid adverse impacts on historic and natural heritage values. Historic cultural plantings which are assessed as having little or no significance and are	Ongoing

Plan reference	Management response	Priority
	weeds may be removed and replaced with more appropriate species which fulfil a similar role in that location.	
3.6.7	Investigate options for adaptive re-use of parts of the Yanga Homestead precinct for caretaker accommodation, catering and dining, a cafe or gift shop.	Low
3.6.8	Investigate options for adaptive re-use of buildings in the Yanga Woolshed precinct for short-term accommodation for schools or other groups, re-enactments and shearing demonstrations.	Low
3.6.9	Investigate options for adaptive re-use of Redgum Cottage by the local Aboriginal community for cultural activities, meetings, display of Aboriginal heritage items and similar activities.	Low
<b>Visitor use</b>		
3.7.1	Develop the visitor experiences and facilities listed in Table 7 subject to favourable feasibility and cost–benefit assessment, and completion of environmental and heritage impact assessment and approvals. Additional visitor experiences to those listed in Table 7 which do not require the construction of built facilities and/or trails may also be developed.	High
3.7.2	Encourage partnerships with commercial (private sector) operators to deliver new and enhanced visitor experiences.	High
3.7.3	Monitor the social and environmental impacts of recreation activities including group activities. Visitor sites may be closed for rehabilitation where adverse impacts are identified.	Ongoing
3.7.4	Allow public vehicle access on the park roads shown on Figure 1 and within the visitor precincts shown on Figures 5 and 6.	Ongoing
3.7.5	Introduce a permit system for controlled public vehicular access to Woolpress Bend Campground and other parts of the parks not accessible via the park road network.	Medium
3.7.6	Allow cycling on all park roads and designated management trails, and on the proposed dual-use tracks once constructed.	Medium
3.7.7	Permit horse riding on park roads and management trails by consent where appropriate, in accordance with conditions.	Ongoing
3.7.8	Investigate the potential for developing Aboriginal cultural tourism opportunities in consultation with the Aboriginal community.	High
3.7.9	Consent may be granted for use of the Homestead and Woolshed precincts and other locations in the parks for group activities. Groups of 20 or more people, whether commercial or non-commercial, need to obtain prior consent from NPWS.	Ongoing
3.7.10	Working dogs, working horses and sheep are temporarily allowed in the parks as part of approved tourism activities such as shearing demonstrations and historic re-enactments, provided all animals are under the control of a handler.	Ongoing
<b>Information, education and research</b>		
3.8.1	Provide education and interpretive information for the parks in consultation with local schools, business partners and the Aboriginal community.	Medium
3.8.2	Develop marketing and promotional material for the parks which includes consideration of the Victorian visitor market.	High

Plan reference	Management response	Priority
3.8.3	Encourage universities and other research bodies to continue carrying out research relevant to adaptive management of the parks.	Low
3.8.4	Promote volunteer opportunities in the parks in consultation with the local community.	Low
<b>Pests</b>		
4.1.1	Manage pest species in accordance with pest management strategies relevant to the parks. The highest priorities are protecting threatened ecological communities, wetland and river red gum habitat, migratory waterbirds and threatened species.	High
4.1.2	Monitor regularly to determine the presence and extent of pest species to inform pest control operations and revision of the pest management strategy.	Medium
4.1.3	Implement integrated weed and pest animal control programs in cooperation with neighbouring landowners and other stakeholders including Local Land Services, Landcare groups and local councils.	Medium
4.1.4	Investigate options for control of carp including the use of water management infrastructure, harvesting and biological controls.	Medium
4.1.5	Assess the potential for impacts on waterbirds during nesting events before undertaking any pest animal and weed control or monitoring operations, including ground and aerial shooting and carp removal.	High
<b>Fire</b>		
4.2.1	Implement the fire management strategy for the Yanga parks.	High
4.2.2	Participate in the Mid Murray Bush Fire Management Committee. Maintain cooperative arrangements with local RFS brigades and other fire authorities and surrounding landowners in regard to fuel management and fire suppression.	Ongoing
4.2.3	Manage the parks to protect biodiversity values in accordance with the identified fire regimes in the fire management strategy.	High
4.2.4	Monitor the ability of native plants to recover between fires and review regimes where relevant.	Ongoing
4.2.5	Rehabilitate areas disturbed by fire suppression operations as soon as practicable after a fire event.	High
<b>Climate change</b>		
4.3.1	Continue existing fire, pest and weed management programs to contribute to ecosystem health and the ability of the parks to cope with climate change.	Ongoing
4.3.2	Continue monitoring the key ecological values and other appropriate indicators to prepare for the effects of climate change.	Ongoing
4.3.3	Support research which adds to understanding of the specific effects of climate change on natural and cultural values in the parks.	Low
4.3.4	Ensure water management and vegetation management is integrated under an adaptive management framework to contribute to the creation of permanent refuge habitat in the parks.	High
<b>NPWS-managed assets</b>		
5.1.1	Review the function and future potential of vacant houses in the parks in consultation with relevant stakeholders.	Medium

Plan reference	Management response	Priority
5.1.2	Continue to make all houses and cottages available for staff accommodation or other rental in accordance with the relevant NPWS policies.	Ongoing
5.1.3	Review the management trail network and maintain management trails required to meet the needs of park operations and staff housing. Close trails surplus to operational needs and allow to revegetate. Realignment of existing trails may occur to improve NPWS vehicle access or to reduce impacts on natural and cultural values. No new trails may be constructed.	Medium
5.1.4	Investigate the potential of the gravel source in Big Cultivation Paddock to provide gravel for road and trail maintenance in the parks. Subject to the outcome of this investigation, pursue approval to extract gravel in accordance with NPWS environmental and cultural impact assessment processes and the relevant regulatory requirements.	Medium
5.1.5	Review boundary fencing to determine priorities for replacement in consultation with neighbouring landowners. Provide assistance under the NPWS <i>Boundary Fencing Policy</i> and establish boundary fencing agreements as required.	Ongoing
5.1.6	Maintain NPWS-owned water management infrastructure in working order and in consultation with other water management authorities where required.	Ongoing
5.1.7	Develop additional water management infrastructure as required, as funding permits (including the infrastructure works listed in Table 11).	High
5.1.8	Seek the granting of an easement over park land where the Abercrombie pipeline has been constructed. Decommission or rehabilitate irrigation channels and ground tanks in the parks which are made redundant by the completion of the Abercrombie pipeline as appropriate.	High
5.1.9	Assess exhausted borrow pits for natural revegetation and rehabilitate them as appropriate.	Low
<b>Non-NPWS uses and operations</b>		
5.2.1	Work with Water NSW and other relevant stakeholders to improve the safety and interpretation of Yanga Lake Regulator.	Low
5.2.2	Support other water managers in the operation and maintenance of non-NPWS water management infrastructure.	Ongoing
5.2.3	Allow pets and livestock to be transported through the parks to private property and other lands that are only accessible on roads which traverse the parks, as long as the animals remain fully within the vehicle at all times.	Ongoing
5.2.4	Work cooperatively with Murray River Council to ensure roads and other essential infrastructure is maintained and accessible.	Ongoing
5.2.5	Investigate options for adding excess Crown lands to the parks including Crown roads which are not needed for access purposes and travelling stock reserves which are not needed for stock grazing.	
5.2.6	Consult with VicTrack about the management of the disused railway reserve that traverses Yanga National Park and Yanga State Conservation Area so as to contribute to protection of park values.	Low
5.2.7	Continue to liaise with electricity providers regarding access to, and maintenance of, existing powerlines within the parks. Seek the granting	Medium

Plan reference	Management response	Priority
5.2.8	of the easement required for the Yanga River Pump Station on Yanga National Park adjoining the Murrumbidgee River. Seek extinguishment of Crown licences (numbers 404172 and 404168) and investigate options for adding these lands to the parks.	Medium
5.2.9	Monitor the commercial fishing activities approved in the parks to ensure adverse impacts on natural and cultural values are minimised.	Medium
5.2.10	Beekeeping is not permissible in the Yanga parks.	Ongoing

## Appendix A – Key ecological values in the Yanga parks

Ecological risk assessment (Childs 2010)

Key ecological value	Justification	Current status	Target	Justification of target
River red gum communities	<p>An iconic ecological community for inland Australia that is poorly reserved in the Riverina Bioregion and includes plants and animals protected under the BC Act (e.g. Mossgiel daisy, barking owl)</p> <p>Largest contiguous forest outside the Murray Valley</p> <p>Important nesting habitat for waterbirds listed under international migratory bird agreements (e.g. JAMBA/CAMBA/ROKAMBA) and protected under the EPBC Act</p> <p>Supports a terrestrial ecosystem when dry, which includes species listed on the BC Act and EPBC Act</p>	<p>Vegetation mapping for the Lower Murrumbidgee Floodplain shows a rapid decline in tree health from 1997 to present (McCosker 2008). Tree health surveys and general observations report large areas of river red gum forest and woodland are severely stressed and tree mortality is high.</p>	<p>The river red gum forest should receive a major flooding event at least every second year (ideally 8–9 years out of every 10). Approximately 200 GL is required to flood the river red gum forest including filling Tala and Yanga lakes (Davy pers. comm. 2008). Comparatively, the 2000 flood flooded 8663 ha of Yanga National Park.</p>	<p>Enhance biodiversity within river red gum forests and woodlands and improve tree condition and habitat quality for various species listed under BC Act and EPBC Act.</p>
Black box woodlands	<p>An important ecological community that is poorly reserved in the Riverina Bioregion</p> <p>Supports many species of plants and animals listed under the BC Act and EPBC Act e.g. winged peppergrass, hooded robin (south-eastern form)</p>	<p>The Fingerboards (Uara Creek) and Yanga Nature Reserve (Fiddlers Creek) are comprised of extensive black box woodlands. Fingerboards was last flooded in 2000, and the nature reserve has not been effectively flooded for many decades. Tree stress and mortality in these areas is prevalent.</p>	<p>Black box woodlands to receive late winter/spring flooding for &gt;3 months for two successive years, and subsequently inundated once every 5–7 years. An approximate total of 100 GL is required to flood the nature reserve and Fingerboards for an extended duration. This volume includes ‘conveyance losses’, but does not include delivery flows.</p>	<p>Enhance biodiversity within black box and lignum woodlands and improve habitat quality for various species listed under the BC Act and EPBC Act.</p>

Key ecological value	Justification	Current status	Target	Justification of target
Tall spike rush wetlands	Critical nesting and foraging habitat for waterbirds listed under the BC Act and EPBC Act, including species protected by international migratory bird agreements Critical habitat for the southern bell frog	Extensive areas of tall spike rush are presently confined to sites that are frequently flooded (e.g. Mercedes Swamp, The Avenue, Piggery Lake). It is assumed that >5 years without flooding is likely to result in a decline of tall spike rush wetland area.	Maintain stable flood heights in tall spike rush wetlands during major waterbird breeding events, or receive flooding at least once every 3 years during prolonged dry periods.	Maintain critical nesting and foraging habitat for wetland-dependant species, especially species listed under the BC Act, EPBC Act and international migratory bird agreements.
Egrets (representing colonial nesting waterbirds)	Important biological indicator of wetland health Significant decline in egret abundance and nesting colonies throughout Australia (e.g. Glover et al. 2008)	Recent successful breeding events for egrets on the Yanga/Lower Murrumbidgee floodplains were recorded in 1989 (Maher 1990), 1991–94 (J Brickhill [former Regional Operations Coordinator, Office of Environment and Heritage] pers. comm. 2008), 2005 (Maher 2006), 2009, 2010–2011, 2014–2015, 2015–2016 (Spencer 2017) and 2016–2017 (Spencer et al. 2018).	Flooding is required at least every 3 years into targeted wetland or nesting and foraging sites. To ensure the long-term viability of colonial nesting waterbird sites, stable water levels (~1 m deep) are required in Sept–Oct that gradually recede during Nov–Dec. Water 30–60 cm deep should remain in nesting and foraging areas until late Jan–Feb (Maher 2006).	Egret species have an average life expectancy of 8–10 years (McKilligan et al. 1993). Hence, successful breeding cycles are critical in order to increase current populations and enhance genetic viability.
<b>Southern bell frogs</b>	Listed as endangered on BC Act and vulnerable on EPBC Act The Lower Murrumbidgee contains the largest known southern bell frog population in NSW	Wassens (et al. 2008) found the species is at a high risk of becoming locally extinct due to reductions in flood frequency, extent and duration.	Critical wetlands such as Mercedes Swamp, The Avenue and Piggery Lake to be flooded annually or 9 years out of 10 if possible (Wassens et al. 2008).	To prevent extinction and maintain or enhance current populations.

Table updated to refer to Biodiversity Conservation Act 2016 (BC Act) rather than Threatened Species Conservation Act 1995.



## Appendix B(1) – Flood-dependent vegetation communities occurring in the Yanga parks

Vegetation class <sup>1</sup>	NSW plant community type (Benson <sup>2</sup> )	Hectares
Inland Riverine Forests	River Red Gum – Sedge-dominated Very Tall Open Forest in Frequently Flooded Forest Wetland along Major Rivers and Floodplains in South Western NSW (Benson 2)	5,933
	River Red Gum – Black Box Woodland Wetland of the Semi-arid (warm) Climatic Zone (mainly Riverina Bioregion and Murray Darling Depression Bioregions) (Benson 10)	Not mapped
	River Red Gum – Warrego Grass – Herbaceous Riparian Tall Open Forest Wetland mainly in the Riverina Bioregion (Benson 7)	1,083
	River Red Gum – Wallaby Grass Tall Woodland Wetland on the Outer River Red Gum Zone mainly in the Riverina Bioregion (Benson 9)	3,701
	River Red Gum – Lignum Very Tall Open Forest or Woodland Wetland on Floodplains of Semi-arid (warm) Climate Zone (mainly Riverina Bioregion and Murray Darling Depression Bioregion) (Benson 11)	10,590
Inland Floodplain Woodlands	Black Box – Lignum Woodland Wetland of the Inner Floodplains in the Semi-arid (warm) Climate Zone (mainly Riverina Bioregion and Murray Darling Depression Bioregion) (Benson 13)	3,027
	Black Box Open Woodland Wetland with Chenopod Understorey mainly on the Outer Floodplains in South Western NSW (mainly Riverina Bioregion and Murray Darling Depression Bioregion) (Benson 15)	9,043
	Black Box Grassy Open Woodland Wetland of Rarely Flooded Depressions in South Western NSW (mainly Riverina Bioregion and Murray Darling Depression Bioregion) (Benson 16)	Not mapped
Inland Floodplain Shrublands	Lignum Shrubland Wetland of the Semi-arid (warm) Plains (mainly in the Riverina Bioregion and Murray Darling Depression Bioregion) (Benson 17)	1,336
	Nitre Goosefoot Shrubland Wetland on Clays of the Inland Floodplains (Benson 160)	6,048
	Canegrass Swamp Tall Grassland Wetland of Drainage Depressions, Lakes and Pans of the Inland Plains (Benson 24)	Not mapped
Inland Floodplain Swamps	Shallow Marsh Wetland of Regularly Flooded Depressions on Floodplains mainly in the Semi-arid (warm) Climatic Zone (mainly Riverina Bioregion and Murray Darling Depression Bioregion) (Benson 12)	150
	Permanent and Semi-permanent Freshwater Lakes Wetland of the Inland Slopes and Plains (Benson 238)	1,980

Vegetation class <sup>1</sup>	NSW plant community type (Benson <sup>2</sup> )	Hectares
	Common Reed – Bushy Groundsel Aquatic Tall Grassland Wetland of Inland River Systems (Benson 181)	Not mapped

<sup>1</sup> Vegetation class – described by Keith (2004).

<sup>2</sup> NSW Vegetation Classification and Assessment (VCA) database, (Benson 2006; Benson 2008; Benson et al. 2010).

## Appendix B(2) – Non-flood-dependent vegetation communities occurring in the Yanga parks

Vegetation class <sup>1</sup>	NSW plant community type (Benson <sup>2</sup> )	Hectares
Aeolian Chenopod Shrublands	Black Bluebush Low Open Shrubland of the Alluvial Plains and Sandplains of the Arid and Semi-arid Zones (Benson 153)	13,509 (Mapped with Benson 163)
	Pearl Bluebush Low Open Shrubland of the Arid and Semi-arid Plains (Benson 154)	Not mapped
Riverine Chenopod Shrublands	Bladder Saltbush Shrubland on Alluvial Plains in the Semi-arid (warm) Zone including Riverina Bioregion (Benson 157)	Not mapped
	Old Man Saltbush Shrubland mainly of the Semi-arid (warm) Climate Zone (south western NSW) (Benson 159)	14
	Dillon Bush (Nitre Bush) Shrubland of the Semi-arid and Arid Zones (Benson 163)	(Mapped with Benson 153)
Inland Saline Lakes	Disturbed Annual Saltbush Forbland on Clay Plains and Inundation Zones mainly of South Western NSW (Benson 164)	Not mapped
Sand Plain Mallee Woodlands	Chenopod Sandplain Mallee Woodland/Shrubland of the Arid and Semi-arid (warm) Zones (Benson 170)	721
Sand Plain Mulga Shrublands	Prickly Wattle Tall Open Shrubland of Dunes and Sandplains of Semi-arid and Arid Regions (Benson 139)	70
Riverine Sandhill Woodlands	Yarran Tall Open Shrubland of the Sandplains and Plains of the Semi-arid (warm) and Arid Climate Zones (Benson 23)	4,897
	Slender Cypress Pine – Sugarwood – Western Rosewood Open Woodland on Sandy Rises mainly in the Riverina Bioregion and Murray Darling Depression Bioregion (Benson 21)	Not mapped
Semi-arid Sand Plain Woodlands	Black Oak – Western Rosewood Open Woodland on Deep Sandy Loams mainly in the Murray Darling Depression Bioregion (Benson 58)	5,085 (Mapped as Benson 57)
Riverine Plain Woodlands	Weeping Myall Open Woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion (Benson 26)	31

<sup>1</sup> Vegetation class – described by Keith (2004).

<sup>2</sup> NSW Vegetation Classification and Assessment (VCA) database; (Benson 2006; Benson 2008; Benson et al. 2010).

# Appendix C – Vegetation profiles for the Lowbidgee

## Lowbidgee profile

Rivers and Floodplains – Creeklines and Secondary Floodplains – Shallow Depressions  
(image and table correlate from left to right)



Landform	<u>Rivers and Floodplains</u>	<u>Creeklines and Secondary Floodplains</u>	<u>Shallow Depressions</u>
<b>Vegetation</b>	Riverine forest	Black box woodland	Lignum – goosefoot / canegrass swamp
<b>Notes</b>	River red gum forest or woodland with understorey of herbs, sedges and grasses; includes weir pools and billabongs. Alluvial, heavy grey, brown or red clay soils.	Black box woodland with often sparse understorey of grasses or shrubs. Alluvial, heavy brown or grey clays, self-mulching or compact.	Open scrub to tussock grassland in depressions and low-lying areas subject to intermittent flooding. Alluvial, heavy grey, cracking clays, sometimes slightly saline.
<b>Examples</b>	Redbank Weir	McFarlands State Forest, Quandong State Forest, Goonawarra Nature Reserve, Yanga Nature Reserve	Murrumbidgee River floodplain, Maude Rd south of Maude, Warwaegae Rd, Cobb Highway at One Tree

Source: Native Vegetation Guide for the Riverina (Kent et al. 2002).

## Lowbidgee profile

Creeklines and Secondary Floodplains – Undulating Plains, Low Rises and Levees – Level to Depressed Plains (image and table correlate from left to right)



<b>Landform</b>	<u>Creeklines and Secondary Floodplains</u>	<u>Undulating Plains, Low Rises and Levees</u>	<u>Level to Depressed Plains</u>
<b>Vegetation</b>	Black box woodland	Black/pearl bluebush chenopod shrubland	Bladder saltbush chenopod shrubland
<b>Notes</b>	Black box woodland with often sparse understorey of grasses or shrubs. Alluvial, heavy brown or grey clays, self-mulching or compact.	Low shrubland to low open shrubland dominated by pearl bluebush and/or black bluebush. Aeolian, deep calcareous sands and loams, red-brown duplex sandy soils with clay subsoil.	Low shrubland to low open shrubland dominated by bladder saltbush and other chenopods. Alluvial, grey, self-mulching and cracking clays to red duplex soils with grey and brown clays, sometimes saline.
<b>Examples</b>	McFarlands State Forest, Quandong State Forest, Goonawarra Nature Reserve, Yanga Nature Reserve	Jim Barron exclusion plot on the Oxley Rd, Jeraly Hill on the Sturt Highway west of Hay, Maude Rd approx. 5 km east of Maude	Corrong Rd, Nullagong Rd, northern part of Craigelea Rd, western part of Thelangerin Rd

Source: Native Vegetation Guide for the Riverina (Kent et al. 2002).

## Lowbidgee (western) profile

Creeklines and Secondary Floodplains – Sandplains and Low Rises – Sandplains, Swales and Dune Crests (image and table correlate from left to right)



<b>Landform</b>	<u>Creeklines and Secondary Floodplains</u>	<u>Sandplains and Low Rises</u>	<u>Sandplains, Swales and Dune Crests</u>
<b>Vegetation</b>	Black box woodland	Belah - rosewood woodland	Mallee woodland
<b>Notes</b>	Black box woodland with often sparse understorey of grasses or shrubs. Alluvial, heavy brown or grey clays, self-mulching or compact.	Low woodland to low open woodland dominated by belah and rosewood, with and open shrubby understorey on sandplains and lunettes. Alluvial or aeolian, red or brown calcareous loams or loamy sands.	Tall shrubland to low woodland dominated by multi-stemmed mallee eucalypts. Aeolian, sandy red loams.
<b>Examples</b>	McFarlands State Forest, Quandong State Forest, Goonawarra Nature Reserve, Yanga Nature Reserve	Formerly a small area east of Kieeta Creek near Balranald, nearest example is on the Sturt Highway west of The Willows	Hatfield Rd approx 10km north of Balranald to Penarie

Source: Native Vegetation Guide for the Riverina (Kent et al. 2002).

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