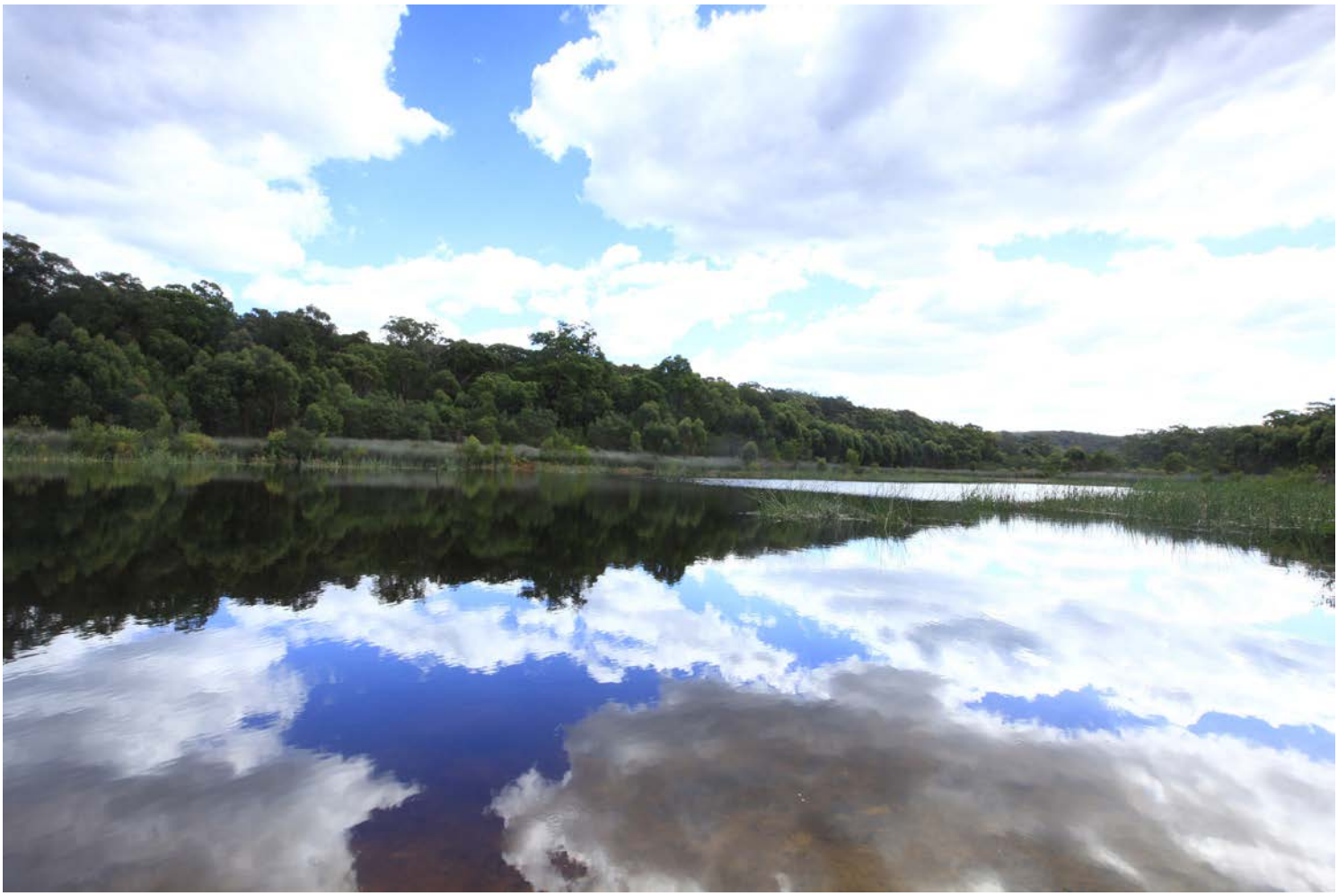
NSW NATIONAL PARKS & WILDLIFE SERVICE

Thirlmere Lakes National Park

Plan of Management



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Cover photo: Lake Couridjah view towards Lake Werri Berri Thirlmere Lakes National Park. Rosie Nicolai/DPIE

This plan of management was adopted by the Minister for Energy and Environment on 22 August 2019.

Thirlmere Lakes National Park is in the traditional country of the Dharawal and Gundungurra people.

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

For additional information or any inquiries about this park or this plan of management, contact the NPWS Nattai Area Office, PO Box 12, Wallacia NSW 2745 or by telephone on (02) 4774 6800.

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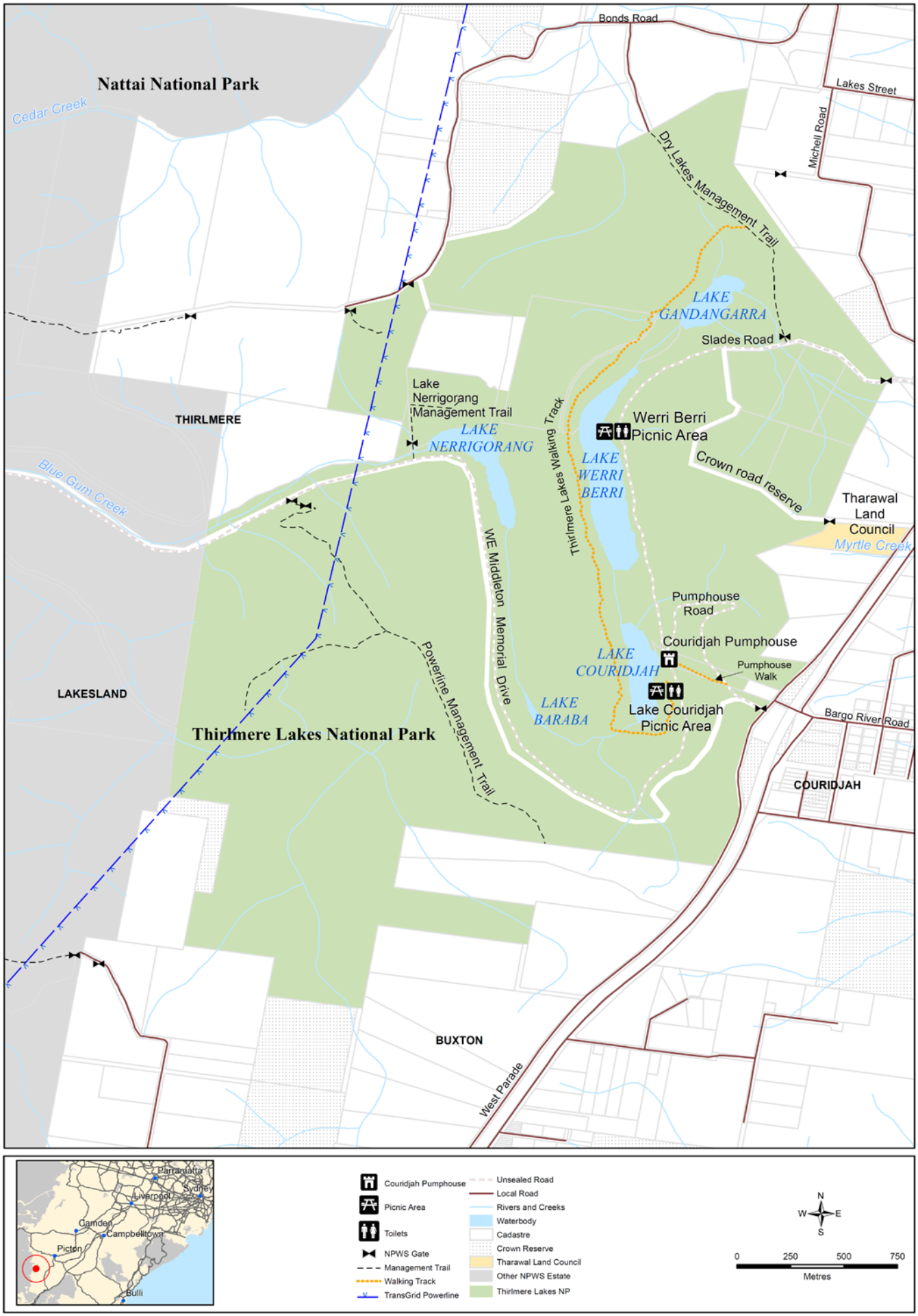

Figure 1 Map of Thirlmere Lakes National Park

1. Introduction

1.1 Location, gazettal and regional setting

Thirlmere Lakes National Park (also referred to in this plan as the park) encompasses 660 hectares and is located in the NSW Southern Highlands, approximately 90 kilometres south–west of Sydney and 10 kilometres from Picton (see Figure 1). The park is adjacent to the villages of Thirlmere, Buxton and Couridjah.

The park was first reserved as a state park in March 1972 under the *National Parks and Wildlife Act 1967* and managed by Wollondilly Shire Council. It was redesignated a national park in 1974 under the *National Parks and Wildlife Act 1974*. Two inholdings, which were private land, were added to the park in 2008. The park is currently jointly managed by the NSW National Parks and Wildlife Service (NPWS) and WaterNSW.

Thirlmere Lakes National Park was established to protect a small system of five perennial freshwater lakes of considerable geomorphological and biological significance – Lake Gandangarra, Lake Werri Berri, Lake Couridjah, Lake Baraba and Lake Nerrigorang. Known collectively as the Thirlmere Lakes, the lakes and the surrounding park support a unique assemblage of terrestrial and aquatic native plants and animals, including a range of threatened species, three endangered ecological communities and one vegetation community found only in the park.

Thirlmere Lakes National Park is within the Sydney Basin Bioregion, and is an important component of a larger system of protected areas that extends and links to the west, north and east.

The park forms part of the Greater Blue Mountains World Heritage Area. It is also designated as part of the Warragamba Special Area under the *Water NSW Act 2014*. The purpose of special areas is to protect the quality of stored waters for drinking purposes and to maintain the ecological integrity of their catchments. Warragamba Special Area has an important function of providing relatively unpolluted water to Lake Burragorang, the main source of drinking water for Sydney.

The park abuts Nattai National Park to the west, with a mixture of semi-rural and rural landholdings and small Crown land blocks to the north, east and south. Excised from the gazetted area of the park are Crown road reserves, most of which align with access to the park.

The park is located within the areas of the Tharawal Local Aboriginal Land Council, the Greater Sydney Local Land Services and Wollondilly Shire Council. The *Hawkesbury–Nepean Catchment Management Action Plan 2013–2023* (HNCMA 2013) describes how land management agencies and communities can work together to achieve productive, biodiverse, resilient landscapes and liveable urban areas.

1.2 Statement of significance

Thirlmere Lakes National Park is significant for its natural and cultural values, including:

Landscape and catchment attributes

The Thirlmere Lakes are part of an entrenched valley that is believed to have been formed by geological uplift. As a result of its geological formation, the Thirlmere Lakes are a unique wetland system that has undergone a low level of sedimentation. Geologically, the system is believed to be approximately 15 million years old.

Thirlmere Lakes National Park is an important component of a large system of protected areas that includes the Blue Mountains and Nattai national parks, and Burragorang, Bargo, Bargo River, Nattai and Yerranderie state conservation areas. The park is part of the Greater Blue Mountains Area World Heritage property and an element of the Bargo linkage, a critical connection between the World Heritage property and the Upper Nepean State Conservation Area and Metropolitan Special Area to the east (DECC 2007b). The park is part of the Warragamba Special Area (under the Water NSW Act), which contributes to the protection of the quality of drinking water entering Lake Burragorang, the main water storage for greater metropolitan Sydney. The park is on the edge of the Cumberland Plain and part of the Cumberland Koala Linkage (see Section 3.6).

Biological significance

Thirlmere Lakes National Park is within the Sydney Basin Bioregion. As part of the larger protected area network of the region it provides a link for movement of native animals to the Blue Mountains and other protected areas to the north and east.

The park protects a range of threatened species and communities including three endangered ecological communities (*Lepironia* Freshwater Wetland, Oakdale Alluvial Rough Bark Apple Forest, and the critically endangered Shale/Sandstone Transition Forest), three threatened plant species, 10 threatened animal species and a number of waterbird species, including several listed under international migratory bird agreements. The Thirlmere Sand Swamp Woodland vegetation community is found only in this park and the freshwater sponge *Radiospongilla sceptroides*, which occurs in the lakes, is thought to be confined to the Warragamba catchment.

This site is listed in the Directory of Important Wetlands in Australia (DOE 2013) and is considered likely to meet the criteria for designation as an internationally significant wetland under the Ramsar Convention on Wetlands of International Significance (UNESCO 1971) (Riley et. al 2012).

Aboriginal connections to Country

Thirlmere Lakes National Park forms part of Country for Aboriginal people and provides opportunities for the maintenance and renewal of cultural practice and connections to Country.

There is much evidence of this connection to Country within the park, including art sites, artefact scatters and shelters. Stories and mythology, cultural resources and the landscape itself provide strong cultural links to the park for the Aboriginal community.

Historic heritage

Development of the Great Southern Railway in the 1860s led to the establishment of pumping stations to take water from the lakes. The Couridjah Pumphouse and its associated structures are linked to the railway heritage of the area. The building originally housed a pump that was used to transfer water from Lake Couridjah for steam trains moving along the southern loop line. It is thought to be the only building of its type still in existence (NPWS 1998).

Recreation and tourism

The Thirlmere Lakes have been recognised for their scenic and recreational value since at least 1867, when the opening of the Great Southern Railway line helped popularise picnic areas beside the lakes. The park provides opportunities for recreational pursuits, including swimming, canoeing, kayaking, bushwalking, cycling and horse riding. The park is important for the local community and visitors from outside the area.

World Heritage

The park is part of the Greater Blue Mountains Area World Heritage property. The property was inscribed on the World Heritage List for its representation of the evolutionary adaptation and diversification of the eucalypts in post-Gondwana isolation on the Australian continent.

2. Management context

2.1 Legislative and policy framework

National parks in New South Wales are managed within a legislative and policy framework, primarily the National Parks and Wildlife Act and Regulation, the *Biodiversity Conservation Act 2016* and the policies of the NSW National Parks and Wildlife Service (NPWS).

Other legislation, strategies and international agreements may also apply to management of the area. In particular, the NSW *Environmental Planning and Assessment Act 1979* may require assessment of the environmental impact of works proposed in this plan. The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* may apply in relation to actions that affect matters of national environmental significance, such as World Heritage values and 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 park plan of management, 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 also applies to any future additions to the park. 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 the National Parks and Wildlife Act (section 30E), 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 a 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 reuse) 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 that does not damage conservation values.

Sydney Catchment Special Areas

The park is classed as Schedule 2 land within the Warragamba Special Area under the Water NSW Act (Schedule 1 and Schedule 2 are defined in the Sydney Water Catchment Management Regulation 2013). Under the Act, special areas are identified to protect the quality of stored waters for drinking purposes and to maintain the ecological integrity of their

catchments. The Warragamba Special Area protects the quality of the drinking water supply of Lake Burragorang, the main source of drinking water for Greater Sydney by acting as a buffer to help stop the flow of nutrients and other substances that could affect water quality. Human activity is restricted within the special area.

The *State Environmental Planning Policy (Sydney Drinking Water Catchment) 2011* applies to the park, and requires public authorities to consider whether a proposed activity would have a neutral or beneficial effect on water quality before conducting any activity to which part 5 of the Environmental Planning and Assessment Act applies.

WaterNSW and NPWS have signed a joint management agreement and prepared a *Special Areas Strategic Plan of Management* (WaterNSW & OEH 2015). The agreement and the *Special Areas Strategic Plan of Management* set out the responsibilities of WaterNSW and NPWS for the integrated management of the Warragamba Special Area. NPWS is responsible for the management of lands reserved under the National Parks and Wildlife Act while WaterNSW is responsible for the maintenance and protection of water quality.

World Heritage

Thirlmere Lakes National Park is part of the listed Greater Blue Mountains Area World Heritage property. This area is of international significance on the basis of its outstanding natural values (see Section 3.1 of this plan).

The management principles and responsibilities for World Heritage properties are described in the Australian World Heritage Intergovernmental Agreement. These include management of World Heritage properties in accordance with the World and National Heritage provisions of the Environment Protection and Biodiversity Conservation Act and in accordance with Australia's obligations under the World Heritage Convention to identify, protect, conserve, present and transmit to future generations Australia's cultural and natural heritage of outstanding universal value. Management arrangements must also ensure that the integrity and authenticity of World Heritage properties are maintained, and provide for identifying communities and stakeholders and how they will participate in property management and decision-making.

The *Greater Blue Mountains World Heritage Area Strategic Plan* (DECC 2009) was considered in the preparation of this plan of management.

National Heritage

The Greater Blue Mountains Area World Heritage property, which includes Thirlmere Lakes National Park, was one of 15 World Heritage sites included in the National Heritage List on 21 May 2007.

Management principles for National Heritage places are established under regulations to the Environment Protection and Biodiversity Conservation Act. These principles state that the primary objectives for the management of National Heritage places are to identify, protect, conserve, present and transmit National Heritage values to future generations (see Section 3.2).

2.3 Specific management directions

In addition to the general principles for the management of national parks (see Section 2.2), the following specific management directions apply to the management of the park:

- promoting the values of the park, in particular, its outstanding universal values, to visitors, neighbours and other stakeholders

- providing low-key visitor facilities for recreational activities such as swimming, canoeing, picnicking, cycling, horse riding and walking
- managing the Thirlmere Lakes in an unpolluted state, consistent with its status as a wetland listed in the Directory of Important Wetlands in Australia
- protecting Aboriginal heritage values and facilitating local Aboriginal community involvement in the management of the park
- protecting the railway heritage values in the park
- encouraging research and monitoring of the biology of the park and the hydrology of the Thirlmere Lakes that will contribute to the management of the park's values
- ensuring the maintenance of the quality of drinking water entering Lake Burragorang through management of the catchment.

3. Values

This plan aims to conserve both the natural and the cultural values of the park. 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 document 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 World Heritage

Thirlmere Lakes National Park is part of the Greater Blue Mountains Area World Heritage property. The Greater Blue Mountains Area was formally nominated by the Australian Government for inscription on the World Heritage List in June 1998. In November 2000, the nominated area of more than 1 million hectares was inscribed on the World Heritage List, under two of the criteria for natural values of outstanding universal significance (UNESCO 2017):

- outstanding and representative examples in a relatively small area of the evolution and adaptation of the genus *Eucalyptus* and eucalypt-dominated vegetation on the Australian continent (criterion ix)
- significant natural habitats for the in situ conservation of biological diversity, including the eucalypts and eucalypt-dominated communities, taxa with Gondwanan affinities, and taxa of conservation significance (criterion x).

A wide range of plant and animal lineages and communities with ancient origins in Gondwana survive within the Greater Blue Mountains Area, many of which are wholly or largely restricted to the property. The Greater Blue Mountains Area also provides the principal habitat for many threatened species of plants and animals. The eucalypt forests of the Greater Blue Mountains Area are the most diverse and intact scleromorphic communities of the Earth's temperate zones.

The *Greater Blue Mountains World Heritage Area Strategic Plan* (DECC 2009) has been prepared to assist in meeting Australia's international responsibilities under the World Heritage Convention. The strategic plan provides the broad management principles for the area, and establishes the framework for the integrated management, protection, interpretation and monitoring of the values of the eight reserves that comprise the Greater Blue Mountains Area. The strategic plan does not provide detailed management prescriptions for the individual reserves within the World Heritage property; these are contained within plans of management for the individual reserves.

This plan of management addresses World Heritage objectives, meets the requirements of Australian World Heritage management principles and the *Greater Blue Mountains World Heritage Area Strategic Plan*, and contains provisions for evaluating and monitoring the effectiveness of management. The main monitoring program undertaken for the park is State of the Parks reporting, which has been undertaken for Thirlmere Lakes since 2004 (OEH 2017). This reporting provides quantitative information on all of the park's values, any threats to those values and changes to the condition of values. This reporting tool satisfies some of the requirements for monitoring changes in the outstanding universal values of the park.

A monitoring program to detect changes in groundwater levels in the park began in 2011 (Russell 2012). This program was extended in 2013 to include near real-time information on the water levels in each of the five lakes, plus information on local rainfall (see Section 3.4).

This monitoring program aims to provide data on threats to groundwater and surface water and to detect changes that could affect the outstanding universal values of the park.

Issues

The report of the Thirlmere Lakes Inquiry (Riley et al. 2012) noted that scientific research and hypothesis-based monitoring of the condition of biological processes and biodiversity were at the time inadequate to detect changes to the values of the park, specifically changes to the hydrology of the Thirlmere Lakes and any possible effect this may have on the park's outstanding universal values, such as its biodiversity and the threatened species that occur in the park. New monitoring systems such as those for groundwater, local rainfall and water levels in the Thirlmere Lakes, will provide data relevant to detecting changes in these values over the long-term.

Desired outcomes

- The outstanding universal values of the park are identified, protected, conserved, presented and, where necessary, rehabilitated in accordance with the principles of the World Heritage Convention.
- Address any changes in or threats to the park's outstanding universal values.

Management response

3.1.1 Protect, conserve and interpret the outstanding universal values of the park, in accordance with the principles of the World Heritage Convention.

3.1.2 Facilitate the ongoing development and implementation of research and monitoring programs to detect any changes in the outstanding universal values of the park.

3.2 National Heritage

The Greater Blue Mountains Area was placed on the National Heritage list in 2007 for the outstanding universal values for which it was inscribed on the World Heritage List. Additional values of national significance may be identified for the property. After further research and documentation, some of these may qualify for inclusion in the National Heritage listing.

Desired outcome

- Identify, protect and, where appropriate, interpret National Heritage values.

Management response

3.2.1 Appropriately manage and interpret the National Heritage values of the park.

3.3 Wetlands

The Thirlmere Lakes are listed in the Directory of Important Wetlands in Australia. The directory identifies nationally important wetlands, based on criteria developed by the Australian and New Zealand Environment and Conservation Council Wetlands Network in 1994 (DOE 2013). The Thirlmere Lakes are included in the directory because they:

- are a good example of a wetland type with outstanding historical and cultural significance
- provide an important ecological and hydrological role
- provide habitat for rare plants and animals.

In particular, the Thirlmere Lakes are unique due to their geomorphic formation and are believed to have been stable for approximately 15 million years.

Listing in the Directory of Important Wetlands in Australia means the Thirlmere Lakes are already subject to the 'wise use' provision within the Ramsar Convention on Wetlands of International Significance (UNESCO 1971) (also known as the Ramsar Convention), although not with the same reporting requirements as those associated with a formally listed Ramsar site (Riley et al. 2012). Wise use under the convention is broadly defined as maintaining the ecological character of a wetland. In addition, management of wetlands in New South Wales is guided by the *NSW Wetlands Policy* (DECCW 2010b). This policy sets out the priorities and guiding principles for the management of all wetlands in New South Wales.

Issues

The final report of the Thirlmere Lakes Inquiry (Riley et al. 2012) noted that the Thirlmere Lakes are a significant wetland, and meet the criteria for listing as a wetland of international significance under the Ramsar Convention. In designating a wetland as a Ramsar site, countries agree to establish and oversee a management framework aimed at conserving the wetland and ensuring its wise use.

Desired outcomes

- The significance of the wetland values of the Thirlmere Lakes are assessed.
- The Thirlmere Lakes are managed in accordance with their assessed level of significance.

Management response

3.3.1 Undertake an ecological character description for the Thirlmere Lakes.

3.3.2 Subject to completion of an ecological character description and expert advice, work with the Australian Government in seeking to nominate the Thirlmere Lakes for listing as a Ramsar site.

3.4 Landscape, geology and hydrology

The Thirlmere Lakes are within an entrenched valley meander of a formerly well-developed watercourse. The lakes are thought to have originated through disruption to the drainage pattern of the watercourse when the surrounding countryside was lowered by tectonic down-warping, thus elevating the meander relative to the surrounding land. A small lake system then developed in the elevated basin-like landscape of the entrenched meander. The tectonic down-warping was probably associated with the formation of the Lapstone Monocline, which is a region-scale deformation structure that extends into the district around the park. It has been suggested that the Lapstone Monocline, and thus the lakes themselves, may be at least 15 million years old (Bishop et al. 1982).

The Thirlmere Lakes catchment area consists of rugged sandstone slopes and ridges with associated minor cliff lines, colluvial slopes and alluvial fans (NPWS 1997). Sandy soils are found on the debris slopes and fan surfaces whereas residual soils are found on the sandstone ridge tops. The underlying geology is primarily Hawkesbury Sandstone, although areas of Wianamatta Group shale are also mapped close to the Thirlmere Lakes (NPWS 1997).

The geomorphology of the lake system is fairly stable. The limited area of the catchment of the Thirlmere Lakes and the nature of the surrounding geology have probably been important factors in the low rate of siltation, in contrast to what appears to have occurred in similar geomorphological settings elsewhere in the region. Only a small percentage of lakes ever reach this age as they are usually infilled with sediments (NPWS 1997).

Water reaches the Thirlmere Lakes via two catchments. The first is the surface catchment that supplies the lakes with overland flows of water after rainfall. The second is a groundwater catchment, which has a complex interaction with surface flows and may draw upon water from beyond the surface catchment.

There are five lakes in the system. Lake Gandangarra is the furthest upstream, and drains into Lake Werri Berri, which then drains into Lake Couridjah (see Figure 1). There is a drainage line between Lake Couridjah and Lake Baraba and a very shallow and indistinct channel between Lake Baraba and Lake Nerrigorang.

Blue Gum Creek drains westward from the lakes to the Little River catchment within Nattai National Park. Water from the lakes only flows into this system occasionally, at times when the lakes are full to overflowing. The natural outlet at Blue Gum Creek limits the maximum depth of the Thirlmere Lakes.

In 1974 and 1998 the natural outlet was open and flowing, and water levels in the lakes were the highest since 1874 (Pells and Pells 2011). It appears that between these peak periods Thirlmere Lakes is probably a closed basin system with the exception of groundwater moving along hydraulic (water) flow pathways. The balance between the level of the lakes, groundwater and rainfall patterns is complex. Although our understanding of the system has improved in recent years (Pells & Pells 2011; Riley et al. 2012; Russell et al. 2010), there are still many gaps in knowledge of the surface water and groundwater hydrology of the lake system.

Historically, there are three recorded instances where water levels in the lake have been low or the lakes dry. The most recent occurrences were in 2011 and 2012. In response to significant community concerns about the drying of the lakes, the NSW Government initiated a scientific investigation in October 2011 – the Thirlmere Lakes Inquiry. The inquiry investigated possible causes for the low water levels in the lakes, including natural causes, longwall mining and other land use changes, such as groundwater extraction for domestic and agricultural use (Riley et al. 2012). The inquiry committee comprised four independent scientists and a community representative.

The committee released its final report in October 2012 (Riley et. al. 2012). A major finding was that the water levels of the lakes have fluctuated, between substantially dry and full, over time. As such, the low levels recorded most recently were not unprecedented. Most of the changes in water levels in the lakes in the past 30 years are considered to be the result of changes in rainfall, although the inquiry acknowledges that other factors may be implicated in the current low water levels.

The inquiry found that groundwater moved within the Hawkesbury Sandstone aquifers from the Thirlmere Lakes to the west via the Blue Gum Creek catchment and to the east and north–east via the Bargo–Nepean River catchment. It is not possible to determine the relative groundwater flows from the lakes towards the east and west. The inquiry found evidence of changes in the groundwater levels in the region east of the lakes in the past 30 years that coincide with mining, and this has potentially increased the rate of groundwater flow towards the east. However, it is not possible to disentangle the changes potentially owing to mining from other factors, such as extraction from bores and variations in rainfall recharge.

As a meeting point and a water source for Aboriginal people, the Thirlmere Lakes have also been identified as a culturally significant groundwater-dependent ecosystem (Moggridge 2010) (see Section 3.5).

Issues

Given the uniqueness of the Thirlmere Lakes as a geological system that has not been infilled with sediment, it is important that erosion within the catchment is minimised. In particular, management operations, such as maintenance of visitor facilities and roadwork, need to be undertaken in a way that does not lead to sedimentation within the Thirlmere Lakes.

The final report of the Thirlmere Lakes Inquiry (Riley et al. 2012) found that much about the lakes and their geomorphology and hydrology remains unknown, and without this knowledge the causes of decreasing water levels in Thirlmere Lakes are not known. The inquiry also identified human activities as a potential impact on the hydrology of Thirlmere Lakes.

The committee identified a number of priority research and monitoring actions. The main recommendations from the inquiry included further research into the geomorphology of the area and monitoring of groundwater, surface water interactions, rainfall and other climatic parameters. Such research is required to determine whether human activities such as mining and water extraction are having a detrimental effect on the Thirlmere Lakes. A monitoring program to detect changes in groundwater levels in the park began in 2011 (Russell 2012) and a new monitoring network was established in 2013 to provide near real-time information on the water levels in each of the five lakes, as well as local rainfall (OEH 2016). The committee also found that the 1997 *Thirlmere Lakes National Park Plan of Management* required review.

Future research will be informed by existing and current studies and the findings and recommendations of the inquiry. The research program to improve understanding of the geomorphology and hydrological processes of the lake system may recommend boreholes or investigative drilling to occur within the park, and NPWS supports the implementation of an appropriate sampling program.

The Chief Scientist and Engineer's review of the report of the Thirlmere Lakes Inquiry (Chief Scientist and Engineer 2013) noted that a better understanding of the hydrology and groundwater system of the Thirlmere Lakes is needed before any remediation options can be considered. Long-term monitoring data must be collected to enable identification of trends and patterns and will not immediately be available to support remediation actions, should they be required. Further, the Southern Coalfields report (Department of Planning 2008) notes that remediation techniques are often not feasible or successful over large spatial scales and no successful technique has been identified for swamps or wetlands. If human activities are found to be having a detrimental effect on the Thirlmere Lakes, any proposed remediation actions will need to be properly evaluated to ensure such actions will have a high likelihood of success and that the benefits outweigh any potential detrimental environmental impact.

The Thirlmere Lakes are a dynamic system. Changes in water levels will continue to provide challenges for the protection of natural and cultural values and the management of recreational use.

Desired outcomes

- Soil and erosion controls are implemented for all earthworks undertaken in the park.
- Any human-induced effects on the hydrology of the Thirlmere Lakes are adequately identified by scientific research and monitoring.
- Where human-induced changes to the hydrology of the Thirlmere Lakes are identified, remediation options are evaluated before implementation.

Management response

3.4.1 The Department of Planning, Industry and Environment will establish and lead a committee of government scientists to develop a research program to investigate causes of the changes in lake levels, based on scientific data and recommendations of the report of the Thirlmere Lakes Inquiry (Riley et al. 2012).

3.4.2 Encourage research that improves understanding of the hydrology of the Thirlmere Lakes.

3.4.3 Where human impacts on the hydrology of the Thirlmere Lakes are identified through research and monitoring, explore and evaluate any remedial action that may be applicable within the park.

3.4.4 Work with consent and determining authorities to mitigate any impacts of developments with the potential to affect park values.

3.4.5 Monitor all areas of soil disturbance for accelerated erosion and impacts on natural or cultural values.

3.4.6 Regularly maintain management and walking trails to maintain access and minimise erosion.

3.4.7 Support relevant organisations and groups to assess and monitor the health of the Thirlmere Lakes catchment and Blue Gum Creek.

3.5 Native plants

The park supports a diverse range of vegetation communities, which can be divided into three major groups based on the environments in which they occur – the lentic environment (standing water), lake margins and colluvial (loose unconsolidated sediment) flats, and the ridges and slopes.

The lentic environment supports aquatic and wetland species, such as the grey rush (*Lepironia articulata*). The lake margins and colluvial/alluvial flats support a diverse array of littoral and riparian forests and woodlands dominated by species such as flax-leafed paperbark (*Melaleuca linariifolia*) and river peppermint (*Eucalyptus elata*). The ridges and slopes support woodland communities. Within each of these environments, a number of vegetation communities have been classified (NPWS 2003) (see Table 1).

The vegetation communities within the park are largely intact. Disturbance and clearing has occurred on a small number of sites that were previously private land. These areas are regenerating naturally.

Three endangered ecological communities (EEC) occur in the park (see Table 1). Approximately 40 hectares of Shale Sandstone Transition Forest occur in the ridge areas of the park. This community occurs on the edge of the Cumberland Plain in areas with a shale influence. Approximately eight hectares of Oakdale Alluvial Rough Bark Apple Forest (a component of the River-Flat Eucalypt Forest on Coastal Floodplains EEC) occur in the park, along lake margins and in the channels between lakes. There are also approximately 30 hectares of *Lepironia* Freshwater Wetlands (a component of the Freshwater Wetlands on coastal floodplains EEC) in the park. This community occurs in areas of periodic or continuous inundation with water. Across their range all three communities have been subject to extensive disturbance, clearing and invasion by weeds. Only a small proportion of the overall extent of these communities is protected in the reserve system (NPWS 2003).

Table 1 Vegetation communities

Vegetation community	Location, description and area (hectares)[#]	Conservation significance[^]
Exposed Burragorang Sandstone Shrub Woodland	Extensively distributed on ridge tops; a low open forest or woodland dominated by Sydney peppermint (*Eucalyptus piperita)* and red bloodwood (*Corymbia gummifera*) with narrow-leaved stringybark (*Eucalyptus sparsifolia*) and white stringybark (*E. globoidea*); a fairly dense sandstone shrub and heath layer; area 306 ha	
Lepironia Freshwater Wetland	Occurs in shallow waters on the fringes of Thirlmere Lakes; in deeper waters, includes grey rush (*Lepironia articulata*) and watershield (*Brasenia schreberi*); along shorelines and in shallow waters, community includes sedgelands; area 30 ha	EEC (BC Act)
Nattai Sandstone Dry Shrub Forest	Dry open forest on broad Hawkesbury Sandstone ridges and exposed upper slopes; the canopy is moderately tall, with a diverse mix of understorey shrubs; area 191 ha	
Oakdale Alluvial Rough Bark Apple Forest	Found on undulating country in association with drainage depressions near the interface of Wianamatta Group shales and sandstones of the Mittagong Formation; the community is a component of River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions vegetation community, which is listed as an Endangered Ecological Community; area 8 ha	EEC (BC Act)
Shale Sandstone Transition Forest	Occurs at the edges of the Cumberland Plain, within 400 m of the shale/sandstone boundary; this community is dominated by a range of eucalypt species, with a small tree stratum and shrub layer; area 39 ha	CEEC (BC Act) CE (EPBC Act)
Sheltered Sandstone Intermediate Blue Gum Forest	Extensively distributed across the northern and eastern areas of the Warragamba Special Area on sheltered slopes and gullies associated with sandstone plateaus; tall eucalypt species mountain blue gum (*Eucalyptus Deanei*) and smooth-barked apple (*Angophora costata*), with an understorey of ferns and low shrubs; area 1.3 ha	
Thirlmere Sand Swamp Woodland	Low woodland occupying sandy drainage flats adjoining the eastern side of Thirlmere Lakes; low Parramatta red gum (*Eucalyptus parramattensis* subsp. *Parramattensis*) forms an open canopy, with flax-leafed paperbark (*Melaleuca linariifolia*) present; area 9 ha	Unique to Thirlmere Lakes National Park

Adapted from NPWS (2003).

[#] Area is the area of the community mapped within the park.

[^] EEC = Endangered Ecological Community; CEEC = Critically Endangered Ecological Community; CE = Critically Endangered

A number of species listed as threatened have been recorded in the park (see Table 2) and other threatened species are considered likely to occur, for example, hairy geebung (*Persoonia hirsuta*), Bargo geebung (*Persoonia bargoensis*) and small-flower grevillea (*Grevillea parviflora*), as they have been recorded in the vicinity and suitable habitat exists in the park. The Mittagong geebung (*Persoonia glaucescens*) has been recorded in the park, but not since 1995. This record was the northern extent of the range of the species. Other threatened plants occurring within the park are associated with lake margins, and their

populations increase and decrease with changes in water levels and the area of available habitat. The population of dwarf kerrawang (*Commersonia prostrata*) in the park is considered significant because it is the largest known population of this species.

Table 2 Threatened and significant plant species recorded in the park

Common name	Scientific name	BC Act status[#], SoS management stream*	EPBC Act[#] status
Dwarf kerrawang	*Commersonia prostrata*	Endangered, Site-managed	Endangered
Mittagong geebung	*Persoonia glaucescens*	Endangered, Site-managed	Vulnerable
Tall knotweed	*Persicaria elatior*	Vulnerable, Site-managed	Vulnerable
Watershield	*Brasenia schreberi*	Not listed – Rare^	Not listed

Source: OEH (2013a).
[#] BC Act = NSW *Biodiversity Conservation Act 2016*; EPBC Act = Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.
SoS is the NSW Government's Saving our Species program, part of the *Biodiversity Conservation Program* (OEH 2013a).
^ Rare in NSW under criteria of Briggs and Leigh (1996).

Issues

Strategies for the recovery of threatened species, populations and ecological communities have been set out in a statewide *Biodiversity Conservation Program* (formerly known as the *Threatened Species Priorities Action Statement* [DECC 2007a]). These strategies 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 2013a). The *Saving our Species* program divides species into one of six management streams based on their distribution, ecology, security and what is known about them. All three threatened plant species found in the park are site-managed species. Conservation projects have been identified across the state for site-managed species and, within these projects, key management sites identified for each species. The park contains key management sites for the Mittagong geebung and the dwarf kerrawang. The *Biodiversity Conservation Program* identifies the conservation management actions that need to be undertaken at the key management sites to ensure the populations of these species are sustained. The relevant actions have been incorporated into the management responses in this plan of management.

Two of the three endangered ecological communities within the park (Shale/Sandstone Transition Forest and Oakdale Alluvial Rough Bark Apple Forest) are threatened by impacts from fragmentation resulting from further clearing for urban or rural development. *Lepironia* Freshwater Wetlands are threatened by clearing and also changes to water regimes. Protection of these vegetation communities, and connecting remnants of them, is particularly important for the maintenance of biodiversity in the park and adjacent areas. Accordingly the endangered ecological communities within the park should be assessed for site-based threats and threat abatement measures implemented as necessary.

Shale/Sandstone Transition Forest is also threatened by the likely loss of species composition if subjected to repeated high-frequency fires (NSW Scientific Committee 2000). The *Thirlmere Lakes National Park and Nattai Reserves System Fire Management Strategy* (DEC 2006b) prescribes fire thresholds and operational guidelines to protect biodiversity in

Shale/Sandstone Transition Forest (and the other vegetation communities of the park). The park has been subject to fires that are more frequent than prescribed for the maintenance of biodiversity (see Section 4.2).

Vegetation in the lake beds and surrounds has changed in response to changing water levels. There is evidence of this response occurring previously (e.g. photographs from 1958–59 show the lakes with standing dead trees) and these changes in vegetation reflect the cyclical nature of wetland environments.

Lepironia Freshwater Wetlands, Thirlmere Sand Swamp Woodland and a number of rare and threatened plant species (dwarf kerrawang [Commersonia prostrata], tall knotweed [*Persicaria elatior*] and water shield [*Brasenia schreberi*]) are vulnerable to changes in water levels in the Thirlmere Lakes because this will change the distribution and quality of available habitat, particularly for lake-margin species. There is insufficient information to determine the impact of changes in water levels on these communities and species (Riley et al. 2012). Their distribution and abundance in the park should be monitored with changes in water levels. Greater research and monitoring to examine the impact of changes in water levels on wetland plant species and communities is needed to establish the limits of acceptable change in populations.

The Mittagong geebung preferentially grows in woodland to dry sclerophyll forest on ridges, plateaus and upper slopes. Like most plants in the genus *Persoonia*, this species seems to benefit from reduced competition and increased availability of light and is therefore more often found in disturbance margins, including roadsides. Within the park, populations are at risk from maintenance of trails, weed invasion and illegal activity, such as movement off trails. Plants are killed by fire and recruitment is solely from seed so the species is particularly sensitive to high-frequency fire. Although this species was recorded in the park in 1965, it is likely that the population has become locally extinct as a result of over-burning. Targeted surveys for this species are required.

Desired outcomes

- Populations of threatened and significant plants and ecological communities are conserved.
- Negative impacts on threatened species are minimised.
- The habitat and populations of all threatened plant species are protected and maintained.
- Structural diversity and habitat values are restored in degraded areas.

Management response

3.5.1 Implement relevant strategies in the *Biodiversity Conservation Program* for threatened species, populations and ecological communities present in the park.

3.5.2 Undertake targeted surveys and monitoring of rare and threatened species – in particular, surveys to determine the presence of Mittagong geebung and monitoring of threatened plant species such as dwarf kerrawang in response to changing water levels.

3.5.3 Encourage natural regeneration of areas subject to past disturbance.

3.5.4 Monitor the impact of changes in water levels in the Thirlmere Lakes on rare and threatened plants and *Lepironia* Freshwater Wetlands.

3.6 Native animals

The park contains habitat for a range of native animal species: 97 bird species, 14 reptile, 11 frog and 11 mammal species have been recorded in the park (OEH 2013b). Of these, 13 species are listed as threatened (see Table 3). The high diversity of species recorded in the park reflects the diversity of habitat types including forests, woodland and wetlands (see Section 3.4).

Table 3 Threatened and significant animal species recorded in the park

Common name	Scientific name	BC Act status# SoS management stream	EPBC Act status#
Frogs			
Red-crowned toadlet	*Pseudophryne australis*	Vulnerable, Landscape	
Birds			
Australasian bittern	*Botaurus poiciloptilus*	Endangered, Landscape	Endangered
Brown treecreeper (eastern subspecies)	*Climacteris picumnus victoriae*	Vulnerable, Landscape	
Gang-gang cockatoo	*Callocephalon fimbriatum*	Vulnerable, Landscape	
Glossy black-cockatoo	*Calyptorhynchus lathami*	Vulnerable Landscape	
Latham's snipe	*Gallinago hardwickii*		Marine CAMBA, JAMBA, ROKAMBA*
Little lorikeet	*Glossopsitta pusilla*	Vulnerable, Landscape	
Sooty owl	*Tyto tenebricosa*	Vulnerable, Landscape	
Varied sittella	*Daphoenositta chrysoptera*	Vulnerable, landscape	
White-bellied sea-eagle	*Haliaeetus leucogaster*	Vulnerable,	Marine
Mammals			
Eastern freetail-bat	*Mormopterus norfolkensis*	Vulnerable, Landscape	
Greater broad-nosed bat	*Scoteanax rueppellii*	Vulnerable, Landscape	
Koala	*Phascolarctos cinereus*	Vulnerable, Iconic	Vulnerable

[#] BC Act = NSW *Biodiversity Conservation Act 2016*; EPBC Act = Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.

* Migratory species listed under the international conventions and agreements to which Australia is party are protected under the Environment Protection and Biodiversity Conservation Act. CAMBA = China–Australia Migratory Bird Agreement, JAMBA = Japan –Australia Migratory Bird Agreement; ROKAMBA = Republic of Korea Australia Migratory Bird Agreement.

Thirlmere Lakes National Park is an important component of a large system of protected areas, part of the Greater Blue Mountains Area World Heritage property and an element of the Bargo linkage, which connects the Greater Blue Mountains Area World Heritage property to protected areas to the east (DECC 2007b; see Section 1.2). This linkage is critical for the movement of sandstone-reliant native animals between these two large protected areas. The park is also part of the Cumberland Koala Linkage, which allows movement of koalas (*Phascolarctos cinereus*) between populations in the Nattai National Park with others in the lower Blue Mountains and Wedderburn areas.

The wetland environments of the Thirlmere Lakes provide habitat for waterbirds and other aquatic animals. Species of significance include the Australasian bittern (*Botaurus poiciloptilus*), which is considered to be rare in the greater southern Sydney region (DECC 2007b); white-bellied sea-eagle (*Haliaeetus leucogaster*) and Latham's snipe (*Gallinago hardwickii*), a migratory wader species that forages in areas of shallow water and mudflats (Todd 2000). The freshwater sponge *Radiospongilla sceptroides* has been found in the Thirlmere Lakes. This species is found in a number of locations along eastern Australia and also in one location in New Zealand (Racek 1969). The biology of this species is poorly understood. However, it is of significance because it is believed that its reproductive biology does not include gemmulation (sexual reproduction) (NPWS 1997). The lack of gemmulation is thought to reflect the lack of changes to environmental conditions within the Thirlmere Lakes associated with an evolving lake system. The vulnerable red-crowned toadlet (*Pseudophryne australis*), whose distribution is restricted to the Sydney Basin, has been recorded in ephemeral creeks in the park.

Woodlands and forests provide habitat for a range of other native animals, including woodland birds that are known to have declined elsewhere in their range, such as the little lorikeet (*Glossopsitta pusilla*), the eastern subspecies of brown treecreeper (*Climacteris picumnus victoriae*), varied sitella (*Daphoenositta chrysoptera*) and the rockwarbler (*Origma solitaria*), which is a species of concern due to range-wide declines (DECC 2007b). Forest and woodland habitat in the park provide habitat for a number of bat species, including the eastern freetail-bat (*Mormopterus norfolkensis*) and the greater broad-nosed bat (*Scoteanax rueppellii*), both of which are considered vulnerable.

Koalas have been recorded in the park. Although there are no core populations of koala, the park is part of an important linkage between koala populations in Nattai National Park and the Wedderburn Area, known as the Cumberland Koala Linkage (DECC 2007b).

Issues

Strategies for the recovery of threatened species, populations and ecological communities have been set out in a statewide *Biodiversity Conservation Program* (formerly known as the *Threatened Species Priorities Action Statement* [DECC 2007a]). These strategies 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 2013a).

The *Saving our Species* program places species into one of six management streams based on their distribution, ecology, security and what is known about them. Ten threatened animal species found in the park are landscape-managed species and one is an iconic species (see Table 3). Landscape-managed species are conserved by managing threats that occur across the landscape and that affect multiple species, such as land clearing and habitat degradation and fragmentation. The koala is listed as an iconic species. The koala will be managed in accordance with the recovery plan for the species (DECC 2008).

Illegal collection of bush rock (commonly for use in landscaping) has been known to occur in the park. Bush rock (loose rocks on rock surfaces or on the soil surface) serves many purposes in the natural environment. It provides habitat for many plants and animals, with animals using rocks and rock environments for shelter, to hide from predators, find food, avoid extreme weather conditions and escape bushfires. Bush rock is also known to provide egg-laying sites for reptiles. Removal of bush rock is listed as a key threatening process under the Biodiversity Conservation Act (NSW Scientific Committee 1999) and is a threat to a number of native animals occurring, or potentially occurring, in the park, including the threatened red-crowned toadlet. Prohibiting public vehicle access to management trails (see Section 5.1) and protecting habitat during trail management will assist in maintaining potential habitat for animals that utilise bush rock.

Many native animals rely on tree hollows for shelter and nesting. Deadwood and dead trees also provide essential habitat for a variety of native animals and are important to the functioning of many ecosystems. The removal of dead trees can result in loss of habitat (as they often contain hollows used for shelter by animals), disruption of ecosystem process and soil erosion. Loss of hollow-bearing trees and removal of deadwood and dead trees have been listed as key threatening processes under the Biodiversity Conservation Act (NSW Scientific Committee 2003, 2007). These processes pose a threat to a range of hollow-dependent or log-dependent native animals occurring or potentially occurring in the park, including the sooty owl (*Tyto tenebricosa*), gang-gang cockatoo (*Callocephalon fimbriatum*), little lorikeet brown treecreeper (eastern subspecies), eastern freetail-bat and greater broad-nosed bat.

A review of priorities for biodiversity survey across NPWS reserves in the Sydney Basin Bioregion ranked the fauna survey effort of Thirlmere Lakes National Park as poor and recommended comprehensive systematic fauna surveys be conducted (DECCW 2010a).

Variations in water levels of the Thirlmere Lakes change the quality and availability of habitat for a number of wetland animal species. There is insufficient information to determine the impact of these changes in water levels on wetland animal species (Riley et al. 2012). It is thought that species such as the Australasian bittern and other waterbird species benefit from high water levels, and species such as the freshwater sponge *Radiospongilla sceptroides* may be adversely affected by drying of the lakes. The Latham's snipe forages on mudflats and shallow waters, so it is expected that this species would benefit during times when the water levels in the lakes are low. Research and monitoring of the impact of changes in water levels on wetland animal populations is needed.

Desired outcomes

- Knowledge of animal species occurring in the park is improved.
- Populations of significant animal species and ecological communities are conserved.
- Negative impacts on threatened species are minimised.
- The habitat and populations of all native animals are protected and maintained.

Management response

3.6.1 Implement relevant strategies in the *Biodiversity Conservation Program* and recovery plans for threatened species, populations and ecological communities present in the park.

3.6.2 Undertake systematic fauna surveys across the park, including targeted surveys for threatened species and species that are likely to be affected by changes in water levels.

3.6.3 Protect areas of bush rock, hollow-bearing trees and deadwood during park management operations to protect species reliant on these habitats.

3.6.4 Monitor the impact of changes in water levels in the Thirlmere Lakes on native animals.

3.7 Aboriginal connections to Country

Thirlmere Lakes National Park lies within the traditional country of the Dharawal and Gundungurra people, and within the area of the Tharawal Local Aboriginal Land Council. The land, water, plants and animals within a landscape are central to Aboriginal spirituality and contribute to Aboriginal identity. Aboriginal communities associate natural resources with the use and enjoyment of foods and medicines, caring for the land, passing on cultural knowledge, kinship systems and strengthening social bonds. Aboriginal heritage and connection to nature are inseparable and need to be managed in an integrated manner across the landscape.

The Aboriginal name for the area adjacent to the lakes was 'Couridjah', believed to mean honey and refers to the nectar of the banksia flowers which are a feature of the park (NPWS 1997). The explorer and botanist George Caley noted in his diary that the local Aboriginal people collected the nectar by washing the flowers in their water-filled coolamons. The early European name of the area was 'Coradgery', a derivative of Couridjah, and the lakes were originally known as Coradgery Lagoons (NPWS 1997).

Aboriginal sites are places with evidence of Aboriginal occupation or places that are related to other aspects of Aboriginal culture. They are important as evidence of Aboriginal history and as part of the culture of local Aboriginal people. A number of sites have been recorded in the park, including art sites, artefact scatters and shelters. There are almost certainly other (unrecorded) sites within the park.

A native title claim (NC1997/007) covers the area of the park.

Issues

Aboriginal sites are at risk of damage during park management operations, particularly those involving earth disturbance, such as construction or maintenance of trails, fire mitigation and development of visitor facilities.

Although the NSW Government has legal responsibility for the protection of Aboriginal sites and places, NPWS acknowledges the right of Aboriginal people to make decisions about their own heritage. Aboriginal communities will be consulted and involved in managing Aboriginal sites and places and related issues, and promoting and presenting Aboriginal culture and history.

The *Greater Blue Mountains World Heritage Area Strategic Plan* outlines a number of actions relating to consultation with, employment of and capacity building programs for local Aboriginal people, and working towards co-management of the whole Greater Blue Mountains Area World Heritage property (DECC 2009).

Desired outcomes

- Significant Aboriginal places and values are identified and protected.
- Aboriginal people are involved in management of the park.
- Impacts on Aboriginal heritage values are minimised.
- Understanding of the cultural values of the park is improved.

Management response

3.7.1 Continue to consult and involve the Tharawal Local Aboriginal Land Council, the Dharawal and Gundungurra people, other relevant Aboriginal community organisations and custodial families in the management of their Country, including the management of Aboriginal sites and cultural and natural values.

3.7.2 Record and conserve Aboriginal sites and values in consultation with the Tharawal Local Aboriginal Land Council, the Dharawal and Gundungurra people, other relevant Aboriginal community organisations and custodial families.

3.7.3 Undertake an archaeological survey and cultural assessment before starting all works with the potential to affect Aboriginal sites or values.

3.7.4 Encourage further research into the Aboriginal cultural heritage values of the park jointly with the Tharawal Local Aboriginal Land Council, the Dharawal and Gundungurra people, other relevant Aboriginal community organisations and custodial families.

3.7.5 Pursue opportunities for better involvement of Aboriginal people in the management of the park, consistent with the *Greater Blue Mountains World Heritage Area Strategic Plan* (DECC 2009), including opportunities for consultation, employment and capacity building.

3.8 Historic heritage

Heritage places and landscapes are composed of living stories and 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, aesthetic and social significance. NPWS conserves the significant heritage features of NSW parks and reserves.

John Wilson was an ex-convict and almost certainly the first white man to have visited what is now the Bargo area. Following his release from servitude, Wilson chose to wander in the bush with the Aboriginal people rather than work in the settlement. However, Wilson was sent on two official expeditions in Sydney's south–west during 1798 and it was during his second trip that the Thirlmere Lakes were discovered by Europeans. An entry in the diary of the second Wilson expedition, dated 14 March 1798 reads ‘We crosst three deep vallies, with the large ponds of water in each of the vallies. We also crosst one deep gully, we then came to for the night.’

In December 1802, George Caley, who was following the tracks of the explorer Francis Barrallier, became disoriented and headed southward, coming upon the lakes. He believed that he was the first white man to discover them because the diaries of Wilson’s expedition had been taken back to England with Governor Hunter. Caley named the largest lake Scirpus Mere (‘reedy lake’) and made reference to the native flora. Caley wrongly concluded that the lakes were the source of the Bargo River. The area was at this time part of the reserve for the government-owned ‘wild cattle of the cow pastures’. The superintendents of the wild cattle may have also been some of the earliest European visitors to the lakes.

On 24 September 1867, the Governor, Sir John Young, appointed a commission to inquire into the best method of supplying Sydney with water. This commission investigated the potential of the ‘Couridjah Lagoons’ together with a number of other catchments, but eventually, in 1869, recommended the Upper Nepean system to the east of Bargo and Appin.

In November 1867, *The Sydney Morning Herald* reported the visit of ‘His Excellency the Governor, the Ministers and several influential personages’ to Couridjah. During February 1873, Henry Parkes, then Premier and Chief Secretary of New South Wales, selected

Coradgery Lagoons as the site of the final entertainment for a touring group of 150 to 200 ladies and gentlemen who were accompanying delegates from New Zealand and various Australian colonies. The excursion was designed to promote goodwill and harmony and to encourage emulation for progress among the colonies. The *Town and Country Journal* report called the lakes the Picton Lagoons. Reports about these influential visits helped popularise the picnic areas beside the lakes during the early years of railway transport to the area.

The history of Thirlmere Lakes is tied to the history of railways on the Southern Tablelands during the late 19th and early 20th centuries. When the main southern railway line was extended to Mittagong in 1867, a pumping station was established above Lake Couridjah to provide a water supply from the lakes for use by the steam engines. Channels were also constructed to connect the various lakes. While steam engines used the southern railway to Mittagong until 1964, the pumphouse was used for water for steam engines until about 1919. After this, the pumphouse was believed to have been used for domestic water supply during the 1920s and 1930s. The boiler and pump were removed from the pumphouse in 1964 (NPWS 1998).

Other elements associated with the pumphouse include remnants of the pipe array, which ran between Lake Couridjah, the pumphouse and to two underground tanks. A walking track is located adjacent to Pumphouse Road, which was used by the pumphouse keeper for access when operating the pump. The pumphouse building has been assessed as having values of state historic significance (NPWS 1998) and is listed on the Wollondilly Council Local Environmental Plan as a heritage item. Although the building has been assessed as significant against a number of the State Heritage Register criteria, it has not been listed on the State Heritage Register.

A conservation management plan for the Couridjah Pumphouse has been prepared (NPWS 1998). The aims of the plan are to stabilise the fabric of the building and to improve the educational value of the building. Work has been undertaken to stabilise the building fabric and it is now considered to be in a stable condition. Ongoing management will focus on continuous maintenance of the building. Little work has been undertaken on other features associated with the pumphouse, such as the pipe array. During the 1990s the two underground tanks were filled in owing to concerns for public safety.

In the late 19th century, it was proposed that Picton, and its extensive railway depot, obtain water from Thirlmere Lakes, and sufficient water pipes were acquired to extend a water line along the railway track to Picton. However, Picton was incorporated as a municipality in 1895 and water was obtained from a small reservoir on the Bargo River. It was thought that the lakes would not have been a sufficiently reliable source of supply because it had been reported that they were nearly dry in the 1902 drought. The lakes were again said to be almost completely dry in the drought of 1928.

Picton Municipal Council persuaded the Railways Department to change the name of Picton Lakes Station back to Couridjah and, in 1960 the name of the lakes was changed from Picton Lakes to Thirlmere Lakes.

During the early decades of this century, and after considerable agitation from local residents, Wollondilly Shire Council built an unsealed access road through the park and named it W.E. Middleton Drive after the father of the then Shire President, R.E. Middleton. A 14-kilometre extension to this road was proposed by way of either a road or a rail link to the Burragorang Valley via Blue Gum Creek. A number of surveys were completed and a start was made to the road during the depression of the 1930s under relief work schemes, but the nature of the terrain led to washouts and landslides and the work was abandoned.

During the mid to late 1950s, the aquatic plants around the lake margins and the channels between the lakes were cleared and poisoned to improve conditions for power boating and

waterskiing. The Nepean Acclimatisation Society stocked the lakes with trout fingerlings in the mid-1960s and some success was recorded.

A number of other structures and items including evidence of past occupation, such as old buildings, foundations and water tanks, are present in the park. None of these items have been identified as having heritage significance, although some of them have importance to the families who previously lived on the properties. Many of these buildings are subject to ongoing illegal entry and vandalism.

Issues

The historical and conservation value of the pumphouse building has been assessed (NPWS 1998) and works undertaken to stabilise the structure. However, other associated elements such as the pipe arrays, tanks and the walking track have not been assessed or preserved. Not all items of heritage value or potential heritage value have been recorded in appropriate databases.

The railway heritage theme provides a valuable resource for educational and visitor experiences in the park. However, any works undertaken to improve visitor access need to be undertaken in a way that does not affect heritage values.

Given the potential presence of unrecorded artefacts or items, management works that cause ground disturbance, in particular work on roads and walking tracks, in the vicinity of heritage items need to consider the potential to unearth or destroy such items.

Many of the sites that provide evidence of past occupation are in a poor state and are subject to ongoing vandalism and other illegal activities.

Desired outcomes

- Minimise negative impacts on historic heritage values.
- The understanding of the cultural values of the park is improved.
- Significant historic features are appropriately conserved and managed.

Management response

3.8.1 Record and assess the significance of historic heritage items, and manage heritage items in accordance with their assessed level of significance.

3.8.2 Undertake archaeological survey and cultural assessment before starting all works with the potential to affect historic sites and places.

3.8.3 Record and remove buildings and other items that are assessed as not having heritage significance.

3.8.4 Implement the conservation management plan for the Couridjah Pumphouse (NPWS 1998).

3.8.5 Investigate listing of the Couridjah Pumphouse on the State Heritage Register.

3.9 Visitor use

NPWS parks provide a range of recreational and tourism opportunities for visitors and NPWS aims to ensure that visitors enjoy, experience and appreciate the parks while at the same time conserving and protecting park values.

Thirlmere Lakes National Park is located within the Wollondilly Tourism Region. The population in the Wollondilly Local Government Area was 47,000 in 2010 and is projected to grow to 70,100 by 2036 (DPI 2010). The park is located near the growth centres of Greater

Sydney and it is expected that the numbers of visitors and will increase as the population of these areas grows. Given the small size of the park, its status as a World Heritage property, as well as its role in protecting water quality entering Warragamba Dam, recreational activities need to be planned carefully.

Current visitor numbers are estimated to be about 25,000 per year, with most visitor activity concentrated at the picnic areas at Lake Couridjah and Lake Werri Berri. The park provides opportunities for low-key visitor activities in a natural setting, including bushwalking, picnicking, swimming, canoeing, birdwatching and horse riding. Within the region, railway heritage is a strong tourism theme and the Couridjah Pumphouse and associated elements provide a link to this interest (see Section 3.8). There are also significant opportunities to promote World Heritage values in the park.

Around the park, day use facilities are provided at Burragorang Lookout in Burragorang State Conservation Area and Caves Creek in Bargo River State Conservation Area. Park visitors access the Blue Gum Walk within Nattai National Park through Thirlmere Lakes National Park. Facilities are also provided at the Mount Annan Botanical Gardens, at Wirrimbirra Sanctuary and in reserves managed by WaterNSW at Warragamba, Cordeaux, Avon, Cataract and Nepean dams, as well as several reserves managed by local government. Caravan parks and camping grounds with facilities are available in the nearby centres of Bargo, Mittagong, Oakdale and Camden. Bush camping is permitted in the Nattai National Park and Bargo, Burragorang, and Nattai state conservation areas (outside Schedule 1 lands as defined in the Sydney Water Catchment Management Regulation 2013). Visitors to the area can also experience the Trainworks museum in the nearby village of Thirlmere.

Public access to the park is via a system of unsealed roads: Slades Road, Pumphouse Road and W.E. Middleton Memorial Drive. The road system within the park is partly public road easement, managed by Wollondilly Shire Council, and partly NPWS park roads (see Section 5.1).

Competitions and large-scale organised activities of a non-commercial nature require consent under the National Parks and Wildlife Regulation. Activities requiring consent include rogaining events, weddings, activities organised by community organisations and commercial filming. High-impact activities, such as staging areas and overnight camping, occur off-park on other land tenures. Large-scale events are not considered suitable in the park.

Commercial tour operators undertake activities such as car tours and guided walks in the park. Commercial activities need to be licensed under the National Parks and Wildlife Act.

Day use

Day use areas, typically picnic facilities or sites for interpretation and education, are the main destination for most visitors to parks. Thirlmere Lakes National Park provides two day use areas, one at Lake Werri Berri (Werri Berri Picnic Area) and one at Lake Couridjah (Couridjah Picnic Area).

The two day use areas provide low-key visitor facilities, including barbecues and picnic tables. Both areas are used as a base for swimming in the lakes during the warmer months. The main user groups are local residents from the Wollondilly area and visitors from out of the area, particularly day visitors from Sydney. When there is sufficient water in the lakes to allow swimming, the two day use areas are well-used during warmer months of the year. Through winter and when water levels in the lakes are low there is far less use of the lakes and associated facilities.

There is an opportunity to encourage visitors to other local attractions to use the park facilities for lunch as part of a day trip to the area. In particular, as Couridjah Picnic Area is

adjacent to the Couridjah Pumphouse, people could be encouraged to visit this precinct as part of a railway heritage-themed day visit.

Bushwalking

Bushwalking allows visitors to be in close contact with the environment and can increase understanding and enjoyment of parks and the environment generally. The Lakes Walking Track forms a loop around lakes Couridjah, Werri Berri and Gandangarra. However, this walking track has developed on an ad hoc basis and its condition varies depending upon terrain and level of use. The track passes through a number of intermittently wet areas, particularly in the channels between lakes, and this has led to erosion of the track surface in these areas. The track is currently not graded or maintained in accordance with the Australian Standard for walking tracks (SAI 2001).

A number of other informal footpads and trails have been formed through the park. Although all of these require assessment, only a small number have the potential for development into walking tracks. Pending further assessment, those tracks not required for management purposes (including visitation) will be allowed to regenerate naturally. The condition of these tracks and any safety or environmental consideration will be taken into account as part of this assessment.

One such track approximately follows the route that the pumphouse keeper took between his residence and the Couridjah Pumphouse. Currently, this track is in poor condition and is close to the pipe array previously used to pump water from Lake Couridjah. An opportunity exists to upgrade the ‘Pumphouse Walk’ to interpret the railway heritage of the park, linking the pumphouse to Couridjah Railway Station. There are also opportunities to use other informal tracks to improve access to the park and to provide links to other visitor facilities.

Horse riding

Horse riding is not permitted on Schedule 2 lands under the Sydney Water Catchment Management Regulation, except on public roads or otherwise by consent in the plan of management. Horse riding is allowed on the public roads in the park, which are: Slades Road, W.E. Middleton Memorial Drive and Pumphouse Road. Horse riding on management trails and walking tracks in the park is not permitted, except for Dry Lakes Management Trail for the purpose of accessing the public roads in the park from Dry Lakes Road. The environmental impacts on this management trail are currently low and contained. This is consistent with the Sydney Water Catchment Management Regulation.

Most horse riders in the park reside in the local area and ride directly from their home into the park. However, as horse riding is permitted on Dry Lakes Management Trail some horse riders from outside the local area use the road reserve on Dry Lakes Road to park trailers and unload their horses. This location is outside the park, and outside the catchment of the Thirlmere Lakes. This site is also considered safe as it is away from through traffic.

Cycling

The park provides opportunities for cycling on public roads (Slades Road, W.E. Middleton Memorial Drive and Pumphouse Road). Cycling is not permitted on management trails or walking tracks in accordance with the Sydney Water Catchment Management Regulation, which restricts bicycle access to public roads within Schedule 2 lands.

Water-based activities

When they contain sufficient water, lakes Werri Berri, Couridjah and Nerrigorang provide opportunities for non-motorised recreational water activities such as swimming, canoeing and kayaking. These types of low-impact, low-noise activities are considered to be compatible

with the natural, undeveloped setting. Lakes Gandangarra and Baraba are located in more remote sections of the park and do not have public access to facilitate these activities.

Research has found increased pollutant levels in the lakes, including lead and suspended sediment, as a result of motorised boats (Horsfall 1984). It is expected that motorised boats would adversely affect waterbird species in the lakes. The confined nature of the valley system surrounding the Thirlmere Lakes amplifies the noise of any motorised craft. Motorised boats, therefore, interfere with the enjoyment of other users of the park. Further, the Sydney Water Catchment Management Regulation only allows vessels that are propelled by wind or human power within special areas. For these reasons, use of motorised boats is not considered an appropriate recreational use in the Thirlmere Lakes. Use of motorised vessels may be approved by consent for authorised research or management purposes.

Issues

Currently, visitor experiences in the park focus primarily on water-based activities, such as swimming, canoeing and also picnicking by the lakes, and facilities within the park cater primarily for this. Many of these activities are only possible when the lakes are substantially full. Visitors also appreciate opportunities to view the lakes from suitable vantage points. During periods of low water levels, the current visitor facilities and experiences do not meet community expectations. The visitor experience provided in the park needs to expand to include activities that do not rely on the water levels of the lakes, such as bushwalking, birdwatching and encouraging day visitors to other attractions in the area to use the park.

The existing day use areas at Lake Werri Berri and Lake Couridjah are not meeting visitor expectations or providing adequate facilities. A review of these day use areas will be conducted and a precinct plan prepared, determining any upgrades to facilities that might be needed. No additional day use areas will be provided and the day use areas will continue to be of a similar scale. The review will include consideration of visitation patterns, disabled access, access to the lakes, selective removal of vegetation to establish viewing corridors to the lakes and erosion control. The review will also give consideration to access and visitor opportunities provided at lakes Baraba, Nerrigorang and Gandangarra.

Visitor activities and facilities in the park must have only low impact on the natural environment. Specifically, the park is designated Schedule 2 land within the Warragamba Special Area. The Sydney Water Catchment Management Regulation restricts human activities within Schedule 2 land to low-impact activities in order to protect the quality of water entering drinking water sources such as Lake Burragorang. No vehicles (including cars, motorbikes and bicycles) or horses are allowed within Schedule 2 land, except on public roads (or by consent). No pets, powered watercraft or firearms are permitted.

Owing to the small size of the park and the limited accessibility, camping, including bush camping, is not compatible with protection of the park's values. Opportunities are provided elsewhere, including in the adjacent Nattai National Park.

The two current day use areas were located and designed in the 1950s. Owing to their high rates of visitor use and their slope, the areas are susceptible to erosion and water pollution by sediments. Erosion control measures have been put in place to prevent erosion across the car parks and picnic areas. These measures have been largely successful. However, some erosion does occur and all areas require ongoing monitoring. The area is most susceptible to erosion and subsequent sedimentation entering the lakes during periods when the lake levels are receding, owing to the increased exposure of sediment.

Desired outcomes

- Visitor use is appropriate and ecologically sustainable.

- Visitors are encouraged to be aware of and appreciate the park's values and their conservation.
- Negative impacts of visitors on park values are minimised.
- Facilities and activities are planned and managed to provide a satisfying visitor experience and minimise impacts, with no unacceptable impacts on the natural and cultural heritage values of the park or other users.

Management response

3.9.1 Provide and promote opportunities for low-impact activities in the park.

3.9.2 Provide interpretation and information about safety and minimal impact use at Couridjah and Werri Berri picnic areas.

3.9.3 Provide for visits by organised groups, subject to limits on numbers and other conditions needed to keep impacts to a minimum.

3.9.4 Prohibit camping in the park.

3.9.5 Liaise with Wollondilly Shire Council regarding the maintenance of public roads to ensure continued access

3.9.6 Monitor the social and environmental impacts of visitor use and where negative effects are occurring, implement measures to minimise or eliminate these impacts.

Day use

3.9.7 Continue to provide low-key facilities, including gas barbecues, toilets and picnic facilities at Werri Berri and Couridjah picnic areas.

3.9.8 Review the day use areas and visitor facilities at Lake Couridjah and Lake Werri Berri and prepare and implement a precinct plan, to improve public access and amenity.

3.9.9 If facilities at Couridjah and Werri Berri picnic areas are replaced, ensure works keep erosion and water pollution to a minimum.

3.9.10 Require visitors in the park to use gas barbecues and not wood fires.

3.9.11 Promote the two picnic areas as a destination for day visitors coming to other attractions in the area.

Bushwalking

3.9.12 Upgrade the Lakes Walking Track to Australian Standards Class 3 to improve visitor safety and amenity and protect fragile environments.

3.9.13 Formalise and upgrade the Pumphouse Walk to Australian Standards Class 3.

3.9.14 Undertake an assessment and either formalise or close informal walking tracks within the park. Any walking tracks that are formalised should be upgraded to meet the relevant classification under Australian Standards.

Cycling

3.9.15 Continue to allow cycling on public roads in the park (Slades Road, Pumphouse Road and W.E. Middleton Memorial Drive) and to prohibit cycling in other areas of the park.

Horse riding

3.9.16 Horse riding is permitted on public roads in the park (Slades Road, Pumphouse Road and W.E. Middleton Memorial Drive) and on Dry Lakes Management Trail for the purpose of accessing Dry Lakes Road.

3.9.17 Install and maintain signage on Dry Lakes Management Trail, and other areas as required, to indicate where horse riding is permitted in the park.

3.9.18 Written consent from NPWS is required for horse riding that is part of a competition or organised activity (including non-commercial activities). All commercial activities require a licence.

Water-based activities

3.9.19 Only human or wind-powered watercraft are permitted on the Thirlmere Lakes for recreational purposes.

3.10 Information and education

Providing information for visitors assists in the protection of natural and cultural heritage, promotes support for conservation and increases the visitor enjoyment and satisfaction. NPWS runs a Discovery program and guided activities frequently occur in the park.

The park is a popular destination with both the local community and visitors from outside the area. This provides an opportunity to educate the community about the conservation of natural and cultural heritage, in particular World Heritage values, and protection of water catchments. The *Interpretation and Visitor Orientation Plan: Greater Blue Mountains World Heritage Area* (NPWS 2002) identifies strategies to interpret and promote the Greater Blue Mountains Area World Heritage property. Information about the park is currently available on interpretive displays at both Couridjah and Werri Berri picnic areas. Other opportunities to promote the World Heritage values of the park should be pursued, consistent with the interpretation and visitor orientation plan.

When water levels in the lake are high, the Wooglemai Environmental Education Centre uses the park for educational and recreational activities as part of their school programs, such as kayaking on Lake Werri Berri. A number of commercial tour operators also undertake activities in the park that provide an educational experience for visitors about the natural and cultural values of the park.

Issues

The Tharawal Local Aboriginal Land Council has a facility on West Parade, Couridjah, which adjoins the park, and the land council has expressed an interest in developing educational programs in the park. Programs may include environmental education, such as walks, talks or stream-watch activities, or events such as culture camps. These programs may be run in conjunction with existing or planned facilities at the land council site. In particular, the land council site provides an opportunity for camping or overnight accommodation that is not provided in the park.

Community interest in the issue of water levels in the Thirlmere Lakes, as well as community involvement and input into the Thirlmere Lakes Inquiry, has shown there is a high level of interest in the park and the issues that may affect the Thirlmere Lakes.

There is an opportunity to increase community participation in the management of the park through volunteer programs and the Friends of Thirlmere Lakes has been established to facilitate community involvement in park management.

Desired outcomes

- Public appreciation and awareness of the park's natural, cultural and recreational values is improved through community engagement, education and interpretation.
- The values of the Greater Blue Mountains Area World Heritage property are promoted.
- The park is a useful educational resource for local schools, community organisations and the wider community.

Management response

3.10.1 Encourage the development of educational opportunities in the park, particularly those that contribute to improved understanding of the park's natural and cultural heritage.

3.10.2 Provide opportunities for the local Aboriginal community to be engaged in the development of material and programs for interpretation of Aboriginal culture and heritage.

3.10.3 Maintain signage at the Lake Couridjah and Lake Werri Berri picnic areas to provide visitors with information about the natural and cultural values of the area and appropriate use of the park.

3.10.4 Communicate with park neighbours and the local community regarding park values and the conservation of these values, focusing on the park's status as a World Heritage property.

3.10.5 Foster and assist appropriate research that contributes to improved understanding of the park's natural and cultural heritage.

3.10.6 Provide opportunities for increased community involvement in the management of the park, such as the formation of volunteer groups.

4. Threats

4.1 Pests

Pest species are plants, animals and pathogens that have negative environmental, economic and social impacts; commonly they are introduced species but can include native species not endemic to the location. Pests can have impacts across the range of park values, including impacts on biodiversity, cultural heritage, catchment and scenic values.

NPWS prepares pest management strategies that identify pest species across that region's parks. These strategies also identify priorities for control, including actions listed in the *Biodiversity Conservation Program (see Sections 3.5 and 3.6)*, threat abatement plans and other strategies, such as the NSW *Biodiversity Priorities for Widespread Weeds* (NSW DPI and OEH 2011) and the *NSW Biosecurity Strategy 2013-2021* (DPI 2013).

The NPWS pest management strategy identifies pest species and priority programs for the parks (OEH 2013c). The overriding objective of the pest management strategy is to minimise adverse impacts of introduced species on biodiversity and other park and community values while complying with legislative responsibilities. The strategy also identifies where other site-specific or pest-specific plans or strategies need to be developed to provide a more detailed approach.

The *Biosecurity Act 2015* and regulations provide specific legal requirements for the prevention, eradication or containment of state-level priority weeds. These requirements apply equally to both public and privately owned land. A regional strategic weed management plan prepared under the Biosecurity Act identifies those pest plants that are being prioritised for management action, investment and compliance effort within the Greater Sydney Local Land Services region (Greater Sydney LLS 2017). These priorities will be implemented via the relevant NPWS pest management strategy.

The NPWS pest management strategy identifies several significant weed species as occurring in the park (see Table 4).

Table 4 Significant weeds recorded in the park

Common name	Scientific name	Status under Biosecurity Act*
Camphor laurel	*Cinnamomum camphora*	Weed of regional concern
Blackberry	*Rubus fruticosus* spp. aggr.	State priority weed objective
Boneseed	*Chrysanthemoides monilifera* subsp. *monilifera*	State priority weed objective
Fireweed	*Senecio madagascariensis*	State priority weed objective
Fleabane	*Conyza* spp.	
Inkweed	*Phytolacca octandra*	
Lantana	*Lantana camara*	State priority weed objective
Purpletop	*Verbena bonariensis*	
Radiata pine	*Pinus radiata*	Weed of regional concern
Salvinia[#]	*Salvinia molesta*	State priority weed objective.

* *Biosecurity Act 2015*

[#] Previously recorded in the park (NPWS 1997)

An infestation of boneseed occurred adjacent to the park and several plants have been detected in the park over the past five years. This species is of concern because it is a weed that is able to colonise areas and compete with native species in the absence of disturbance (DEC 2006a). A cooperative program has been established with Wollondilly Shire Council to eradicate this species from the area.

The vegetation communities of the park are largely intact. Weed infestations primarily occur along road verges, in picnic areas and areas subject to previous disturbance or clearing. Weeds affect endangered ecological communities within the park, such as Shale Sandstone Transition Forest, important communities such as wetland vegetation communities, and several threatened plants (see Sections 3.5). Currently, programs are undertaken to regenerate previously cleared areas using bush regeneration and spraying techniques.

Terrestrial animal pests that have been recorded in the park include cats (*Felis catus*), foxes (*Vulpes vulpes*), goats (*Capra hircus*), wild pigs (*Sus scrofa*) and rabbits (*Oryctolagus cuniculus*). The impact of pest animal species in the park includes competition, predation and grazing or browsing. Pest animal species affect endangered ecological communities, threatened animal and plant species, and migratory wetland bird species. In addition, species such as goats potentially have an effect on Aboriginal sites. Pest animal programs include baiting for wild dogs (which also controls foxes) within the park.

Introduced fish species are a threat to the aquatic organisms of the park, including native fish and frog species, and to ecosystems of the Thirlmere Lakes. Aquatic pest species that have been recorded in the park include plague minnow (*Gambusia holbrooki*) and silver perch (*Bidyanus bidyanus*). Predation by plague minnow is listed as a key threatening process under the Biodiversity Conservation Act. The only known method for eradicating introduced fish is complete draining of an infested wetland, but this is not a practical control method in the Thirlmere Lakes. However, a natural drying event in the future may provide an opportunity to eradicate this species. The *NSW Freshwater Fish Stocking Fishery Management Strategy* 2005 (DPI 2005) prohibits the stocking of the lakes with freshwater fish species.

Wild dogs, including dingos

Wild dogs are known to occur in the park. Wild dogs – dingos (*Canis lupus dingo*), feral dogs (*Canis lupus familiaris*) and their hybrids – are a declared pest for the purposes of the *Local Land Services Act 2013* owing to their impacts on livestock. NPWS therefore has a statutory obligation to control wild dogs on the lands it manages.

Historically the impact of dingos and wild dogs in the park has been reported to be negligible. However, more recently, risks to neighbouring properties have been identified and where appropriate, dingos and wild dogs are controlled in consultation with neighbouring property owners and relevant authorities.

The dingo is also considered to be a native animal of New South Wales. To balance the need for wild dog control with the conservation of dingos, wild dog control activities for lands listed under Schedule 2 of the Wild Dog Pest Control Order, such as the adjacent Nattai National Park, must be guided by a wild dog management plan that addresses both control and conservation objectives (NSW Government 2015).

Desired outcomes

- Pest plants and animals are controlled and where possible eliminated.
- Negative impacts of pest animals on park values are minimised.
- Impacts on neighbouring operations are minimised.

- Programs are undertaken cooperatively with neighbours and other agencies.

Management response

4.1.1 Manage pest species in accordance with pest management strategies relevant to the park. Conduct annual reviews of the prioritised pest programs, update the strategy if required and develop and implement an annual pest control program for the park. Current priorities are the control of wild dogs, eradication of boneseed, and control of weed species in areas previously subject to clearing.

4.1.2 Seek the cooperation of neighbours in implementing weed and pest control programs, and undertake control in cooperation with Local Land Services and Wollondilly Shire Council.

4.1.3 Undertake ongoing control programs for wild dogs.

4.1.4 Monitor priority weeds and their impacts and treat any new outbreaks where possible.

4.1.5 If suitable techniques become available or opportunities occur (such as the drying of the lakes), use these to remove exotic fish.

4.1.6 Work with Local Land Services and other stakeholders in the management of dingos and wild dogs, including incorporation of the park in strategic planning, where appropriate.

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 2013d).

Fire is a natural feature of many environments and is essential for the survival of some plant communities and persistence of some animals in an area. 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.

The fire history in the park is well documented (Noakes 1998). Recent fires in the park occurred in 1998, 2001 and 2006. In 1998, areas of the park were burnt in a hazard reduction burn. Both the 2001 and 2006 fires were wildfires that burnt 100% of the park and 60% of the park respectively. The fire regime for these areas is therefore considered too frequent for the protection of biodiversity (RFS 2006).

The fires in 2006 occurred during a period of lower lake levels. The fire ignited the exposed peat beds and caused an underground fire that burned for approximately two months. The Thirlmere Lakes Inquiry report (Riley et al. 2012) notes that changes in peat may have an impact on the lakes aquatic ecosystem but it is not known what this impact may be.

A fire management strategy that defines fire management for the park and the nearby Nattai reserves has been prepared (DEC 2006b). This describes the recent fire history of the park, key assets within and adjoining the park (including sites of natural and cultural heritage value), fire management zones, asset protection zones and fire control advantages, such as management trails and water supply points. It also contains fire regime guidelines for conservation of the park's vegetation communities.

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

Desired outcomes

- Negative impacts of fire on life, property and the environment are minimised.
- The potential for spread of bushfires on, from, or into the park is minimised.
- Fire regimes are appropriate for conservation of native plant and animal communities.
- Areas of peat and aquatic ecosystems are protected from fire until the impact of fire on these ecosystems is understood.

Management response

4.2.1 Implement the fire management strategy for the park.

4.2.2 Continue to be involved in the Wollondilly–Wingecarribee Bush Fire Management Committee and maintain cooperative arrangements with local Rural Fire Service brigades and surrounding landowners in regard to fuel management and fire suppression.

4.2.3 Develop and implement an annual program of bushfire management and hazard reduction works consistent with the park's fire management strategy.

4.2.4 Suppress unplanned fires in the park in accordance with the park's fire management strategy.

4.2.5 Manage the reserve to protect biodiversity in accordance with the identified fire regimes in the fire management strategy.

4.2.6 Monitor the ability of flora to recover between fires and review regimes where relevant.

4.2.7 Rehabilitate areas disturbed by fire suppression operations as soon as practical after the fire.

4.2.8 Encourage further research into the impact of fire on peat and aquatic ecosystems.

4.2.9 Exclude fire from peat areas and aquatic ecosystems where practical.

4.3 Climate change

Anthropogenic climate change has been listed as a key threatening process under the Biodiversity Conservation Act. Projections of future changes in climate for New South Wales include higher temperatures, increasing sea levels and water temperatures, more intense but possibly reduced annual average rainfall, increased temperature extremes and higher evaporative demand. These changes are likely to lead to greater intensity and frequency of fires, more severe droughts, reduced river run-off and water availability, regional flooding and increased erosion.

In south–east NSW it is predicted that the average daily temperature will increase throughout the year, with increased rainfall in summer and decreased rainfall in winter. Evaporation is predicted to increase in spring and summer, while increased rainfall in summer may result in increased run-off and a moderate increase in the magnitude of high-flow events. Increased erosion is likely (DECCW 2010c).

Wetlands and their biota are defined by their adaptation to natural climatic variation. If climate change takes these variations beyond the extremes that have been experienced

historically, some wetlands will become vulnerable (DECCW 2010b). The impact of climate change on the Thirlmere Lakes is not clear. However, it is expected that the frequency of drying of the lakes will increase (Riley et al. 2012). The potential impacts of climate change on wetlands include a reduction in river and stream flow which, in combination with a warmer climate, may result in excessive drying of wetlands, increased algal blooms, salinisation risks and reduced aquatic biodiversity (van Dam et al. 2004).

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

The park is part of the Bargo linkage, an important wildlife corridor which connects the Greater Blue Mountains Area World Heritage property to protected areas to the east (Upper Nepean State Conservation Area and Metropolitan Special Area) (DECC 2007b). This linkage is critical for the migration of sandstone-reliant animals between these two large protected areas. The park is also part of the Cumberland Koala Linkage, which allows migration of koalas between populations in the Nattai National Park with others in the lower Blue Mountains and Wedderburn areas.

Programs to reduce the pressures arising from other threats, such as habitat fragmentation, invasive species, bushfires and pollution, will help reduce the severity of the effects of climate change.

Desired outcomes

- The effects of climate change on natural systems are reduced.
- Connectivity between habitats is protected and enhanced.
- Adequate monitoring of ecosystems is undertaken to detect impacts of climate change on the values of the park.

Management response

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

4.3.2 Undertake monitoring programs to detect any impacts of climate change on park values.

4.3.3 Pursue additions to the park to improve connectivity to other protected areas in the region, particularly lands to the east of the park that form part of the Bargo linkage.

5. Management operations and other uses

5.1 Management facilities and operations

The network of management trails in the park is regularly used for fire management and other operational activities. In accordance with NPWS policy, vehicle use of management trails is only available for NPWS authorised activities, mostly associated with essential reserve management. Use by the public is generally limited to bushwalking (see Section 3.9).

The park has three management trails: Powerline Management Trail, Dry Lakes Management Trail and Lake Nerrigorang Management Trail (see Figure 1). Powerline Management Trail is used by TransGrid to access the 33-kilovolt powerline and its associated infrastructure.

There are two public roads within the park. Parts of Slades Road and Pumphouse Road are within the park and NPWS is responsible for maintaining these sections. Other sections of Slades Road and W.E. Middleton Memorial Drive are within a road reserve that does not form part of the park and are managed by Wollondilly Shire Council.

Issues

As the park is part of the Warragamba Special Area, the maintenance of trails and other assets needs to be undertaken in a way that has no effect on or benefits water quality.

No new management trails are required for park management purposes. The realignment of existing management trails may be undertaken where a net benefit to natural or cultural values is identified.

W.E. Middleton Memorial Drive and Slades Road (see Figure 1) do not lie entirely within the road reserve that is excluded from the gazetted area of the park. Additionally, there are portions of Crown road reserve that do not contain or relate to constructed roads. These road reserves contain undisturbed vegetation and are managed consistently with the surrounding park.

Ongoing maintenance of the road system within the park is the responsibility of both Wollondilly Shire Council and NPWS. It is desirable for the two agencies to work cooperatively on road maintenance, to improve efficiency and cost-effectiveness.

Desired outcomes

- Park infrastructure and assets are routinely maintained.
- Management facilities and operations adequately service management and visitor needs.
- Maintenance and construction have a minimum impact on park values and have a neutral or beneficial impact on water quality.

Management response

5.1.1 Maintain the management trails shown on Figure 1.

5.1.2 Liaise with other agencies, such as Transgrid and Wollondilly Shire Council, regarding maintenance of roads and management trails where appropriate.

5.1.3 Maintain the public and park road system to allow visitor access to a two-wheel drive standard.

5.1.4 No new trails to be constructed, and temporary trails constructed for operational reasons, such as fire management, to be rehabilitated.

5.1.5 Investigate the closure and gazettal of unconstructed sections of Crown road reserve.

5.1.6 In cooperation with relevant state and local government agencies, seek an adjustment of the park boundary and the public road reserves to better align with existing constructed roads.

5.2 Non-NPWS uses and operations

Leases and licences

Four groundwater monitoring bores, located adjacent to lakes Gandangarra, Couridjah and Nerrigorang, are subject to a licence under section 151(1) of the National Parks and Wildlife Act granted to the Commissioner of Water, NSW Office of Water (now WaterNSW). The bores have been installed to monitor both deep and shallow groundwater changes around Thirlmere Lakes in the medium to long term, and will greatly improve our understanding of the hydrology of the lakes (Russell 2012).

The Thirlmere Lakes Inquiry recommended initiating a number of additional monitoring programs to improve understanding of the hydrology of the lakes, including the monitoring of surface water levels, local weather and stream gauging on Blue Gum Creek (see Section 3.4). These monitoring projects will involve installing permanent infrastructure.

There is an access road between W.E. Middleton Memorial Drive and Blue Gum Creek for the purpose of access to a private inholding. Use of this access road is covered by a licence.

TransGrid has one high-voltage electricity transmission line traversing the park between Bonds Road and Buxton Road, near the western boundary of the park (see Figure 1). This transmission line is covered by a formal easement granted under section 153(1) of the National Parks and Wildlife Act. Transmission lines and their 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. These impacts are minimised through a statewide agreement between TransGrid and NPWS for inspection and maintenance of existing transmission lines and infrastructure.

Issues

As the park is part of the Warragamba Special Area, the maintenance of trails and other assets needs to be undertaken in a way that has a neutral or beneficial effect upon water quality.

Desired outcomes

- Non-NPWS related uses and activities are managed to minimise impacts on park values and infrastructure. Transmission lines within the planning area are managed in accordance with the statewide easement and maintenance agreement.
- Uses that contribute to the understanding of the hydrology of the Thirlmere Lakes will be supported.

Management response

5.2.1 Continue to liaise with TransGrid regarding access and maintenance needs in accordance with the agreement.

5.2.2 Allow access to the inholding, consistent with NPWS policy and in accordance with the licence issued for this purpose.

5.2.3 Permit WaterNSW and other agencies or organisations to install infrastructure that contributes to research and monitoring of the Thirlmere Lakes system under an appropriate licence and subject to environmental and cultural assessments.

6. Implementation

This plan of management establishes a scheme of operations for Thirlmere Lakes National Park.

Identified activities for implementation are listed in Table 5. 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 5 List of management responses

No.	Management response	Priority
	3.1 World Heritage	
3.1.1	Protect, conserve and interpret the outstanding universal values of the park, in accordance with the principles of the World Heritage Convention	Ongoing
3.1.2	Facilitate the ongoing development and implementation of research and monitoring programs to detect any changes in the outstanding universal values of the park.	Medium
	3.2 National Heritage	
3.2.1	Appropriately manage and interpret the National Heritage values of the park.	Ongoing
	3.3 Wetlands	
3.3.1	Undertake an ecological character description for the Thirlmere Lakes.	Medium
3.3.2	Subject to completion of an ecological character description and expert advice, work with the Australian Government in seeking to nominate the Thirlmere Lakes for listing as a Ramsar site.	Medium
	3.4 Landscape, geology and hydrology	
3.4.1	Department of Planning, Industry and Environment will establish and lead a committee of scientists to develop a research and data collection program to investigate causes of the changes in lake levels, based on recommendations of the report of the Thirlmere Lakes Inquiry (Riley et al. 2012).	High
3.4.2	Encourage research that improves understanding of the hydrology of the Thirlmere Lakes.	High
3.4.3	Where human impacts on the hydrology of the Thirlmere Lakes are identified through research and monitoring, explore and evaluate any remedial action that may be applicable within the park.	High
3.4.4	Work with consent and determining authorities to mitigate any impacts of developments with the potential to affect park values.	Ongoing

No.	Management response	Priority
3.4.5	Monitor all areas of soil disturbance for accelerated erosion and impacts on natural or cultural values.	Ongoing
3.4.6	Regularly maintain management and walking trails to maintain access and minimise erosion.	Ongoing
3.4.7	Support relevant organisations and groups to assess and monitor the health of the Thirlmere Lakes catchment and Blue Gum Creek.	Ongoing
	3.5 Native plants	
3.5.1	Implement relevant strategies in the Biodiversity Conservation Program for threatened species, populations and ecological communities present in the park.	High
3.5.2	Undertake targeted surveys and monitoring of rare and threatened species, in particular surveys to determine the presence of Mittagong geebung and monitoring of threatened plant species such as dwarf kerrawang in response to changing water levels.	Medium
3.5.3	Encourage natural regeneration of areas subject to past disturbance.	Low
3.5.4	Monitor the impact of changes in water levels in the Thirlmere Lakes on rare and threatened plants and *Lepironia* Freshwater Wetlands.	Medium
	3.6 Native animals	
3.6.1	Implement relevant strategies in the *Biodiversity Conservation Program* and recovery plans for threatened species, populations and ecological communities present in the park.	High
3.6.2	Undertake systematic fauna surveys across the park, including targeted surveys for threatened species and species that are likely to be affected by changes in water levels.	Medium
3.6.3	Protect areas of bush rock, hollow-bearing trees and deadwood during park management operations to protect species reliant on these habitats.	High
3.6.4	Monitor the impact of changes in water levels in the Thirlmere Lakes on native animals.	Medium
	3.7 Aboriginal connections to Country	
3.7.1	Continue to consult and involve the Tharawal Local Aboriginal Land Council, the Dharawal and Gundungurra people, other relevant Aboriginal community organisations and custodial families in the management of their Country, including the management of Aboriginal sites and cultural and natural values.	High
3.7.2	Record and conserve Aboriginal sites and values in consultation with the Tharawal Local Aboriginal Land Council, the Dharawal and Gundungurra people, other relevant Aboriginal community organisations and custodial families.	Ongoing
3.7.3	Undertake an archaeological survey and cultural assessment before starting all works with the potential to affect Aboriginal sites or values.	Ongoing
3.7.4	Encourage further research into the Aboriginal cultural heritage values of the park jointly with the Tharawal Local Aboriginal Land Council, the Dharawal and Gundungurra people, other relevant Aboriginal community organisations and custodial families.	Medium
3.7.5	Pursue opportunities for better involvement of Aboriginal people in the management of the park, consistent with the *Greater Blue Mountains World Heritage Area*	Medium

No.	Management response	Priority
	Strategic Plan (DECC 2009), including opportunities for consultation, employment and capacity building.	
	3.8 Historic heritage	
3.8.1	Record and assess the significance of historic heritage items, and manage heritage items in accordance with their assessed significance.	Low
3.8.2	Undertake archaeological survey and cultural assessment before starting all works with the potential to affect historic sites and places.	Ongoing
3.8.3	Record and remove buildings and other items that are assessed as not having heritage significance.	Low
3.8.4	Implement the conservation management plan for the Couridjah Pumphouse (NPWS 1998).	Ongoing
3.8.5	Investigate listing of the Couridjah Pumphouse on the State Heritage Register.	Low
	3.9 Visitor use	
3.9.1	Provide and promote opportunities for low-impact activities in the park.	Ongoing
3.9.2	Provide interpretation and information about safety and minimal impact use at Couridjah and Werri Berri picnic areas.	Ongoing
3.9.3	Provide for visits by organised groups, subject to limits on numbers and other conditions needed to keep impacts to a minimum.	Ongoing
3.9.4	Prohibit camping in the park.	Ongoing
3.9.5	Liaise with Wollondilly Shire Council regarding the maintenance of public roads to ensure continued access.	Medium
	<u>Day use</u>	
3.9.6	Continue to provide low-key facilities including gas barbecues, toilets and picnic facilities at Werri Berri and Couridjah picnic areas.	Ongoing
3.9.7	Review the day use areas and visitor facilities at Lake Couridjah and Lake Werri Berri and prepare and implement a precinct plan, to improve public access and amenity.	Medium
3.9.8	If facilities at Couridjah and Werri Berri picnic areas are replaced, ensure works keep erosion and water pollution to a minimum.	Ongoing
3.9.9	Require visitors in the park to use gas barbecues and not wood fires.	Ongoing
3.9.10	Promote the two picnic areas as a destination for day visitors coming to other attractions in the area.	Ongoing
	<u>Bushwalking</u>	
3.9.11	Upgrade the Lakes Walking Track to Australian Standards Class 3 to improve visitor safety and amenity and protect fragile environments.	Medium
3.9.12	Formalise and upgrade the Pumphouse Walk to Australian Standards Class 3.	Medium
3.9.13	Undertake an assessment and either formalise or close other informal walking tracks within the park. Any walking tracks that are formalised should be upgraded to meet the relevant classification under Australian Standards.	Low

No.	Management response	Priority
	Cycling	
3.9.14	Continue to allow cycling on public roads in the park (Slades Road, Pumphouse Road and W.E. Middleton Memorial Drive) and to prohibit cycling in other areas of the park.	Ongoing
	Horse riding	
3.9.15	Horse riding is allowed on public roads in the park (Slades Road, Pumphouse Road and W.E. Middleton Memorial Drive) and on Dry Lakes Management Trail for the purpose of accessing Dry Lakes Road.	Ongoing
3.9.16	Install and maintain signage on Dry Lakes Management Trail, and other areas as required, to indicate where horse riding is permitted in the park.	High
3.9.17	Require written consent from NPWS for horse riding that is part of a competition or organised activity (including non-commercial activities). All commercial activities require a licence.	Ongoing
3.9.18	Monitor the social and environmental impacts of horse riding including erosion and weeds, and where negative effects are occurring, implement measures to minimise or eliminate these impacts.	Ongoing
	Water-based activities	
3.9.19	Only human or wind-powered watercraft will be permitted on the Thirlmere Lakes for recreational purposes.	Ongoing
	3.10 Information and education	
3.10.1	Encourage the development of educational opportunities in the park, particularly those that contribute to improved understanding of the park's natural and cultural heritage.	Low
3.10.2	Provide opportunities for the local Aboriginal community to be engaged in the development of material and programs for interpretation of Aboriginal culture and heritage.	Ongoing
3.10.3	Maintain signage at the Lake Couridjah and Lake Werri Berri picnic areas to provide visitors with information about the natural and cultural values of the area and appropriate use of the park.	Ongoing
3.10.4	Communicate with park neighbours and the local community regarding park values and the conservation of these values, focusing on the park's status as a World Heritage property.	Ongoing
3.10.5	Foster and assist appropriate research that contributes to improved understanding of the park's natural and cultural heritage.	Low
3.10.6	Provide opportunities for increased community involvement in the management of the park, such as the formation of volunteer groups.	Low
	4.1 Pests	
4.1.1	Manage pest species in accordance with pest management strategies relevant to the park. Conduct annual reviews of the prioritised pest programs, update the strategy if required and develop and implement an annual pest control program for the park. Current priorities are the control of wild dogs, eradication of boneseed, and control of weed species in areas previously subject to clearing.	High
4.1.2	Seek the cooperation of neighbours in implementing weed and pest control programs, and undertake control in cooperation with Local Land Services and Wollondilly Shire Council.	Ongoing

No.	Management response	Priority
4.1.3	Undertake ongoing control programs for wild dogs.	High
4.1.4	Monitor priority weeds and their impacts and treat any new outbreaks where possible.	Ongoing
4.1.5	If suitable techniques become available, or opportunities occur (such as the drying of the lakes), use these to remove exotic fish.	Low
4.1.6	Work with Local Land Services and other stakeholders in the management of dingoes and wild dogs, including incorporation of the park in strategic planning, where appropriate.	High
	4.2 Fire	
4.2.1	Implement the fire management strategy for the park.	High
4.2.2	Continue to be involved in the Wollondilly–Wingecarribee Bush Fire Management Committee and maintain cooperative arrangements with local Rural Fire Service brigades and surrounding landowners in regard to fuel management and fire suppression.	Ongoing
4.2.3	Develop and implement an annual program of bushfire management and hazard reduction works consistent with the park's fire management strategy.	High
4.2.4	Suppress unplanned fires in the park in accordance with the park's fire management strategy.	High
4.2.5	Manage the reserve to protect biodiversity in accordance with the identified fire regimes in the fire management strategy.	Medium
4.2.6	Monitor the ability of flora to recover between fires and review regimes where relevant.	Low
4.2.7	Rehabilitate areas disturbed by fire suppression operations as soon as practical after the fire.	High
4.2.8	Encourage further research into the impact of fire on peat and aquatic ecosystems.	Low
4.2.9	Exclude fire from peat areas and aquatic ecosystems where practical.	Ongoing
	4.3 Climate change	
4.3.1	Continue existing fire, pest and weed management programs to increase the park's ability to cope with future disturbances, including climate change.	Medium
4.3.2	Undertake monitoring programs to detect any impacts of climate change on park values.	Low
4.3.3	Pursue additions to the park to improve connectivity to other protected areas in the region, particularly lands to the east of the park that form part of the Bargo linkage.	Low
	5.1 Management facilities and operations	
5.1.1	Maintain the management trails shown on Figure 1.	Medium
5.1.2	Liaise with other agencies, such as Transgrid and Wollondilly Shire Council, regarding maintenance of roads and management trails where appropriate.	Ongoing
5.1.3	Maintain the public and park road system to allow visitor access to a two-wheel drive standard.	Medium
5.1.4	No new trails to be constructed, and temporary trails constructed for operational reasons, such as fire management, to be rehabilitated.	Ongoing
5.1.5	Investigate the closure and gazettal of unconstructed sections of Crown road reserve.	Low

No.	Management response	Priority
5.1.6	In cooperation with relevant state and local government agencies, seek adjustment of the park boundary and the public road reserves to better align with existing constructed roads.	Low
	5.2 Non-NPWS uses and operations	
5.2.1	Continue to liaise with TransGrid regarding access and maintenance needs in accordance with the agreement.	Ongoing
5.2.2	Allow access to the inholding, consistent with NPWS policy and in accordance with the licence issued for this purpose.	Ongoing
5.2.3	Permit NSW Office of Water and other agencies or organisations to install infrastructure that contributes to research and monitoring of the Thirlmere Lakes system under an appropriate licence and subject to environmental and cultural assessments.	Medium

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