



NSW NATIONAL PARKS & WILDLIFE SERVICE

Hunter Wetlands National Park

Plan of Management



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This plan of management was adopted by the Minister for Energy and Environment on 23 March 2020.

Hunter Wetlands National Park is in the traditional Countries of the Awabakal and Worimi peoples.

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

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Vision Statement

An important refuge for a diversity of terrestrial and aquatic wildlife and habitat for estuarine vegetation, the park provides a spectacular natural backdrop to the city of Newcastle while demonstrating innovative management of an internationally significant wetland. A vibrant local community seeks to protect and enhance the conservation values and local character of the area.



Red-necked avocet (*Recurvirostra novaehollandiae*) and black-winged stilt (*Himantopus himantopus*). C Herbert

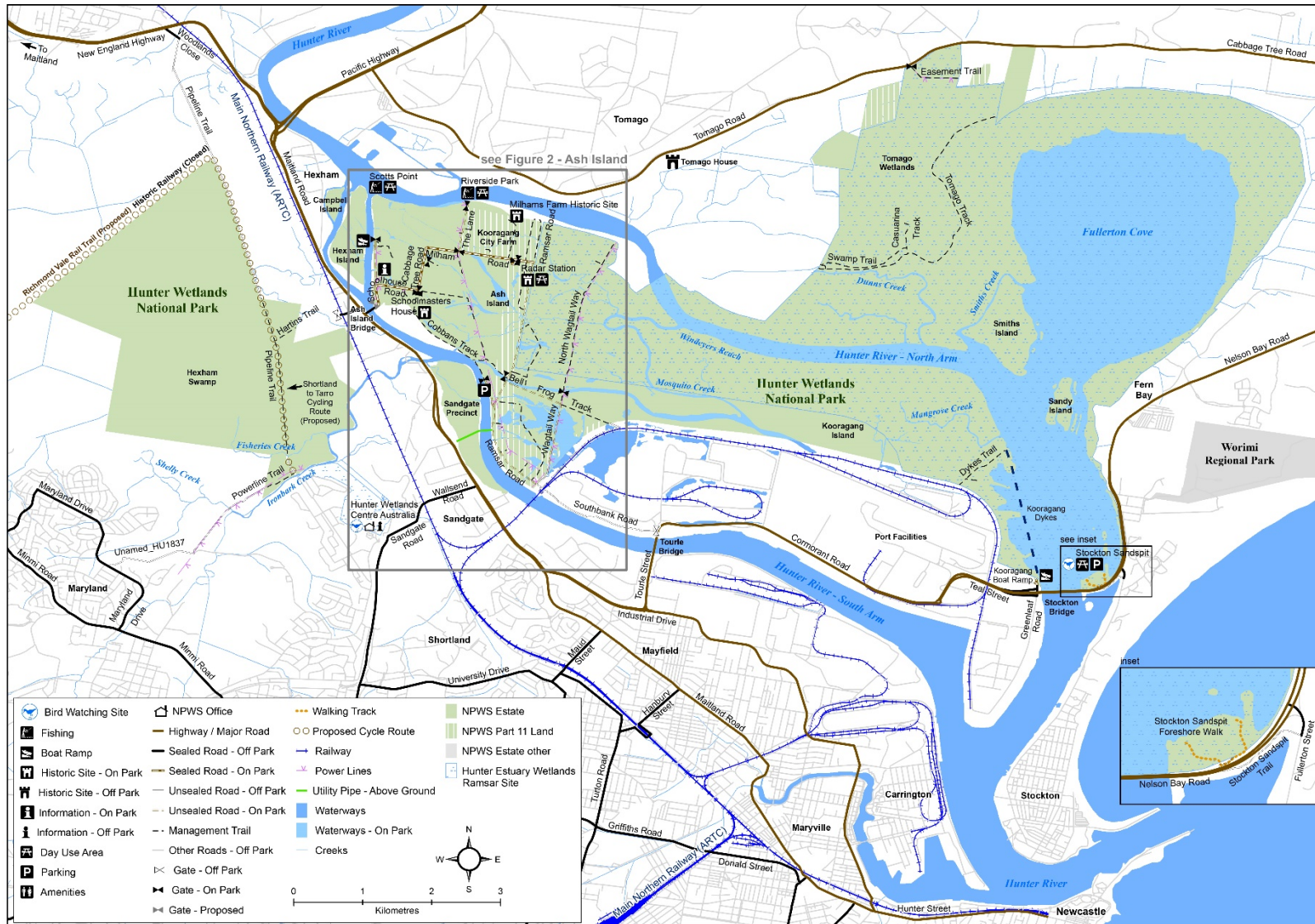


Figure 1 Hunter Wetlands NP Plan of Management

1. Introduction

1.1 Location, reservation and regional setting

Features	Description															
Location	<p>Hunter Wetlands National Park (referred to as ‘the park’ in this plan) lies in the lower estuarine reaches of the Hunter River (see Figure 1 on centre pages). It borders the city of Newcastle to the south and extends from the town of Hexham in the west to Stockton and Fern Bay in the east. The park is in two distinct sections. The eastern part includes: Stockton Sandspit; Sandy and Smiths islands; the bed of Fullerton Cove; part of the north and southern arms of the Hunter River, Tomago Wetlands, Kooragang, Ash, Hexham and Campbell islands. The western part covers Hexham Swamp.</p>															
Reservation dates and previous tenure	<p>The park was established in 2007 under the <i>Hunter Park Estate (Lower Hunter Region Reservations) Act 2006</i>. This Act allowed for the revocation of Kooragang and Hexham Swamp nature reserves and then reserved the lands formerly in these reserves as Hunter Wetlands National Park.</p> <p>Ash, Campbell and Hexham islands were later additions to the park and were previously Crown land managed by the former State Property Authority and leased to the Hunter-Central Rivers Catchment Management Authority for the Kooragang Wetland Rehabilitation Project.</p> <p>The table below shows the area of the park that was originally nature reserve and other additions. Together the total area for the park is now 4549 hectares.</p> <table border="1"> <thead> <tr> <th>Previous name</th> <th>Original date of reservation</th> <th>Area (hectares)</th> </tr> </thead> <tbody> <tr> <td>Kooragang Nature Reserve</td> <td>1983</td> <td>3348</td> </tr> <tr> <td>Hexham Swamp Nature Reserve</td> <td>1990</td> <td>905</td> </tr> <tr> <td>Other additions</td> <td>From 2007 to 2015</td> <td>297</td> </tr> <tr> <td>Total Area</td> <td></td> <td>4549</td> </tr> </tbody> </table> <p>The park includes 29 kilometres of estuarine foreshore, including the intertidal zone down to the mean low water mark and the bed of Fullerton Cove. The plan of management applies to these lands but does not prohibit any action authorised under the <i>Fisheries Management Act 1994</i>.</p> <p>The park also includes approximately 27 hectares of the Tomago Sandbeds Special Area declared under the <i>Hunter Water Act 1991</i>.</p> <p>The area of park covered by this plan includes 204 hectares of unreserved lands, which are vested in the Minister administering the <i>National Parks and Wildlife Act 1974</i> for the purposes of Part 11 of that Act. These ‘Part 11 lands’ incorporate (see Figure 1 and Section 5):</p> <ul style="list-style-type: none"> • an infrastructure corridor • the Kooragang City Farm Licence Area • a small area of land at Scotts Point on Ash Island. 	Previous name	Original date of reservation	Area (hectares)	Kooragang Nature Reserve	1983	3348	Hexham Swamp Nature Reserve	1990	905	Other additions	From 2007 to 2015	297	Total Area		4549
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Other additions	From 2007 to 2015	297														
Total Area		4549														
Regional context																
Biogeographic region	<p>The park is located within the Hunter subregion of the Sydney Basin Bioregion and the Karuah Manning subregion of the NSW North Coast Bioregion. It forms part of a green corridor stretching from Port Stephens to the Watagan Ranges. Most of the Hunter Estuary Wetlands Ramsar site is encompassed by the park (see Section 2.2).</p>															

Features	Description
Surrounding land use	<p>Land uses surrounding the park include a mix of industrial, agricultural and residential uses including: a major coal export loading facility at Kooragang Island, Tomago aluminium smelter, livestock grazing and rural residential lands at Tomago and Hexham, and urban development at Hexham and Fern Bay. To the south of Hexham Swamp, at Shortland, is the Hunter Wetlands Centre Australia, which is freehold land that was added to the Hunter Estuary Wetlands Ramsar site in 2002 (see Section 2.2). Public land owned by Hunter Local Land Services is also located adjacent to the park at Hexham Swamp.</p> <p>The park provides a unique backdrop to Newcastle, one of the fastest-growing regional cities in Australia. The local community rates the conservation of and recreational access to the park highly.</p>
Other authorities	<p>The park is located within the areas of the Awabakal and Worimi local Aboriginal land councils, Hunter Local Land Services and the City of Newcastle and Port Stephens local government areas.</p>

1.2 What is special about the park

Natural heritage

The park is part of a green corridor stretching from the Watagan Ranges, through to Hexham Swamp and Port Stephens (DECCW 2009). The park contributes to the scenic amenity of the city of Newcastle by providing a green buffer.

The wetland system in the park is of international significance and is listed under the Ramsar Convention on Wetlands. It is of exceptional conservation value, containing the second largest area of mangroves in New South Wales and extensive areas of coastal saltmarsh.

The park provides habitat for a diversity of wildlife including 41 threatened species such as the Australasian bittern (*Botaurus poiciloptilus*), green and golden bell frog (*Litoria aurea*) and breeding habitat for the eastern freetail-bat (*Mormopterus norfolkensis*).

The park provides important habitat for migratory bird species listed under international agreements, including the curlew sandpiper (*Calidris ferruginea*), sharp-tailed sandpiper (*C. acuminata*) and the red knot (*C. canutus*). The park is a site on the East Asian – Australasian Flyway and is part of the Hunter Estuary Important Bird Area (BirdLife International 2017).

Cultural landscape

Situated within the Hunter Estuary, the park is part of a broader Aboriginal cultural landscape that extends east to Stockton Beach and west to the woodland areas and foothills of Minmi. Rich in traditional food resources and cultural meaning, today the park provides cultural opportunities for present and future generations of Worimi and Awabakal people and educational opportunities for the wider community.

Historic heritage

The park contains areas that represent some of Newcastle's earliest European settler history, including the early coal and timber industries, quick lime production for colonial building construction, salt, agriculture and food production and the physical remnants of the pre-1950s dairying industry. The park contains the 1890 Ash Island Schoolmasters House,

which is of local historical significance, and the World War II Radar Station buildings, which are of state heritage significance (OEH 2015a).

In the late 1800s, Ash Island was home to two of Australia's most skilled natural history artists, Harriet and Helena Scott. These women recorded the island's plants and animals, and went on to become two of the most distinguished illustrators of plants and animals in late 19th century Australia.

Social value

The park is important to the Newcastle community as a free, accessible, recreational park for uses such as walking, birdwatching, cycling and fishing. It provides opportunities for special interest groups including the Kooragang Wetland Rehabilitation Project volunteers, the Hunter Bird Observers Club and the Rebel Flying Club (model aircraft). The park also offers unique opportunities for providing information and education on estuarine restoration and threatened species.

Scientific values

Volunteers, local schools, universities and research institutions have a long history of involvement in research in the park. The park provides ongoing research potential in the fields of climate change impacts, estuarine and freshwater wetland rehabilitation, shorebird behaviour and habitat requirements and the management of threatened species and communities.

2. Management context

2.1 Legislative and policy framework

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

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

A plan of management is a statutory document under the National Parks and Wildlife Act. Once the Minister has adopted a plan, the plan must be carried out and no operations may be undertaken in relation to the lands to which the plan relates unless the operations are in accordance with the plan. This plan will also apply to any future additions to the 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 are reserved under the National Parks and Wildlife Act to protect and conserve areas containing outstanding or representative ecosystems, natural or cultural features or landscapes or phenomena that provide opportunities for public appreciation, inspiration and sustainable visitor or tourist use and enjoyment.

Under section 30E of the Act, national parks are managed to:

- conserve biodiversity, maintain ecosystem functions, protect geological and geomorphological features and natural phenomena and maintain natural landscapes
- conserve places, objects, features and landscapes of cultural value
- protect the ecological integrity of one or more ecosystems for present and future generations
- promote public appreciation and understanding of the park's natural and cultural values
- provide for sustainable visitor or tourist use and enjoyment that is compatible with conservation of natural and cultural values
- provide for sustainable use (including adaptive 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 natural and cultural heritage. Opportunities are provided for appropriate visitor use in a manner that does not damage conservation values.

Section 30E also explicitly provides for development described in section 185A of the Act to be undertaken in a 'special area' as defined in the Hunter Water Act, having regard to the conservation of the park's natural and cultural values. These developments would principally relate to the purposes of extracting, treating, reticulating or replenishing groundwater.

Wetlands of international importance (Ramsar wetlands)

The park encompasses the Kooragang component of the Hunter Estuary Wetlands Ramsar site. The other, smaller component of the site is the Hunter Wetlands Centre Australia (see Figure 1). The Hunter Estuary Wetlands Ramsar site was listed under the Ramsar Convention on Wetlands of International Significance (UNESCO 1971) in 1984. Countries that are parties to the Convention on Wetlands undertake to implement policies that guarantee the wise and sustainable use of wetlands.

The Ramsar wetlands site includes the original area that was reserved as Kooragang Nature Reserve in 1983 and the Hunter Wetlands Centre Australia site at Shortland (previously known as Shortland Wetlands), which is freehold land that was added to the Ramsar site in 2002.

Management principles for Australian Ramsar sites are established under regulations to the Environment Protection and Biodiversity Conservation Act. These principles state that the primary purpose of management of a Ramsar wetland is to describe and maintain the ecological character of the wetland and to formulate and implement planning that promotes its conservation and its sustainable use. In addition to the Australian Ramsar management principles, other guiding principles are established by the Ramsar Convention on Wetlands and national guidelines, which provide a framework for the Ramsar Convention's implementation in Australia. These provide jurisdictions and other interested parties with clear guidance on the management of Ramsar sites. The above principles and guidelines have been considered in preparing this plan.

NSW State Heritage Register

The park contains a collection of buildings associated with a World War II Radar Station (see Figure 2) that are listed on the NSW State Heritage Register (SHR Listing number 01815). The Radar Station buildings are in the infrastructure corridor, which are Part 11 lands (see Sections 1.1 and 5.3). NPWS policy requires all items listed on the State Heritage Register to have a conservation management plan and be maintained in accordance with best practice management principles. Under the Heritage Act, all buildings listed on the State Heritage Register, other than ruins, must meet minimum standards of maintenance and repair (see Section 3.5).

2.3 Compensatory habitat works

A memorandum of understanding was established between NPWS and the former Newcastle Port Corporation (now part of the NSW Ports Authority). The outcome of the memorandum of understanding is that the priority for management in certain areas of Hunter Wetlands National Park on Ash Island is the construction and management of biodiversity habitats for green and golden bell frog. Biodiversity offsets are measures that benefit biodiversity by compensating for adverse impacts of developments that are occurring elsewhere. The developments that have been offset by works in the park include Newcastle Coal Infrastructure Group and Broken Hill Proprietary (BHP) Billiton projects on nearby Kooragang Island. The biodiversity offset strategy is under way with some habitat sites already established on Ash Island for the green and golden bell frog (see Section 5.2).

In addition, shorebird habitat offsets resulting from planning agreements for rail infrastructure adjoining Kooragang Island are also being negotiated for other areas in the park on Ash Island.

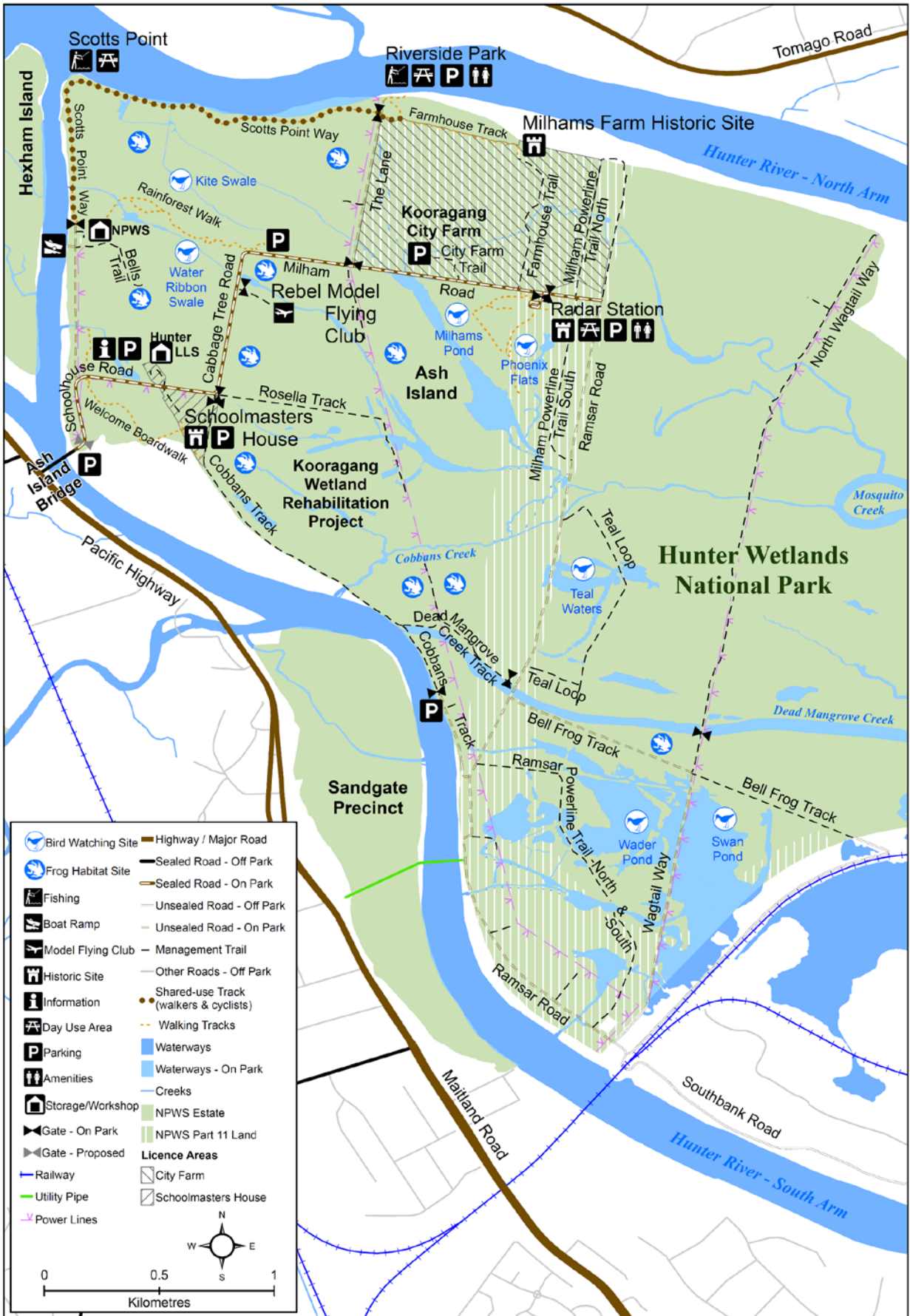


Figure2 Ash Island (Hunter Wetlands National Park)

2.4 Specific management directions

The park lies within a highly modified and evolving estuarine and freshwater environment. Key challenges for park management are the significant predicted growth in the Hunter Region's population, the growing popularity of outdoor recreational activities and the neighbouring port, which is the largest coal exporting port in the world (see Figure 1, port facilities along Cormorant Road).

It is recognised that reinstating the original wetland environment is not achievable throughout the park. Instead, the primary management objectives are to protect the internationally important wetlands and to provide for sustainable visitor use and enjoyment.

A plan of management prepared for Kooragang and Hexham Swamp nature reserves was adopted in 1998. These reserves were revoked and re-reserved as part of Hunter Wetlands National Park (see Section 1.1). Key management directions from the *Kooragang Nature Reserve and Hexham Swamp Nature Reserve Plan of Management* (NPWS 1998) have been incorporated into this plan.

This plan provides a management framework to ensure that key conservation objectives are met while recognising the increased emphasis on recreational opportunities for the future. 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:

- Increase shorebird, fish and estuarine habitats and rehabilitate estuarine and freshwater wetlands through water management and mangrove removal.
- Manage the Ramsar-listed wetland to reduce the effects of habitat loss and fragmentation by restoring and protecting habitat and diversity, and through implementing appropriate pest and weed control programs.
- Rehabilitate and remediate acid sulfate soils through the inundation of wetland areas.
- Conserve and manage the sites of historic importance including the state-listed World War II Radar Station buildings.
- Manage Aboriginal cultural heritage in consultation with the Awabakal and Worimi traditional owners through the conservation of archaeological sites, the interpretation of the cultural landscape, and the provision of opportunities for employment and cultural experiences for the Aboriginal community.
- Provide a range of ecologically sustainable, nature-based recreational and educational opportunities that are consistent with the park's conservation significance.
- Work with and continue to support volunteers and educational institutions to undertake research projects and monitoring activities in the park.
- Ensure non-park infrastructure is managed in accordance with the conservation values of the park.

3. Values

This plan aims to conserve and enhance the exceptional natural values as well as the cultural values of the park. To make this plan clear and easy to use, various aspects of natural heritage, cultural heritage, threats and ongoing use are dealt with individually, although these features are interrelated.

3.1 Geology, landscape and hydrology

The park lies in the eastern, coastal margin of the lower Hunter Estuary. It is situated in a system characterised by complex and interdependent interactions between the Hunter River, tributary channels, the sea and a mosaic of mudflats, beaches, sand spits, mangrove forests, saltmarsh, freshwater wetlands and grassland with floodplain woodland and rainforest on upland areas.

The Hunter River begins in the Mount Royal Range on the western side of Barrington Tops and is the largest coastal catchment in New South Wales. Two rivers, the Paterson and Williams, flow into the Hunter Estuary and drain into the north-east of the Hunter River catchment area. The tidal limit for the Paterson River occurs between Paterson and Gostwyck, approximately 70–75 kilometres from the ocean, and at Seaham Weir on the Williams River, approximately 46 kilometres from the ocean (MHL 2003).

The geomorphic characteristics are those of a typical graded alluvial river and associated floodplain. The character of the estuary transitions from river flats to an estuarine delta below Hexham. The Hunter River deposits sand and silt by way of the two main river channels: the north arm and south arm (see Figure 1). The north arm of the river opens into a shallow, circular embayment called Fullerton Cove. The river exits the estuary into the Pacific Ocean between Pirate Point at Stockton and the rocky outcrops of Nobbys Head. The dominant island in the lower estuary is the man-made Kooragang Island at the mouth of Fullerton Cove, which represents the remnants of the island delta comprised of up to 10 other islands (Williams et al. 2000).

More than 200 years of European intervention has altered the hydrology of the estuary through the construction of drainage and flood mitigation systems as well as dredging activities to aid shipping movements. The associated infrastructure includes more than 112 culverts, bridges and floodgates, and 77 kilometres of drains and levees (Williams et al. 2000; KWRP 2005). All these works have resulted in significant changes to the geology and hydrology of the landscape across large areas of the park. The *Hunter Valley Flood Mitigation Act 1956* allowed for the construction in 1976 of a significant, 12-kilometre long levee bank in the park around Fullerton Cove for flood mitigation. Major floodgates were installed in 1971 on Ironbark Creek at Hexham Swamp under the provisions of the Act to increase agricultural and grazing opportunities.

Kooragang Island has progressively been altered through reclamation, river stabilisation works and dredging to create the Newcastle port facilities. Channels have also been deepened to allow for shipping movements in the south arm of the river. The land reclamation works had predominantly been completed before the gazettal of Kooragang Nature Reserve in 1983. Kooragang Dyke, on the northern side of Kooragang Island, was constructed in the 1960s and is a series of rock dyke walls approximately 1.5 kilometres in length. The dyke was constructed in preparation for infilling the area for industrial development, but the project was subsequently abandoned and is now an important habitat feature.

Soils in the park are characterised by sediments from further upstream that have been deposited in swamps and mud flats. They contain black silty and highly saturated soft clays

with underlying light grey silty sand (NPWS 1998). In some areas of the park the soils are typically strongly leached and are acid throughout the profile.

Acid sulfate soils, a naturally occurring feature of estuaries along the eastern Australian coastline, are historically incompatible with traditional agricultural land use. There is a high risk of acid sulfate soil in several areas within the park (DPI 2008). Some areas in the park, for example near Tomago Wetlands, have a history of wetland drainage which has led to the oxidisation of sulfidic soils resulting in acid leaching from the soil and causing water quality problems.

Issues

- The Hunter River has had a history of major flooding, and it is predicted that climate change will lead to increased coastal flooding and storms (see Section 4.4). This will influence how the park is managed with respect to the location of infrastructure and the management of floodgates and other flood mitigation structures.
- The Hunter Valley Flood Mitigation Scheme continues to operate under the powers of the *Water Management Act 2000* (see Section 5).
- Pollution events that have impacted on the park's conservation values include:
 - the discharge of 72,000 litres of heavy fuel oil by the MS *Magdalene* in 2010, which impacted waterbirds, saltmarsh, mangroves and invertebrates living in the mudflats at Stockton Sandspit and Fullerton Cove
 - groundwater contamination by per-fluoroalkyl and poly-fluoroalkyl substances (or 'PFAS') sourced from the Williamstown Airforce Base, which triggered a 12-month closure of Fullerton Cove to fishing during 2015–16.
- The cumulative impacts from past, current and future activities in and adjacent to the park are poorly understood. Industrial, agricultural and residential activities can affect the sensitive ecosystem health of the estuary through dredging and industrial and urban discharges (including wastewater, stormwater, sewage and oil spills).
- Acid sulfate soil runoff can also impact water quality and estuarine ecosystems. Historic drainage, floodgates and levees have altered the geology, landscape and hydrology with legacies such as acid sulfate soils and changes to freshwater input from neighbouring developments that will continue to need management into the future.
- The drains need to occasionally be cleared in the Tomago Wetlands and a drain management plan needs to be prepared in accordance with the NSW Environment Protection Authority guidelines for managing acid sulfate soils (Tulau 2007).
- Channel dredging may be linked to increased tidal range. This has resulted in significant ecological change through saltmarsh loss and mangrove expansion (see Section 5.2).

Desired outcomes

- The sensitive environments in the park are protected from further impacts.
- The impacts of pollution on air and water quality are reduced.
- The environmental impacts of increased tidal range on saltmarsh and mangroves are reduced.
- The negative impacts of acid sulfate soil on water quality and estuarine habitat are reduced.

Management response

- 3.1.1 Actively manage the hydrology using water management structures. Manage specific areas of mangroves to minimise the effects of the tidal range changes on habitat loss.
- 3.1.2. Contribute to the preparation of emergency risk planning with NSW Ports Authority for the management of oil/chemical spills.
- 3.1.3. Establish and maintain oiled fauna rescue and rehabilitation preparedness with other stakeholders, in particular the port authority and wildlife rescue organisations.
- 3.1.4. Contribute to management strategies for the prevention of stormwater pollution of waterways in the Hunter Estuary with local councils.
- 3.1.5. Cooperate with other agencies in responding to pollution events, including testing and monitoring of contamination.
- 3.1.6. Manage the impact of acid sulfate soil on the park's waterways by flushing strategies including opening floodgates.
- 3.1.7. Contribute to strategic reviews of the Hunter Valley Flood Mitigation Scheme with the aim of improving wetland values.

3.2 Native plants

The park is a coastal vegetation ecosystem containing estuarine tidal and intertidal zones of brackish and freshwater wetlands, with grassland, floodplain forest and rainforest at slightly higher elevations.

Primarily the park supports estuarine vegetation including extensive areas of mangrove forest, swamp oak forest and saltmarsh. The mangrove areas are dominated by grey mangrove (*Avicennia marina*) and to a lesser extent river mangrove (*Aegiceras corniculatum*).

Areas with fresh or brackish water contain freshwater wetlands with a variety of salt-tolerant native sedges and grasses. The common reed (*Phragmites australis*) forms extensive monocultures in Hexham Swamp and Tomago Wetlands, which is consistent with highly disturbed ecosystems (Chambers et al. 2012). Narrow-leaved cumbungi (*Typha domingensis*) is found in Tomago Wetlands, on Ash Island and in areas surrounding Hexham Swamp.

There are five vegetation communities in the park that are listed as threatened ecological communities under the Biodiversity Conservation Act (see Table 1).

Table 1: Threatened ecological communities in the park

Community name (short title) *	BC Act status	Area (hectares)
Freshwater Wetlands on Coastal Floodplains	Endangered	854
Coastal Saltmarsh	Endangered #	559
Swamp Oak Floodplain Forest	Endangered	104
Swamp Sclerophyll Forest on Coastal Floodplains	Endangered	8
Lowland Rainforest	Endangered	0.33

BC Act = Biodiversity Conservation Act.

* all of these communities are found in the North Coast, Sydney Basin and South East Corner bioregions.

listed as vulnerable under the Environment Protection and Biodiversity Conservation Act.

There are large areas of endangered coastal saltmarsh throughout the park, with the dominant species being samphire (*Sarcocornia quinqueflora*) and saltwater couch (*Sporobolus virginicus*). In slightly higher elevation areas on the floodplain, the park is interspersed with pasture and some remnant rainforest areas. There are very small patches of lowland rainforest on the western side of Ash Island (Kleinfelder 2016). Other slightly elevated areas also contain remnant pockets of swamp oak (*Casuarina glauca*) and *Melaleuca* spp., in particular in areas on Ash Island, Hexham Swamp and at Tomago and Kooragang wetlands.

The park supports three threatened plants (see Table 2).

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 2007]). These actions are currently prioritised and implemented through the *Saving our Species* program, which aims to maximise the number of threatened species that can be secured in the wild in New South Wales for 100 years (OEH 2013b).

Table 2: Threatened plants recorded in the park

Common name	Scientific name	BC Act status	EPBC Act status
	<i>Maundia triglochoides</i>	Vulnerable	
White-flowered wax plant	<i>Cynanchum elegans</i>	Endangered	Endangered
	<i>Zannichellia palustris</i>	Endangered	

BC Act = Biodiversity Conservation Act.

EPBC Act = Environment Protection and Biodiversity Conservation Act.

Saltmarsh and mangroves

The park has a long history of human intervention that has affected the original ecosystem. A main objective for the park is to enhance and protect areas of original saltmarsh in order to expand nursery habitat for estuarine species and to expand habitat for shorebirds. This is being achieved through controlled reintroduction of tidal flows from the Hunter River to create a saltmarsh mosaic, and through targeted strategic removal of mangroves as well as control of exotic spiny rush (*Juncus acutus*). The reintroduction of tidal flows to create saltmarsh has seen a rapid proliferation of spiny rush (see Section 4.2) in some areas, as native and exotic freshwater species are replaced by more salt-tolerant species.

Areas of saltmarsh in the Hunter Estuary have reduced due to the expansion of mangrove communities. The Ecological Character Description prepared for the Hunter Estuary Wetlands Ramsar site identified saltmarsh loss as an unacceptable change in the ecological character of the site (DSEWPC 2010). To address this, restoration works commenced on Ash Island, Stockton Sandspit and other smaller areas in the early 2000s. Restored areas of wetland at Tomago and Hexham Swamp now have significant areas of saltmarsh that support large numbers of migratory birds.

In New South Wales, mangroves are protected under the Fisheries Management Act. The removal of mangroves in the park is subject to a licence with the relevant regulatory authority. At significant migratory shorebird sites within the park, programs for mangrove control have been implemented to maintain saltmarsh integrity and shorebird habitat. These areas include Windeyers Reach, Kooragang Dykes, Ash Island, Stockton Sandspit, Sandy and Smiths islands, Tomago Wetlands and some areas of lands associated with the compensatory habitat works (see Figure 1). Approximately 470 hectares in the park are subject to mangrove seedling removal to preserve migratory wader habitat. Any removal of

mangroves is conducted under licence and in consultation with local officers from the relevant regulatory authority.

A saltmarsh action plan (OEH 2016) for the park has been prepared to manage the expansion of this threatened community. This plan includes monitoring of shorebird populations and mapping of saltmarsh areas.

Stockton Sandspit is an artificially created landscape formed from dredge spoil from the building of Stockton Bridge in 1971 (Herbert 2007a). The sandspit is comprised mainly of a lagoon, open sand and saltmarsh, which is maintained to maximise bird roosting, foraging and nesting habitat. Habitat along the southern edge of the sandspit is being optimised by mangrove and weed removal and by plantings of local coastal species. On the northern river edge, the spit is fringed by mangroves and mudflats extending north up the river channel to Fullerton Cove.

Sandy and Smiths islands are two of the few remaining intact islands in the estuary. They support saltmarsh meadow, pockets of coastal banksia (*Banksia integrifolia*), swamp oak, common reed and exotic species such as bitou bush (*Chrysanthemoides monilifera*) in between brackish wetland.

At **Tomago Wetlands**, the park extends from an estuarine wetland of mangrove forest, through to swamp oak forest in brackish water, freshwater swamp oak forest, to swamp sclerophyll forest. In drier areas, smooth-barked apple (*Angophora costata*) and banksia woodland are common. Tomago Wetlands was previously a mosaic of saltwater and brackish environments dominated by saltmarsh.

Kooragang Island extends from Stockton Bridge to Mosquito Creek and is characterised by saltmarsh and mangrove forest with isolated pockets of swamp oak forest. Introduced kikuyu (*Pennisetum clandestinum*) pasture is predominant in higher areas, a legacy of previous farming activities. The non-tidal areas would have previously supported forests of swamp oak, *Melaleuca* spp., cabbage tree palms (*Livistona australis*) and other rainforest species which were cleared for agricultural purposes.

Ash Island was once a distinct island separated from Kooragang Island by Mosquito Creek. The creek was in-filled in the 1960s and Ash Island became the western part of Kooragang Island. Ash Island and the other lower Hunter River islands originally contained lowland rainforest on floodplain, a threatened ecological community that now occurs only as small remnants scattered on the NSW north coast. A project to reinstate rainforest on sections of Ash Island commenced in 1993. This project is now part of the Kooragang Wetland Rehabilitation Project, which is currently managed by Hunter Local Land Services under licence (see Section 5.2). Freshwater swales with kikuyu pasture dominate the northern end of Ash Island while the southern and eastern areas of Ash Island are characterised by mangrove and saltmarsh vegetation (Land Systems EBC 1994; Winning 1996).

Hexham Swamp once supported extensive areas of estuarine wetlands. Historic vegetation surveys identified eight vegetation types including mangroves, saltmarsh and brackish grassland. Hexham Swamp covers approximately 2500 hectares of the 12,500-hectare Ironbark Creek catchment and drains into the Hunter River. Water flowing down Blue Gum and Ironbark creeks is captured on the floodplain creating Hexham Swamp. In 1971 the construction of floodgates on Ironbark Creek drained the swamp and inhibited tidal flows entering the swamp from the Hunter River.

Issues

Vegetation communities in the park have been significantly altered by the construction of flood mitigation and drainage structures, dredging of estuarine channels and clearing for agriculture and grazing. The management directions include protecting and rehabilitating wetland vegetation communities that historically would have been present before structures

were installed, while recognising that complete reversal to the original vegetation community structure is not possible. In specific areas of the park there is a need to manually remove mangroves to allow saltmarsh to expand and to reintroduce and manage tidal flows.

Desired outcomes

- A strategic approach is utilised to manage saltmarsh habitats, in particular through mangrove removal, wetland restoration and management of tidal flows.
- Threatened plant species, populations and ecological communities are conserved.
- Negative impacts on threatened plants species and communities are minimised.
- Structural diversity and habitat values are restored in degraded areas.
- The ecology and conservation needs of the park are improved through research.

Management response

- 3.2.1. Implement a strategic, project-based approach to shorebird habitat enhancement by way of wetland restoration, management of tidal flows and selected mangrove removal in the park.
- 3.2.2. Implement relevant strategies in the *Biodiversity Conservation Program* for threatened species, populations and ecological communities present in the park.
- 3.2.3. Support and encourage strategic rehabilitation works in the broader Hunter Estuary by agencies, conservation groups and not-for-profit organisations.
- 3.2.4. Encourage further research and planning on the park's vegetation, in particular, the distribution, migration pathways, ecology and management needs of threatened species and communities.

3.3 Native animals

In 2011, a baseline fauna survey was undertaken in the park and 110 fauna species were recorded, including 62 birds, 24 mammals, 14 frogs and 10 reptiles (Ecobiological 2011). Table 3 lists the 41 threatened animal species recorded in the park.

Table 3: Threatened animals recorded in park

Common name	Scientific name	BC Act status	EPBC Act status
Frogs			
Green and golden bell frog	<i>Litoria aurea</i>	Endangered	Vulnerable
Birds			
Australasian bittern	<i>Botaurus poiciloptilus</i>	Endangered	Endangered
Bar-tailed godwit	<i>Limosa lapponica</i>		Vulnerable Migratory
Beach stone-curlew	<i>Esacus magnirostris</i>	Critically Endangered	
Black falcon	<i>Falco subniger</i>	Vulnerable	
Black-necked stork	<i>Ephippiorhynchus asiaticus</i>	Endangered	
Black-tailed godwit	<i>Limosa limosa</i>	Vulnerable	Migratory

Common name	Scientific name	BC Act status	EPBC Act status
Broad-billed sandpiper	<i>Limicola falcinellus</i>	Vulnerable	Migratory
Comb-crested jacana	<i>Irediparra gallinacea</i>	Vulnerable	
Curlew sandpiper	<i>Calidris ferruginea</i>	Endangered	Critically endangered Migratory
Eastern curlew	<i>Numenius madagascariensis</i>		Critically endangered Migratory
Eastern grass owl	<i>Tyto longimembris</i>	Vulnerable	
Eastern osprey	<i>Pandion cristatus</i>	Vulnerable	
Freckled duck	<i>Stictonetta naevosa</i>	Vulnerable	
Greater sand plover	<i>Charadrius leschenaultii</i>	Vulnerable	Migratory
Great knot	<i>Calidris tenuirostris</i>	Vulnerable	Migratory
Lesser sand plover	<i>Charadrius mongolus</i>	Vulnerable	Migratory
Little eagle	<i>Hieraaetus morphnoides</i>	Vulnerable	
Little lorikeet	<i>Glossopsitta pusilla</i>	Vulnerable	
Little tern	<i>Sternula albifrons</i>	Endangered	Migratory
Magpie goose	<i>Anseranas semipalmata</i>	Vulnerable	
Painted snipe	<i>Rostratula australis</i>	Endangered	Endangered Migratory
Pied oystercatcher	<i>Haematopus longirostris</i>	Endangered	
Red knot	<i>Calidris canutus</i>		Endangered Migratory
Sanderling	<i>Calidris alba</i>	Vulnerable	Migratory
Sooty oystercatcher	<i>Haematopus fuliginosus</i>	Vulnerable	
Spotted harrier	<i>Circus assimilis</i>	Vulnerable	
Square-tailed kite	<i>Lophoictinia isura</i>	Vulnerable	
Terek sandpiper	<i>Xenus cinereus</i>	Vulnerable	Migratory
Varied sittella	<i>Daphoenositta chrysoptera</i>	Vulnerable	
White-bellied sea-eagle	<i>Haliaeetus leucogaster</i>	Vulnerable	
White-fronted chat	<i>Epthianura albifrons</i>	Vulnerable	
Mammals			
Eastern bentwing-bat	<i>Miniopterus schreibersii oceanensis</i>	Vulnerable	
Eastern false pipistrelle	<i>Falsistrellus tasmaniensis</i>	Vulnerable	
Eastern freetail-bat	<i>Mormopterus norfolkensis</i>	Vulnerable	
Greater broad-nosed bat	<i>Scoteanax rueppellii</i>	Vulnerable	
Grey-headed flying-fox	<i>Pteropus poliocephalus</i>	Vulnerable	Vulnerable
Large-eared pied bat	<i>Chalinolobus dwyeri</i>	Vulnerable	Vulnerable
Little bentwing-bat	<i>Miniopterus australis</i>	Vulnerable	
Southern myotis	<i>Myotis macropus</i>	Vulnerable	

Common name	Scientific name	BC Act status	EPBC Act status
Yellow-bellied sheath-tail bat	<i>Saccolaimus flaviventris</i>	Vulnerable	

BC Act = Biodiversity Conservation Act.

EPBC Act = Environment Protection and Biodiversity Conservation Act.

The endangered green and golden bell frog was first recorded in the northern end of the park at Ash Island in 1997. This species has subsequently been found in a number of habitats in the park including both freshwater and brackish swales. Green and golden bell frog habitat is being constructed on Ash Island through the compensatory habitat offset program and will become a significant asset in the park (see Section 5.2).

Two of the most notable of the 10 species of reptile recorded in the park include the mainland she-oak skink (*Cyclodomorphus michaeli*) and the tree skink (*Egernia mcphreei*), believed to be at the southernmost extent of their range. The casuarina forests at Tomago Wetlands and Ash Island provide the most diverse reptile habitat in the park. The red-bellied black snake (*Pseudechis porphyriacus*), eastern brown snake (*Pseudonaja textilis*) and black-bellied swamp snake (*Hemiaspis signata*) are common.

Native terrestrial mammals recorded in the park include the brown antechinus (*Antechinus stuartii*), swamp rat (*Rattus lutreolus*) and the eastern grey kangaroo (*Macropus giganteus*). The park does not include large connected patches of woodland which are required to support other local macropod species, such as the swamp wallaby (*Wallabia bicolor*) and the red-necked wallaby (*Macropus rufogriseus*) (Ecobiological 2011).

The park is home to a significant number of micro-bat species currently listed as vulnerable under the Biodiversity Conservation Act, including the eastern freetail-bat. This species was first recorded in significant numbers on Ash Island in 2009 with maternity colonies roosting in mature mangrove hollows (McConville 2011). The southern myotis and yellow-bellied sheath-tail-bat (both threatened) have been recorded at Ash Island and Kooragang Island adjacent to the coal port facilities.

The Hunter Estuary is considered one of the most important coastal estuaries in New South Wales and supports an abundance and diversity of bird life. This was the primary reason for the original gazettal of the Kooragang Nature Reserve and its subsequent Ramsar listing in 1984 (see Section 2.2). It supports birds in all stages of their life cycle including breeding, migration stopover, roosting, foraging and drought refuge (DSEWPC 2010). At least 42 migratory species listed on the Environment Protection and Biodiversity Conservation Act have been recorded in the park. Over 190 species of birds have been recorded on Ash Island since 1980. The Hunter Estuary, including the park, is also listed as an Important Bird Area because of the diversity and numbers of migratory birds that the wetland supports.

The estuary is situated near the southern end of the East Asian – Australasian Flyway. The flyway extends from within the Arctic Circle, through Russia, East and South-east Asia, to Australia and New Zealand, stretching across 22 countries (EAAFP 2014). Approximately 55 migratory species travel along it, which includes about five million birds.

Migratory species need stepping stones of suitable habitat along the flyway, such as the Hunter Wetlands, where they can feed, fatten up and rest before they start their arduous journey back to the northern hemisphere for the breeding season.

Since European settlement of the estuary, shorebird habitat has significantly declined. Human-induced impacts both directly within the estuary and along the East Asian – Australasian Flyway are thought to be related to the decline of migratory shorebirds. To address declining habitat, there are currently a number of significant projects undertaking rehabilitation and protection works within the park.

The Tomago Wetland Rehabilitation Project aims to rehabilitate 500 hectares of drained agricultural land, through tidal inundation from the Hunter River and management of flood

mitigation infrastructure. In 2012, migratory shorebirds were recorded at Tomago Wetlands for the first time since the 1970s. There has been an associated increase in available vegetated estuarine habitat for aquatic species as a result of these works.

The Hexham Swamp Rehabilitation Project aims to restore 700 hectares of estuarine woodland both within the park and in land owned and managed by Hunter Local Land Services (see Section 5.2). The Hunter Local Land Services project is aiming to rehabilitate estuarine habitat for fish and prawn nurseries habitat, and to increase the diversity and numbers of shorebirds. Rehabilitation has involved the staged opening of the Ironbark Creek floodgates, which were originally installed in the 1970s.

Other key areas of shorebird habitat within the park being rehabilitated include:

- Kooragang Dykes, part of which has been stabilised and raised to provide roosting habitat
- Windeyers Reach and Ash Island, where saltmarsh is being maintained through strategic mangrove removal
- Stockton Sandspit, which has had a rehabilitation project since 2000 with the active support of Hunter Bird Observers Club volunteers.

Rehabilitation works throughout the park have contributed to a large increase in shorebird habitat in the area. Monitoring of shorebird numbers and habitat are undertaken monthly by the Hunter Bird Observers Club. This group makes a significant contribution to the existing knowledge of shorebird habitat and provides advice on management directions.

As for plants, strategies for the recovery of threatened animal species and populations have been set out in the statewide *Biodiversity Conservation Program* (formerly known as the *Threatened Species Priorities Action Statement* [DECC 2007]) and prioritised and implemented through the *Saving our Species* program.

Issues

- With declining available habitat, continuing industrial development and 'coastal squeeze', the ability to geographically expand the shorebird habitat or allow for vegetation community migration is limited (see Section 4.1).
- Kooragang Dykes and Stockton Sandspit are key shorebird habitat areas that can be impacted by disturbance from visitors accessing these areas for recreation, boating and fishing purposes (see Section 3.6).
- The amphibian chytrid fungus is a significant threat to the green and golden bell frog and is found on Kooragang Island and at Hexham Swamp.
- There is the potential for pollution events in the estuary to affect large areas of shorebird roosting and feeding habitat.

Desired outcomes

- Negative impacts on threatened species are minimised.
- The habitat and populations of threatened animal species are protected and maintained.
- Human disturbance to roosting and foraging shorebirds is minimised, particularly in the months before northwards migration (i.e. between January and April) and disturbance to nesting shorebirds at Stockton Sandspit is minimised, especially during spring.
- Structural diversity and habitat values are restored in degraded areas.
- Pollution events are prevented.

Management response

- 3.3.1. Continue implementing existing significant wetland restoration projects and seek opportunities to improve habitat through targeted restoration projects.
- 3.3.2. Implement relevant strategies in the *Biodiversity Conservation Program* for threatened animal species and populations.
- 3.3.3. Undertake strategic removal of mangroves in the park to rehabilitate bird habitat.
- 3.3.4. Support Hunter Bird Observers Club in their shorebird monitoring, habitat restoration and research activities throughout the park.
- 3.3.5. Support the research programs for green and golden bell frogs, including research on chytrid fungus.
- 3.3.6. Work with the port authority to ensure a rapid and effective response should an oil spill or pollution incident occur.

3.4 Aboriginal connections to Country

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.

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, places and related issues; and in promoting and presenting Aboriginal culture and history.

The park is part of Country for the Awabakal People and the Worimi People. Awabakal Country stretches south from the Hunter River, including Newcastle; and Worimi Country lies to the north and east of the Hunter River.

The Hunter Estuary supports an abundance of food resources including freshwater, estuarine and coastal shellfish and crustaceans, fish, eels, waterbirds and small and large mammals. Early 19th century Europeans observed local Awabakal People to be tall and healthy, an indication that they had access to a varied food supply (Rappoport 2010).

The Gathang (Warrimay) local language dictionary contains a rich vocabulary for resources related to the estuary including: *mundal* (net), *muting* (fishing spear), *guuyang* (canoe), marine and terrestrial animals and plants including *bitjagang* (cockles, mussels), *dhirrabuwi* (oyster), *gatigan* (mud crab) and over 17 species of fish (Lissarrague 2010).

Archaeological sites are evidence of Aboriginal occupation that relate to a range of other aspects of Aboriginal cultural heritage. They are important evidence of Aboriginal history and are part of the culture of local Aboriginal people today.

Sites of particular cultural significance exist in the park's vicinity. Archaeological sites are of high significance to the Awabakal and Worimi peoples because they provide a tangible connection to cultural practices and their ancestors.

Limited archaeological sites have been recorded in the park, mainly as a result of the park being a wetland environment and also due to the history of development and modifications to the landscape. These factors, together with sea level rise over the last 6,000 to 12,000 years, have potentially impacted existing Aboriginal sites that are now part of an ancient, underwater coastline.

Issues

- There are limited records of archaeological sites in the park, partly as a consequence of data not being appropriately recorded when archaeological investigations are undertaken.

Desired outcome

- The Worimi and Awabakal Aboriginal communities are involved in management of the Aboriginal cultural values of the park so that impacts on heritage values are minimised and cultural values are better understood.

Management response

- 3.4.1. Encourage opportunities for the Awabakal and Worimi Aboriginal communities to be involved in rehabilitation work in the park.
- 3.4.2. Continue to consult and involve the Awabakal and Worimi local Aboriginal land councils, other relevant Aboriginal community organisations and custodial families in the management of their Country, including the management of Aboriginal sites and places, and cultural and natural values.
- 3.4.3. Ensure that any archaeological sites found are appropriately recorded and that information is shared with the local Aboriginal community.
- 3.4.4. Encourage further research into the Aboriginal cultural heritage values of the park with the Awabakal and Worimi local Aboriginal land councils and other relevant Aboriginal community organisations.
- 3.4.5. Provide opportunities for Aboriginal people to access Country, to maintain, renew or develop cultural practices and associations.
- 3.4.6. Permit cultural resource use where in accordance with NPWS policy and legislation.

3.5 Shared heritage

Heritage places and landscapes are made up of living stories as well as connections to the past that individuals and communities have inherited from the past and wish to conserve for current and future generations, and can include natural resources, objects, customs and traditions. Cultural heritage consists of places and items that may have historical, scientific, cultural, natural, archaeological, architectural, aesthetic and social significance. NPWS conserves the significant heritage features of NSW parks.

When first explored by Europeans, the Hunter River was heavily timbered with mangroves in the lower tidal reaches and rainforest thickets behind the mangroves. Areas of low-lying land as well as higher ground with shrubby tall open forest dominated the area. Reeds and rushes fringed the river banks and many of the lagoons (Rappoport 2010).

The Awabakal and Worimi peoples made first contact with Europeans when convicts guarded by soldiers were sent to the mouth of the Hunter River to collect coal after its discovery in 1797. Some convicts escaped and lived in the Port Stephens area with the local Worimi People, who considered convicts to be reincarnations of people in their family group (Rappoport 2010).

When the Newcastle convict settlement was established in 1804, the Awabakal and the Worimi mingled freely with the Europeans and relations between the two groups were considered to be affable. The Awabakal also supplied food to the settlement and often took free men on hunting and fishing expeditions (Rappoport 2010). Newcastle developed into an

important cultural and trading site. By the early 19th century, in the wake of European settlement, the numbers of Aboriginal people living on the coast between Sydney and Newcastle were considerably reduced, primarily due to disease outbreaks. Conflict with pastoralists became the most serious problem facing Aboriginal people after the opening up of the Hunter Valley to private settlement. Growing tensions and lack of government assistance led to a series of massacres of Aboriginal people by the settlers. By the 1840s, many Awabakal People had died or moved to the Newcastle area in search of work or rations (Rappoport 2010).

Historical accounts related to Aboriginal people in what is now the park are limited. In 1893, *The Newcastle Morning Herald and Miners Advocate* describes an Aboriginal reserve 100 feet from high water mark all around the Ash Island, it reports 'Ash island which was in the 1840s a favourite place for Aboriginal people, still in existence in 1893 (though) no Aboriginal people used it'.

Early industry

Evidence suggests that good timber was present in the area prior to 1801 and collecting red cedar (*Toona ciliata*) became a job for many convicts. After the penal settlement at Newcastle was abandoned in 1821, private individuals were encouraged to enter the timber trade (Rappoport 2010). However, within 20 years of European settlement in the area, timber such as red cedar and blueberry ash (*Elaeocarpus obovatus*) had been depleted from the Hunter Estuary.

In 1801, Colonel Paterson wrote of the immense deposits of oyster shells in Fullerton Cove at Limeburners Bay and adjacent to Sandy Island at Fern Bay. By 1818, over 50 convict lime burners were established in a camp in extremely harsh conditions and tasked to obtain large quantities of shell to produce lime (Marsden 2002). The lime produced was transported down to Sydney and used in the building of the Hyde Park Barracks, St James Church and the Supreme Court (Newcastle & District Historical Society 1997).

Ash Island

Ash Island was first explored by Europeans in 1801. The explorers found blueberry ash trees, which resembled the English ash, so they named the island after the tree. Early settlers were attracted by the rich alluvial soil on the island, making it an ideal location for farming and grazing (Rappoport 2010).

In 1829, 2560 acres (1036 hectares) of Ash Island were granted to Alexander Walker Scott, an entomologist and entrepreneur. In 1846 the Scott family moved from Sydney to live on Ash Island. Under the tutelage of their artistic father, Alexander's two daughters (Harriet and Helena) worked on the island for over 20 years and recorded its plants and animals, in particular the butterflies and moths. The sisters went on to become two of Australia's most skilled natural history artists and became the pre-eminent illustrators of plants and animals in late 19th century Australia (Australian Museum 2011).

Alexander Scott was a successful businessman and his achievements in the area included the construction of an iron-foundry, forge and patent slip at Stockton and the building of large sea water tanks on Moscheto Island, which were used to supply salt for Sydney. In 1866 Scott was declared bankrupt and he left Ash Island after auctioning a large portion of his Ash Island estate.

The population of the island increased markedly as a result of the land sales in the 1860s. A school was established on Ash Island and John Jackson became the first school teacher in May 1868. By 1893, some 60 pupils went to the school (Rappoport 2010). The Schoolmasters House (see Figures 1 and 2) still exists on the island and is currently used as an office for the Kooragang Wetland Rehabilitation Project. Ash, Moscheto and Dempsey

islands, all located in the park, became important dairying areas and were also renowned for their production of fruit and vegetables.

William Milham was one of the first landholders to purchase land from Scott as a tenant farmer in January 1866. The Milham property consisted of approximately 103 acres (42 hectares) and a house was built in 1890. Remnants of Milham's farmhouse are still visible and are located within the Kooragang City Farm precinct (see Figures 1 and 2).

Ash Island also contains an old silo located near the car park at Milham Road. There were also a number of dairies that operated and some remnants such as concrete slabs remain on the island from this period.

A major flood occurred in 1893 that covered the entire island and was the worst flood experienced in the Hunter Valley since European settlement. The unsanitary conditions in the flood areas resulted in an outbreak of typhoid fever. Lean years followed the flood because the land was too waterlogged to sow crops. In 1906 the Hunter District Water Board connected Ash Island and Hexham to the town water supply. The first bridge linking Ash Island to Hexham opened in 1909, was swept away in the 1920 floods and rebuilt a year later.

Tomago

In 1838 Richard Windeyer purchased 850 acres (344 hectares) at Tomago from Adam Beveridge, and some of this land currently lies inside the park. He experimented with a variety of agricultural ventures and engaged Samuel Bartlett to build a stone mansion of a grand design, which is now known as Tomago House. Tomago House and remaining lands associated with the once large estate lie to the north of the park and are now managed by the National Trust (see Figure 1).

Hexham Swamp

In the mid-1850s, the Main Northern Railway line was built along the north-east edge of Hexham Swamp (see Figure 1). In 1857 the first section of the Richmond Vale Railway was built from Hexham to Minmi near the Sugarloaf Range (Richmond Vale Railway Museum 2010). In 1859 James and Alexander Brown purchased the Richmond Vale Railway. In 1861 the railway began to cater for passenger traffic between Hexham and Minmi and also became known as the 'Minmi Express'. Hexham was the original terminus and ultimately the final headquarters of the Richmond Vale Railway. The historic Richmond Vale Railway lies just north of the park and is part of the proposed Richmond Vale Rail Trail (see Hexham Swamp section on Figure 1). There are discussions occurring about the transfer of this land to NPWS (see Cycling in Section 3.6).

A water pipeline was constructed in Hexham Swamp along Pipeline Trail in 1923. This pipeline (except for a small section in the north — see Section 5.3) has since been removed from the park to an easement beside the Main Northern Railway line.

World War II

In 1941 Newcastle prepared for the defence of the city and for the protection of the BHP steelworks, which were essential for Australia's war effort (Newcastle & District Historical Society 1997). Local Stockton resident, Vera Deacon, recalled about 80 soldiers arriving on Moschetto Island in 1941 where they built a strategic defence position for the protection of the BHP steelworks. On 7 June 1942, six months after war broke out in the Pacific, a Japanese submarine shelled Newcastle, aiming for the steelworks.

In January 1942, Australia's first Royal Australian Air Force Radar Station was set up at Shepherds Hill just south of the city. The Radar Station, referred to as '131 Radar', originally

opened at Richmond Air Base in June 1942 and was relocated to Ash Island two months later. It is thought to have been one of the few radar stations in Australia to have had female operators. The Radar Station on Ash Island operated until it was disbanded in January 1946. The collection of buildings (including two semi-cylindrical concrete 'igloos') is now listed on the NSW State Heritage Register (SHR Listing number 01815). It is regarded to be of state significance as there are few remaining radar igloos surviving from World War II (OEH 2015a).

Kooragang Island

Kooragang Island was earmarked for industrial development by the NSW Government. From 1951 to 1977, the then NSW Public Works Department undertook a major reclamation works project on five islands in the estuary. This resulted in most of these estuary islands being joined together to form what is now known as Kooragang Island. By 1971, NSW Public Works estimated that 704 hectares of Kooragang Island had been partly or wholly developed for industrial use. This was one of the largest reclamation projects undertaken in Australia.

The conservation era

In 1972, the State Pollution Control Commission recommended that 'a fairly large part of the presently undisturbed area of the island should be preserved in its natural state' (Coffey 1973). In 1979 the National Trust nominated the Hunter Estuary (including Hexham Swamp and part of Kooragang Island and Fullerton Cove) for listing on the Register of the National Estate. In 1981, in recognition of its predominantly freshwater values, NPWS identified that the area was worthy of nature reserve status. The NSW Government agreed to its dedication as a nature reserve in 1983. In 1984, Kooragang Nature Reserve was successfully nominated for recognition as a wetland of international significance under the Ramsar Convention on Wetlands. This is now known as the Hunter Estuary Wetlands Ramsar site, following the addition of the Hunter Wetlands Centre at Shortland to the site in 2002.

In 1992, in part due to the impetus from the Fisheries Division of the then NSW Department of Agriculture, the *Kooragang Island Wetland Compensation Project Feasibility Study* (Shortland Wetlands Centre & TUNRA 1992) was prepared. The study signalled a shift in attitudes that allowed consideration of a proposal to rehabilitate wetlands and other degraded habitat in the estuary (Streever 1998). This study led to the inception of the Kooragang Wetland Rehabilitation Project. It aims to protect, restore and create fisheries, shorebird and other wildlife habitat and to create opportunities for recreation, education and research. Another major rehabilitation project is the Hexham Swamp Rehabilitation Project, which began in 2006 to reintroduce tidal flows into Hexham Swamp and to restore over 700 hectares of estuarine habitat for migratory shorebirds and to create nursery areas for fish and prawns. The project area encompasses land owned by Hunter Local Land Services and land within the park. Both projects were originally managed by the Hunter-Central Rivers Catchment Management Authority, now Hunter Local Land Services.

In 2006, the *Lower Hunter Regional Strategy 2006–2031* (DoP 2006) set out a 25-year program to direct and drive conservation efforts in the Lower Hunter Valley. Part of this was the establishment of a new green corridor stretching from the Watagan Ranges, through Hexham Swamp to Port Stephens. In recognition of habitat values and recreational status, Ash, Hexham and Campbell islands were added to Kooragang and Hexham Swamp nature reserves and together the area was renamed Hunter Wetlands National Park in 2010.

Desired outcomes

- Negative impacts on historic heritage values are minimised.
- Understanding of the cultural values of the park is improved.

- Significant historic features are appropriately conserved and managed.

Management response

- 3.5.1. Record, conserve and manage historic sites and potential archaeological sites in accordance with their assessed level of significance.
- 3.5.2. Prepare and implement a conservation management plan for the state-listed World War II Radar Station buildings to guide their future care and use.
- 3.5.3. Increase understanding of heritage in the park, including archaeological sites, through interpretive strategies and education programs such as NPWS Discovery.

3.6 Visitor experiences

NPWS parks provide a range of opportunities for recreation and tourism including opportunities for relaxation and renewal as well as appropriate active pursuits. NPWS aims to ensure that visitors enjoy their experience and appreciate parks at the same time as conserving and protecting park values. The park provides a range of recreational opportunities set in the unique environment of the Hunter River estuary and is close to the Newcastle urban area. Visitors can access the park by car, boat, bicycle or on foot and most park visitors are understood to be locals from the Hunter Region (NPWS 2012).

Visitor use of the park focuses on low-key recreation pursuits such as walking, birdwatching, photography, picnicking, fishing, boating and cycling. Visitation to the park requires particular consideration because recreational uses can negatively impact conservation values such as the roosting, nesting and feeding areas of shorebirds.

Visitor experiences in the park should aim to complement and enhance other experiences provided in the Newcastle region without replicating existing visitor experiences (Hunter Wetlands Centre 2004). These already cater for a broad range of recreational opportunities such as picnicking, walking, mountain biking, beach-going, four-wheel driving and camping.

Camping is not catered for in the park but is available in other nearby parks such as the Watagans National Park.

Access

There is a network of roads and trails in the park as shown on Figure 1. These roads and trails are currently used for a variety of purposes including public access, recreation, park management and access to private property. The main vehicle access to Ash Island is from the Pacific Highway via Ash Island Bridge at Hexham. Access to Stockton Sandspit is available via Nelson Bay Road from Stockton Bridge. Vehicle access in the Tomago and Hexham sections of the park is for management purposes only as the only access in these locations is through private property and permission is required from neighbouring landholders.

There are a range of inappropriate activities occurring on Ash Island, mostly at night, including vandalism and antisocial behaviour. It is proposed to install an entrance gate at Ash Island Bridge (see Figure 2), which will be open during the day.

Day use

Day use areas, typically picnic facilities, are often the main destination for the vast majority of visitors to parks. Day use areas in the park not only provide for picnicking but are often the central focus for other nature-based leisure activities such as boating and fishing, walking, cycling, birdwatching and photography.

Park facilities are located at key locations on Ash Island, the main recreational area for the park. Ash Island contains three major picnic areas located at Riverside Park, Scotts Point and the Radar Station buildings' site. The day use area at Riverside Park is the most visited site, and toilets and shelters were installed in 2013. There is also a day use area at Stockton Sandspit, which is primarily used for birdwatching. See Table 4.

Table 4: Day use areas in the park that are maintained by NPWS

Day use area	Access	Site features	General facilities
Riverside Park	2WD *	Hunter River, access point for picnicking and fishing	Picnic tables, toilets (disabled access), shelters, information display and barbecues
Scotts Point	Walk-in	Hunter River, popular for fishing	Shelter
Radar Station	2WD	Historic heritage	Picnic tables, toilets, historic heritage information display
Stockton Sandspit	2WD	Hunter River, birdwatching	Birdwatching hide, information display

* 2WD = two-wheel drive.

Walking tracks

Bushwalking allows visitors to be in close contact with the environment and can increase understanding and enjoyment of parks and the environment generally. The park provides five bushwalking tracks as outlined in Table 5. The walking track grades identify a track's suitability for different user groups as follows:

- Grade 1 — assisted disabled walkers
- Grade 2 — walkers with young children (generally formed tracks)
- Grade 3 — beginner walkers (generally formed tracks with some steep sections).

There is also a network of management trails throughout the park, as shown on Figures 1 and 2, which are available for walkers (see Section 5.1).

Table 5: Walking tracks in the park

Walking track	Location/setting	Distance	Current grade *	Proposed grade *
Scotts Point Way	Scotts Point Way to Riverside Park, Ash Island	2.5km	Grade 1	Grade 1 (shared-use for walking & cycling)
Farmhouse Track	Riverside Park to Milhams Farm Historic site, Ash Island	580m	Grade 1	Grade 1 (shared-use for walking & cycling)
Welcome Boardwalk	Raised walkway through mangroves to Schoolmasters House, Ash Island	1km	Grade 2	Grade 2
Rainforest Walk	Scotts Point Way to carpark on Milham Road, Ash Island	800m	Grade 2	Grade 2
Stockton Sandspit Foreshore Walk	Follows the perimeter of the Stockton Sandspit	480m	Grade 3	Grade 3

* The Australian Walking Track Grading System has been used as the basis for this track classification system. For further information on these grades please refer to the *User's Guide to the Australian Walking Track Grading System* (DSE no date).

Ash Island is the primary recreational focus for the park providing a range of formed walking tracks. Scotts Point Way, Farmhouse Track, Welcome Boardwalk and Rainforest Walk provide varying experiences, which highlight the estuarine and freshwater wetland environment and remnant rainforest (see Table 5).

There is also an opportunity to walk from Riverside Park to the Radar Station along Farmhouse Track (a shared-use track) and Farmhouse Trail (a management trail) and a network of mown grass walking tracks around the Radar Station.

The Stockton Sandspit Foreshore Walk follows the perimeter of the sandspit on the eastern shore of the Hunter River (see Figure 1). NPWS and the City of Newcastle Council have established the Foreshore Walk to encourage people to stay on this track and keep off the saltmarsh. This walk provides an excellent opportunity to view shorebirds on the exposed mudflats as the tide falls. Council is also planning to build a viewing platform on council land overlooking the Stockton Sandspit.

Birdwatching

Birdwatching is a significant recreational activity in the park, with easily accessible birdwatching areas at Ash Island and Stockton Sandspit (key locations are shown on Figures 1 and 2). A significant number of birdwatchers from Sydney, as well as interstate and overseas, visit the estuary to view shorebirds. There is a bird hide at Stockton Sandspit and the Hunter Bird Observers Club provides information to the community on opportunities for birdwatching in the park.

Fishing and boating

Recreational fishing continues to be a popular activity, particularly on Ash Island. There are some easily accessible shoreline areas for fishing on Ash Island, at Scotts Point and Riverside Park, and on the south arm of the Hunter River near Cobbans Track. Commercial fishing is undertaken in Fullerton Cove (see Section 5.3).

Boat fishing is also popular in some sections of the park, in particular the north and south arms of the Hunter River. Boat ramps can be accessed at two locations: Ash Island and Kooragang Island (see Figure 1). Fishing activities occur all year round at these areas due to easy access from Newcastle.

All fishing activities in NSW waters are regulated under the Fisheries Management Act. Both commercial and recreational fishing must be in accordance with licence conditions specified by the relevant regulatory authority.

Cycling

In accordance with NPWS policy and the *Sustainable Mountain Biking Strategy* (OEH 2011) cycling is permitted on all roads and management trails in the park. This activity is becoming increasingly popular in the park, particularly on Ash Island, which is very popular with families. Ash Island has a road and trail system that provides a number of bicycle routes: sealed and gravel roads between Scotts Point and Riverside Park for less experienced riders and families and unsealed roads appropriate for mountain bike riding in the south-east section of the island. Figure 2 shows the shared-use cycling and walking track on Ash Island along Scotts Point Way and Farmhouse Track. This track is the only shared-use track in the park that is available for walkers and cyclists.

A cycling path has been constructed by the City of Newcastle Council close to the park that runs over Stockton Bridge and close to Stockton Sandspit. This route is popular with people riding from Newcastle. Although this path does not run through the park, it provides a unique opportunity for visitors to view the feeding and roosting shorebirds at Stockton Sandspit.

The *Newcastle Cycling Strategy and Action Plan* proposed a cycling route from Shortland to Tarro through the Hexham Swamp section of the park following Pipeline Trail (City of Newcastle 2012). The Cycling Strategy also proposes another route, the Richmond Vale Rail Trail (see Section 3.5), along a section of the now closed historic rail line. The rail line runs adjacent to the park and is currently owned by Rio Tinto Coal Australia (see Figure 1). NPWS will support the development of both cycling routes as shown on Figure 1.

Horse riding

Horse riding is a popular recreational activity that has cultural associations for many Australians. The NPWS *Strategic Directions for Horse Riding in NSW National Parks* (OEH 2012b) provides a framework to improve riding opportunities. Horse riding is not suitable in the park due to the sensitive wetland ecosystems and lack of connectivity to other horse riding trails. There are horse riding opportunities provided in nearby reserves such as in Glenrock and Sugarloaf state conservation areas and in Werakata National Park.

Desired outcomes

- Visitor use is appropriate and ecologically sustainable.
- Visitor opportunities encourage appreciation and awareness of the park's values and its 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.

Issues

Access

- There is a need to rationalise the road network, to enable maintenance and minimise impacts in certain areas.
- Vehicle access on Kooragang Dykes will continue to be restricted because it is unstable and not suitable for vehicles.
- Pedestrian access will continue at Kooragang Dykes and Stockton Sandspit. Education will be used to encourage minimal disturbance to shorebirds in these areas.
- Vandalism and antisocial behaviour on Ash Island is an ongoing issue.
- Hunter Local Land Services have expressed a need to expand parking facilities at Schoolmasters House to provide for a bus turnaround.

Walking tracks

- Visitors are impacting saltmarsh and disturbing nesting, roosting and feeding shorebirds at Stockton Sandspit.

Fishing and boating

- Kooragang Dykes are a key shorebird habitat area and recreational use from boating, in particular movement of boats along the dyke wall, is impacting the roosting shorebirds.
- Stockton Sandspit is a known site for green weed (*Enteromorpha* sp.), an algae that grows in saline coastal wetlands and is highly sought after by fishers for use as bait for catching luderick (*Girella tricuspidata*). It is also a popular site for collecting yabbies. This presents a conflicting use as fishers harvesting the weed and yabbies may disturb nesting and roosting shorebirds.

Management response

Access

- 3.6.1. Provide public vehicle access on the park roads as shown on Figures 1 and 2.
- 3.6.2. Install an entrance gate at Ash Island Bridge, which will be open during the day.
- 3.6.3. Continue to restrict vehicle access on the Kooragang Dykes as the wall is unstable and is a risk to park users.
- 3.6.4. Continue to provide pedestrian access to Kooragang Dykes and Stockton Sandspit. Use signs and education to encourage pedestrians to stay on walking tracks and minimise disturbance to roosting shorebirds.
- 3.6.5. Avoid vehicle use of unsealed roads and if necessary close gates during periods of heavy rainfall to minimise damage to road surfaces.
- 3.6.6. Allow for expansion of the Schoolmasters House car park in cooperation with the relevant land management agency where demand is demonstrated.

Day use

- 3.6.7. Manage day use areas in the park listed in Table 4.
- 3.6.8. Manage visitor use at Stockton Sandspit to minimise any impacts to roosting shorebirds.

Walking tracks

- 3.6.9. Maintain and upgrade walking tracks in accordance with Table 5 and Figures 1 and 2.
- 3.6.10. Maintain the Stockton Sandspit Foreshore Walk and encourage people to use this track to keep off the saltmarsh.

Birdwatching

- 3.6.11. Continue to involve the birdwatching community, in particular the Hunter Bird Observers Club, in management decisions related to shorebird conservation in the park.
- 3.6.12. Support Hunter Bird Observers Club to provide information to the community on opportunities for birdwatching in the park.
- 3.6.13. Continue to support access to the park for the Hunter Bird Observers Club to undertake birdwatching and bird monitoring.

Fishing and boating

- 3.6.14. In consultation with the waterway management agency investigate and, if feasible, undertake actions or place educational signs at Kooragang Dykes to reduce the impacts of boating, fishing and bait collection on roosting shorebirds and their habitats.
- 3.6.15. Assess the condition and options for future ownership of on-park boat ramps and associated infrastructure.
- 3.6.16. Establish a works program to manage ramps and infrastructure or transfer ownership if beneficial to the park and users.
- 3.6.17. Support and encourage any initiatives by the relevant regulatory authority to undertake research on native fish and crustaceans in the area, impacts of fishing and ways to manage fish populations and habitat.

Cycling

- 3.6.18. Allow cycling on all roads, management trails and shared-use tracks as shown on Figures 1 and 2.
- 3.6.19. Work with the local council in the development of the cycling route(s) in the Hexham Swamp section of the park (see Figure 1), subject to an agreement between NPWS and council for route construction and ongoing maintenance. Ensure works are carried out in accordance with any necessary environmental impact assessment.
- 3.6.20. Work with neighbouring land managers to assist in providing cycling track networks that connect to the park from adjoining areas.

3.7 Information, education and research

The proximity of the park to schools, technical colleges and universities makes it an especially valuable resource for educational visits and research. Education is the main means of increasing public awareness of the values of the park, which in turn promotes appropriate use and sustainable protection for the park.

Scientific research in the park is a critical means of obtaining information needed to guide conservation priorities, environmental management and effective decision-making.

Specific research in the park and the estuary has been undertaken since the 1970s, before it became a nature reserve, and was the basis for reserving the area and for the Ramsar listing. Research in the park adds to a better understanding of wetland systems and the conservation of shorebird habitat. There is significant potential for research into climate change, wetland ecosystems, rehabilitation and shorebird habitat.

Most research studies have focused on wetland rehabilitation, ecological restoration, fish habitat and migratory shorebird habitat. Research continues to inform management decisions.

NPWS aims to manage the park according to the principles of 'wise use' established by the Ramsar Convention on Wetlands. In this context, wise use refers to managing human use of wetlands so that there is continuous benefit to present generations, while at the same time maintaining the values and ecological processes for future generations.

The inaccessibility of much of the park due to lack of roads and water-only access precludes easy visitor access, especially by large groups. However, the areas of Ash Island, Stockton Sandspit, Tomago Wetlands and Hexham Swamp provide ideal locations for wetland education due to their accessibility to wetlands and their proximity to access roads.

Information provision, such as interpretative signage, assists the protection of natural and cultural heritage, promotes support for conservation and increases the enjoyment and satisfaction of visitors.

Issues

- There is thought to be a lack of awareness and appreciation of the wetland system and the park's existence by the community of Newcastle.

Desired outcomes

- There is widespread community understanding and appreciation of the park's natural and cultural values.
- The park is a useful educational resource for local schools and community organisations.
- There is research into maintaining and expanding saltmarsh habitat, and the implications of sea level rise on ecosystems.
- Visitors are aware of the park's recreation opportunities and can easily access park facilities.

Management response

- 3.7.1. Promote visitor experiences that incorporate education on the park's values, its wetland environment and shorebird habitat (e.g. through NPWS Discovery).
- 3.7.2. Undertake and encourage events that highlight the park and its key conservation values.
- 3.7.3. Work with the Worimi and Awabakal communities to develop material and programs for interpretation of Aboriginal culture.
- 3.7.4. Work with local schools to encourage curriculum-based education opportunities for secondary and primary schools, particularly in the areas of ecology, biology and earth sciences.
- 3.7.5. Work with universities to encourage academic research in the park, particularly in the areas of vegetation mapping, changes in tidal range, sedimentation processes, invertebrate and fish studies and the effects of climate change.
- 3.7.6. Promote and seek funding to research and implement maintenance and expansion of saltmarsh habitat.
- 3.7.7. Maintain existing relationships with the relevant land management agency, Hunter Bird Observers Club and universities, and work with other research organisations with an interest in education and research in the park.

4. Threats

4.1 Habitat loss and fragmentation

The park and surrounding areas have been significantly impacted by development and clearing. This has resulted in a high loss of biodiversity and fragmentation of habitat. Native plants and animals and ecological processes within the park are threatened by weeds, pest animals and human-induced changes. Nearly all wetland and shorebird habitat in the estuary has been degraded or reduced in size over time. Opportunities for habitat expansion are limited by the 'coastal squeeze' on existing habitats that are hemmed in by industrial and urban development.

Shorebirds and their habitats in the park have been particularly susceptible to these impacts. Shorebird monitoring in the estuary shows that diversity and numbers of shorebirds in the estuary have declined significantly since the 1970s (Herbert 2007a). Saltmarsh communities vital for shorebird habitat are also threatened by mangrove and spiny rush expansion (Herbert 2007b), caused by a range of factors.

Many of the pressures on the migratory shorebirds come from outside the park and are beyond the direct control of NPWS (see also Section 4.4). Shorebird habitat is being impacted around the globe. Many stopover habitat sites along the East Asian – Australasian Flyway, which is used by migratory shorebirds, are being significantly reduced by reclamation and development.

In the Hunter Estuary, the industrial interface and dredging for shipping access associated with the busy Newcastle Coal Port facilities, plus Newcastle's urban expansion, threaten to alter the hydrological dynamics of the park and its fragile wetland environment. Therefore, holistic management by all land managers and stakeholder agencies in the estuary is needed to protect the natural values of the park. Additionally, long-term conservation of biodiversity depends upon the protection, enhancement and connection of remaining habitat across the landscape, incorporating vegetation remnants on both public and private lands.

Desired outcome

- The negative impacts of habitat loss and fragmentation are reduced.

Management response

- 4.1.1. Plan for strategic additions of land to the park to provide extensions to saltmarsh and shorebird habitat, taking into account predicted sea level rise and associated migration pathways.
- 4.1.2. Maintain cooperative arrangements with neighbouring landholders regarding access, fire and pest species management to minimise impacts on shorebirds.
- 4.1.3. Liaise with neighbours and local and state governments to encourage the protection and enhancement of native vegetation and key habitats and corridors on public and private lands in the vicinity of the park.

4.2 Pests

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

catchment and scenic values. Table 6 outlines the significant pest species that occur in the park.

Table 6: Weeds and pest animals recorded in or near the park

Common name	Scientific name	Comment
Weeds		
Alligator weed ^{BD}	<i>Alternanthera philoxeroides</i>	Potential to become dominant in the understorey of freshwater wetlands, particularly at Tomago and Hexham swamps, and Scotts Point at Ash Island
Bitou bush ^{BD}	<i>Chrysanthemoides monilifera subsp. rotundata</i>	Widespread along coastal areas
Blackberry ^{BCE}	<i>Rubus fruticosus</i> agg.	Impacting threatened freshwater wetlands at Tomago and Ash Island
Chinese violet ^C	<i>Asystasia gangetica</i> subsp. <i>micrantha</i>	Limited on Ash Island
Groundsel ^C	<i>Baccharis halimifolia</i>	Impacting threatened freshwater wetlands at Tomago and Ash Island
Lantana ^{BEF}	<i>Lantana camara</i>	Affecting threatened ecological communities including freshwater wetlands at Tomago
Kikuyu	<i>Pennisetum clandestinum</i>	Large areas throughout park
Pampas grass ^C	<i>Cortaderia selloana</i>	Impacting threatened freshwater communities at Tomago
Prickly pear ^{DE}	<i>Opuntia</i> spp.	Limited on Sandy Island
Spiny rush	<i>Juncus acutus</i>	Impacting estuarine communities throughout the park
Pest animals		
Cattle	<i>Bos taurus</i>	Regular occurrences of cattle at Tomago and Hexham Swamp due to inadequate gating and fencing
European red fox ^{AF}	<i>Vulpes vulpes</i>	Recorded throughout the park and has potential to severely impact shorebirds
Hare	<i>Lepus capensis</i>	Isolated recordings on Ash Island
Pig ^A	<i>Sus scrofa</i>	Isolated recordings in the park at Tomago and Hexham Swamp
Plague minnow ^F	<i>Gambusia holbrooki</i>	Likely to occur in a number of the water bodies in the park
Rabbit ^{AF}	<i>Oryctolagus cuniculus</i>	Isolated recordings on Ash Island
Wild dogs ^A	<i>Canis lupus</i> subpp.	Recorded in land adjacent to the park at Tomago; control programs undertaken in neighbouring areas

A Regional priority pest animal (Hunter LLS 2018).

B State level priority weed under the *Biosecurity Act 2015*.

C Identified as a regional level priority weed (Hunter LLS 2017).

D Additional species of concern (Hunter LLS 2017).

E Declared Weed of National Significance.

F Species listed as a key threatening process under the *Biodiversity Conservation Act 2016*.

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

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

NPWS prepares regional pest management strategies that identify the operations and control actions undertaken by NPWS to meet the priorities from regional strategic pest and weed management plans. This also includes other important programs such as the Biodiversity Conservation Program (see Sections 3.2 and 3.3).

The overriding objective of the NPWS regional pest management strategies is to minimise adverse impacts of introduced species on biodiversity and other park and community values while complying with legislative responsibilities. These strategies are regularly updated. Reactive programs may also be undertaken in cooperation with neighbouring land managers, in response to emerging issues. Significant pest species recorded in the park are listed in Table 6 and discussed below.

As part of the NPWS regional pest management strategy, targeted weed programs are being undertaken throughout the park. These programs have been prioritised through a rating matrix to determine priority levels. The highest priority programs are dealing with weed threats to coastal saltmarsh, which is important habitat for migratory shorebirds and vital for the integrity of the wetland listing under the Ramsar Convention on Wetlands. Coastal saltmarsh is also listed as a threatened ecological community under both the Biodiversity Conservation Act and the Environment Protection and Biodiversity Conservation Act. The most significant environmental weed impacting saltmarsh is spiny rush, which has the potential to invade and change the structure of saltmarsh across the park. Saltmarsh is also subject to incursion by mangroves, which are being actively managed (see Section 3.2). Other weeds also impact this community (though to a lesser extent) and are being managed as part of these weed control programs.

Other high priority sites for weed control include other threatened ecological communities in the park, as well as Kooragang Dykes, Stockton Sandspit, Tomago Wetlands and Hexham Swamp.

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

European red foxes occur throughout the park and surrounding landscape. Foxes suppress native animal populations, particularly medium-sized mammals, ground-nesting birds and freshwater turtles. They have also been implicated in the spread of a number of weed species such as bitou bush. Native species most likely to be impacted in the park are nesting, feeding and roosting shorebirds and green and golden bell frogs. Predation by foxes is listed as a key threatening process under the Biodiversity Conservation Act (NSW SC 1998) and the Environment Protection and Biodiversity Conservation Act (DSEWPC 2011). They are also a declared pest throughout New South Wales. Fox control programs are periodically undertaken in the park.

Before the park's reservation, grazing was a dominant land use. Stray cattle are regularly found at Hexham Swamp and periodically at Tomago Wetlands due to inadequate fencing

and gates. Grazing and trampling by domestic stock is a threat to wetlands as it has the potential to change vegetation composition and modify drainage patterns.

Desired outcomes

- Continue targeted weed control programs for high priority weeds and areas in the park, including threatened ecological communities and shorebird habitats.
- Pest plants and animals are controlled and where possible eliminated from particular areas.
- Negative impacts of pest species on park values are minimised.
- Maintain awareness of any new pest and weed species that has the potential to impact the park.

Management response

- 4.2.1. Manage pest species in accordance with pest management strategies relevant to the park. Pest control programs will be aimed at priority weeds such as spiny rush and other weeds species in saltmarsh.
- 4.2.2. Undertake strategic fox control programs in the park.
- 4.2.3. Monitor state level and regional level priority weeds and significant environmental weeds and their impacts. Treat any new outbreaks where possible.
- 4.2.4. Prepare and implement a site-specific pest management strategy for the park.
- 4.2.5. Seek the cooperation of neighbours in implementing weed and pest control programs. Undertake control in cooperation with local councils, the relevant land management agency and other neighbours.
- 4.2.6. When necessary, undertake pest control programs by participating in wild dog baiting with the relevant land management agency and neighbours at Tomago.
- 4.2.7. Investigate fire as a weed management tool for the park.
- 4.2.8. Work with neighbours to minimise the impact of grazing on park values through the construction and maintenance of stock-proof boundary fencing. Fencing assistance may be provided in accordance with NPWS policy.

4.3 Fire

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

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

The fire history in the park is only partially known, with the most recent wildfires occurring in the park in 2013 at Hexham Swamp, Tomago Wetlands and Ash Island. Wildfires have occurred in wetland areas dominated by common reed and on Ash Island in ungrazed pasture, cumbungi and a saltmarsh community dominated by weed species such as spiny

rush. Most fires in the park are likely to be a result of arson. The nature of fire in wetlands is that the fires tend to burn hot, travel fast, and burn out very quickly.

Areas throughout the park, including saltmarsh, mangrove and casuarina communities, are sensitive to fire and fire should be excluded from the park where possible.

A fire management strategy for the park has been prepared. The fire management strategy outlines 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 and fire control advantages (such as management trails) and water supply points. It also contains the 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 local 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 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.

Management response

- 4.3.1. Manage the park in accordance with the fire management strategy and review the strategy as required.
- 4.3.2. Continue to be involved in the local bush fire management committee and maintain cooperative arrangements with local rural and urban fire and rescue services and surrounding landowners regarding fuel management and fire suppression.
- 4.3.3. Suppress unplanned fires in the park in accordance with the fire management strategy.
- 4.3.4. Manage the park to protect biodiversity in accordance with the identified fire regimes in the fire management strategy.
- 4.3.5. Rehabilitate areas disturbed by fire suppression operations as soon as practical after the fire.
- 4.3.6. Monitor the ability of native plants and animals to recover between fires and review regimes where relevant.

4.4 Climate change

Regional climate change projections have been prepared by the NSW and ACT governments and research centres (OEH 2015b). It is predicted for the Hunter Region that by 2030 maximum temperatures will rise by 0.7°C and annual rainfall will increase, particularly in autumn. There are projected to be more hot days and fewer cold nights. Increases in severe fire weather are projected in summer and spring. Although these changes are relatively small (up to two more days per year on average) they are projected to occur during prescribed burning periods (spring) and the peak fire risk season (summer), which has implications for fire management in the park. Little change is predicted for winter and autumn will see a decreasing fire risk, which is likely due to increases in projected rainfall (OEH 2015c).

Human-induced climate change has been listed as a key threatening process under the Biodiversity Conservation Act (NSW SC 2000a) and the associated loss of habitat is listed under the Environment Protection and Biodiversity Conservation Act (TSSC 2001). Climate change may significantly affect biodiversity by changing the size of populations and the distribution of species, modifying species composition and altering the geographical extent of habitats and ecosystems. Also in coastal areas, lowland freshwater ecosystems such as in the park are likely to be affected by rising water tables. In permeable substrates, the saltwater table is likely to rise and push fresh water towards the surface and these changes are likely to change the vegetation in affected areas. The potential impact of climate change is difficult to assess since it depends on the compounding effects of other pressures, particularly barriers to migration and pressure from feral animals. Species most at risk are those unable to migrate or adapt, particularly those with small population sizes or with slow growth rates.

Increased nutrients, fertilisers and pollutants are likely to stay longer in the estuary with less rainfall and flushing (Gillanders et al. 2011). Acid sulfate soil conditions and their impacts may also intensify. Seasonal algal blooms and higher water temperatures will affect salinity stratification in the water column, which will impact estuarine fish species growth, distribution, mortality and abundance (Gillanders et al. 2011).

The effect of rising mean sea levels will be felt during extreme storm conditions when strong winds and falling pressure bring about a temporary and localised increase in sea level known as a storm surge. Storm surges occurring on higher mean sea level areas will lead to inundation and damaging waves penetrating further inland, increasing flooding, erosion and the subsequent detrimental impacts on built infrastructure and natural ecosystems (CSIRO 2007). In relation to the estuarine environment, rising sea levels and extreme storm conditions will mean that low-lying habitats in the park will potentially be severely impacted. Critical habitat loss will be compounded with sea level rise, especially where coastal development prevents landward migration of species such as mangrove and saltmarsh (Saintilan 2013).

A major threat for the park is that important roosting and feeding shorebird habitat will be inundated if sea levels rise. Also, if sea level rise eventuates as predicted, existing controlled hydrological management of some areas to facilitate saltmarsh communities (such as at Tomago Wetlands) will become increasingly difficult. Establishing migratory routes for saltmarsh vegetation while managing the impact of freshwater inputs will become critical to retaining the park's current values (Rogers et al. 2012).

Desired outcomes

- The effects of climate change are adaptively managed where feasible.
- Natural systems are able to adapt or migrate to cope with climate change impacts.

Management response

- 4.4.1. Continue existing fire, pest and weed management programs to increase the park's ability to cope with future disturbances, including climate change, and encourage research into appropriate indicators to monitor the effects of climate change.
- 4.4.2. Continue with projects to stabilise and raise the height of structures used for shorebird roost habitat such as at Kooragang Dykes.
- 4.4.3. Undertake a study of important plant communities and habitat areas (e.g. threatened ecological communities) within coastal hazard zones to investigate priorities for managing permanent inundation due to sea level rise. Implement actions as required within the park.

5. Management operations and non-NPWS uses

5.1 Access and infrastructure

A network of management trails throughout the park provides access for management purposes, including pest monitoring and control, rehabilitation works and fire management, as well as other authorised purposes (see Sections 5.2 and 5.3). Management trails are typically maintained to four-wheel drive, dry weather standard. Volunteers and groups such as Kooragang Wetland Rehabilitation Project, Hunter Bird Observers Club and researchers regularly use management trails to undertake approved activities. These trails may also be used for non-vehicle based recreational purposes, such as bushwalking and cycling (see Section 3.6).

Some short sections or extensions to existing management trails may need to be constructed to link to the proposed constructed habitat for green and golden bell frogs required as part of the compensatory habitat works (see Section 5.2). The exact location of these trails is currently undetermined, although if required will be in the vicinity of the frog habitat sites as shown on Figure 2 and any works would be subject to environmental impact assessment.

Some of the management trails continue onto other land tenures adjacent to the park including:

- Port Waratah Coal Services land and other freehold lands at Tomago
- Port of Newcastle Investments land at Kooragang Island
- Hunter Water, Hunter Local Land Services and Aurizon lands at Hexham Swamp.

NPWS often requires access along sections of these trails outside the park for the efficient implementation of management operations.

Sections of Tomago Track and some trails on neighbouring lands at Tomago and Fullerton Cove coincide with the Fullerton Cove ring levee, which was constructed under the Hunter Valley Flood Mitigation Scheme. These trails may require realignment should future modifications occur to the levee.

The park contains two workshops/storage sheds (see Figure 2) required for management purposes on Ash Island. One workshop, located on Scotts Point Way, is used by NPWS. This is currently isolated from other facilities and additional infrastructure such as a toilet or additional office space may be required in the future. The other storage shed, located on Schoolmasters Road, is used under licence for the Kooragang Wetland Rehabilitation Project (see Section 5.2). This site may require construction of some additional minor structures that support the outcomes of the rehabilitation project such as additional storage space. Both of these facilities are located within disturbed kikuyu paddocks. Any structures would be confined to expansion of existing facilities and would not be located in or adjacent to areas of saltmarsh or mangroves.

Desired outcomes

- Access and infrastructure for management operations is adequate and has limited impact on park values.
- Access for other purposes is managed to minimise impacts on natural and cultural values.

Management response

- 5.1.1. Maintain the network of management trails as shown on Figures 1 and 2. Realign sections of trail if required in response to modifications to the Hunter Valley Flood Mitigation Scheme levee.
- 5.1.2. Maintain the two workshops in the park. Expansion or improvements to these facilities may occur to support NPWS or lessee/licensee management operations and will be confined to existing precincts.
- 5.1.3. Gate management trails where necessary to prevent unauthorised vehicle access.
- 5.1.4. Close trails no longer required for management and rehabilitate and manage weeds where required.
- 5.1.5. Seek to formalise ongoing arrangements for access to the park via trails that cross neighbouring lands.
- 5.1.6. If necessary, construct management trails to link to the proposed constructed habitat areas for green and golden bell frogs as part of the compensatory habitat works.

5.2 Other conservation management operations

Other management operations directly related to the conservation of the park and its values include those works undertaken by volunteers as well as works associated with the Kooragang Wetland Rehabilitation Project, Hexham Swamp Rehabilitation Project and compensatory habitat works. Both the Kooragang Wetland and Hexham Swamp rehabilitation projects are managed by a joint steering committee that provides advice to the Hunter Local Land Services Board in relation to the two projects. The steering committee acts as a conduit for the exchange of information between Local Land Services and local communities.

Kooragang Wetland Rehabilitation Project

The Kooragang Wetland Rehabilitation Project commenced in 1993, before the reservation of Ash Island as part of the park. The project involves ongoing rehabilitation works to restore tidal flushing to estuarine streams and wetlands, and regenerating and revegetating floodplain rainforest and woodland.

Areas on Ash Island, including the Schoolmasters House and Kooragang City Farm precincts, are being used under licence for the purposes of the project (see Figure 2 Licence Areas). Kooragang City Farm precinct (which is Part 11 land, see Section 1.1) is a restoration project that includes a community garden and a cattle grazing operation to demonstrate sustainable agriculture on a wetland site. The lands and associated facilities that are being used are covered by a licence issued to Hunter Local Land Services who are currently managing the project. This licence allows for the construction and maintenance of new facilities associated with the project within the licence area. An annual operation plan is prepared for the Kooragang Wetland Rehabilitation Project covering the licence area, which requires NPWS approval and provides the detail of new and ongoing activities associated with the project.

Hunter Local Land Services also maintains a network of informal walking tracks in the park required to access sites associated with the rehabilitation project. Within the smaller licensed area in the Schoolmasters House precinct, there is small greenhouse adjacent to the workshop off Schoolhouse Road used by Hunter Local Land Services (see Section 5.1). Continued licensing of this area is considered appropriate providing the use of the area is consistent with the objects of the National Parks and Wildlife Act.

Hexham Swamp Rehabilitation Project

The Hexham Swamp Rehabilitation Project involves the progressive opening of floodgates on Ironbark Creek to restore up to 700 hectares of estuarine wetland in Hexham Swamp. The area includes large sections in the south and east of the park surrounding Ironbark and Fisheries creeks, as well neighbouring freehold land. The project aims to reinstate tidal inundation to restore estuarine wetlands including mangrove and saltmarsh habitat. The project primarily involves the management and monitoring of the floodgates and tidal flows.

Volunteers

The park has a significant history of volunteer involvement. NPWS supports volunteers to undertake several research and operational projects including environmental research and planning, water and vegetation monitoring and bush regeneration. Hunter Local Land Services' Kooragang Wetland Rehabilitation Project supports a large volunteer network that undertakes a range of functions including environmental research and water monitoring, bird surveys and environmental rehabilitation activities at Ash Island, Hexham Swamp and Stockton Sandspit. The Hunter Bird Observers Club undertakes comprehensive monthly shorebird monitoring throughout the park and shorebird research and rehabilitation activities at Ash Island, Stockton Sandspit and Hexham Swamp. Volunteers provide an invaluable contribution to the management of the park.

Compensatory habitat works

As discussed in Section 2.3, the memorandum of understanding between NPWS and the relevant port authority provides for the construction of compensatory habitat on Ash Island as offsets for developments off-park. Under the terms of this memorandum of understanding, habitat including breeding and foraging habitat for the green and golden bell frog is being constructed and maintained by Newcastle Coal Infrastructure Group and BHP Billiton as part of planning approvals for infrastructure developments on nearby Kooragang Island (NCIG 2010).

Additionally, as part of other planning approval requirements, Newcastle Coal Infrastructure Group is seeking to offset additional project impacts by expanding shorebird habitat on Ash Island. It is proposed that this will be achieved through mangrove management including physical removal, ongoing maintenance and possible construction of water management infrastructure in the area south of Bell Frog Track. Newcastle Coal Infrastructure Group is currently working with NPWS on an agreement to undertake these works.

Desired outcomes

- Habitat values are improved and expanded.
- Facilities for other conservation management operations are adequate and have limited impacts on park values.
- Habitat restoration works occur under NPWS supervision and within the terms of current approvals.

Management responses

- 5.2.1. Continue to license other organisations to implement rehabilitation projects in the park as appropriate.

Kooragang Wetland Rehabilitation Project

- 5.2.2. Coordinate with Hunter Local Land Services regarding their annual operational plan for Kooragang Wetland Rehabilitation Project and provide approvals where appropriate.
- 5.2.3. Ensure that NPWS infrastructure used by the Kooragang Wetland Rehabilitation Project, such as the Schoolmasters House and associated workshop, are appropriately maintained by the licensee in accordance with the licence.
- 5.2.4. Close informal walking tracks in the park used by the Kooragang Wetland Rehabilitation Project when no longer required for access.

Hexham Swamp Rehabilitation Project

- 5.2.5. Oversee the implementation of on-park works where required for the Hexham Swamp Rehabilitation Project by Hunter Local Land Services.

Volunteers

- 5.2.6. Work with the local community to protect the park's natural and cultural values and support volunteers involved in a range of rehabilitation, research, education, bird and vegetation monitoring projects in the park.

Compensatory habitat works

- 5.2.7. Work cooperatively with companies that have planning approval to undertake habitat compensatory works on Ash Island and provide necessary consents, leases or licences for the works as required.
- 5.2.8. Work with Newcastle Coal Infrastructure Group to prepare an agreement to undertake compensatory habitat works to expand shorebird habitat in the area south of Bell Frog Track. Should an agreement be prepared, undertake actions that may include the management of mangroves including the physical removal of trees where necessary, the ongoing maintenance to ensure expansion of saltmarsh habitat, including removal of mangrove seedlings, and the possible development of water management infrastructure.

5.3 Non-NPWS uses and operations

The park contains a number of public utilities such as powerlines and pipelines that existed before the park's creation. There are also several groups (see also Section 5.2) that were undertaking licensed activities in the area now reserved as park that continue to operate under a lease, licence or consent that existed before the park's reservation. A corridor of Part 11 land (see Section 1.1) across Ash Island has been identified and zoned for future infrastructure development. Although not part of the reserved area of park, it is subject to this plan of management.

Public utilities

Several public utilities traverse the park, primarily on Ash Island (see Figures 1 and 2). These include electricity transmission lines and gas, water and sewerage pipelines.

The electricity transmission lines are owned and operated by Ausgrid and TransGrid. The TransGrid lines are operated under a formal easement granted under section 153 of the National Parks and Wildlife Act. The Ausgrid lines are not covered by a formal easement,

however, in accordance with the *Electricity Supply Act 1995*, Ausgrid can operate and use the existing power lines whether or not there is a formal easement in place.

Transmission lines and associated infrastructure can have impacts through clearing or trimming of native vegetation, use of herbicides, vehicle access and the maintenance of access trails, as well as the visual impact of the lines and towers. Power lines crossing wetlands have also been identified as an issue for bird strike. Some of these impacts are minimised through a statewide agreement between TransGrid and NPWS for inspection and maintenance of existing transmission lines and infrastructure. Though no access or maintenance agreement currently exists with Ausgrid, the company must comply with the National Parks and Wildlife Service Act and Regulation when carrying out any maintenance or replacement work and will require NPWS consent for certain works.

Hunter Water maintains a major water pipeline that crosses the Sandgate precinct above ground and then goes underground along Ramsar Road in the Part 11 land (see Figure 1 Utility Pipe). Hunter Water also operates a separate, large water pipeline that runs through the north-east section of Hexham Swamp. The Sydney to Newcastle gas pipeline managed by a private company, Jemena, runs through an easement on Hexham, Campbell and Ash islands. There is also a small section of a sewerage pipeline in the park in the Tomago Wetlands section.

Approximately 27 hectares of the park extends into the Tomago Sandbeds Special Area, declared under the Hunter Water Act. This area is subject to the protection provisions of section 51 of the Hunter Water Act and Regulation. The special area protects an underground aquifer that can supply about 20% of the lower Hunter's drinking water. An extensive system of underground bores and vacuum stations draws raw water from the sandbeds and pumps it to Grahamstown Water Treatment Plant. While no bores or pumping stations are currently located in the park, such developments are specifically permitted under section 185A of the National Parks and Wildlife Act without the requirement for an easement or licence.

Hunter Valley Flood Mitigation Scheme

The Fullerton Cove ring drain, levee bank and associated infrastructure traverse the park north of Fullerton Cove. This levee bank and associated infrastructure currently allows for saltwater inundation of the Tomago Wetlands to achieve important environmental outcomes, while also providing a flood mitigation function during catchment flooding. The scheme was constructed under the provisions of the Hunter Valley Flood Mitigation Act and is now managed under the Water Management Act. A review of the operations of the scheme may require modifications to the scheme's infrastructure to improve wetland values.

Infrastructure corridor (SP2)

An infrastructure corridor associated with industrial zoning at Tomago and Kooragang Island crosses the Ash Island section of park. Established by *State Environmental Planning Policy (Major Development) 2005*, the corridor is currently zoned Special Purpose Zone SP2 Infrastructure, which allows for the construction of infrastructure required to link the Tomago and Kooragang industrial areas and for environmental protection works in the area. Currently, this land does not form part of the reserved area of park but is retained as Crown land and is held and managed by NPWS under Part 11 of the National Parks and Wildlife Act. As such it is subject to the provisions of this plan and the National Parks and Wildlife Regulation. The heritage-listed Radar Station lies within this corridor.

Zonings under state environmental planning policies are subject to review and can be amended if no longer required. Discussions with the Department of Planning and Environment have indicated that a review for this area is possible. If this occurs NPWS

would seek to include this Part 11 land into the park. If added to the park, future infrastructure development in this area would be subject to an authorisation under the National Parks and Wildlife Act, such as a licence or easement.

Commercial fishing and aquaculture activities

All commercial fishing and aquaculture activities in NSW waters are regulated under the Fisheries Management Act and must be in accordance with licence conditions specified by the relevant regulatory authority. Some sections of the park's boundary are defined as the mean low water mark and so the park includes the intertidal zone. The park also includes the bed of Fullerton Cove. Inclusion of these areas within the park does not change the relevant regulatory authority and fishing operations will continue to be managed by this authority. Commercial fishing activities in the park include fish and prawn trawling and one commercial oyster operation near Fern Bay.

Licence areas

Parts of the park, particularly on Ash Island, have previously disturbed environments that are suitable for restorations projects. Some of these areas may be licensed for activities that support ecological restoration and are consistent the objectives of the National Parks and Wildlife Act.

Other uses

A residential house was previously located at Scotts Point on Ash Island, on a property that also included a greyhound training track. This property was transferred to NPWS management as part of the transfer of Crown land in 2010. At that time, the house was uninhabitable and was removed from the park in 2016. The training track was also removed. This area of land is currently Part 11 land. NPWS will seek to add this area to the park in the future.

The Rebel Model Flying Club is a model aeroplane club that has operated on Ash Island (on the corner of Cabbage Tree Road and Milham Road) since 1990. It operates in the park under a licence agreement. Club members maintain the licensed area by mowing a grassy landing strip, and the site has a shelter.

Areas of Ash Island were previously used for cattle grazing and some fencing from this period remains on the island. These fences are no longer required and can restrict fauna movement.

Desired outcome

- Non-NPWS uses and activities are managed to minimise impacts on park values and infrastructure.

Management response

- 5.3.1. Continue to liaise with TransGrid regarding access and maintenance needs in accordance with the existing agreement.
- 5.3.2. Continue to permit Ausgrid to maintain and access their existing power lines that traverse the park.
- 5.3.3. Investigate ways to reduce bird strike on transmission lines, particularly around Swan Pond and Wader Pond area.

- 5.3.4. Continue to permit relevant authorities such as Hunter Water and Jemena to access and maintain pipelines in the park.
- 5.3.5. Work with Hunter Water regarding groundwater protection and extraction from the section of Tomago Sandbeds Special Area within the park.
- 5.3.6. Continue to allow the Hunter Valley Flood Mitigation Scheme to operate and permit modifications resulting from reviews of the scheme that improve park values.
- 5.3.7. Seek a review of the infrastructure corridor zone and, should it be no longer be required, include this Part 11 land in the national park.
- 5.3.8. Work cooperatively with the relevant regulatory authority and user groups to ensure that activities licensed under the Fisheries Management Act have minimal impact on park values.
- 5.3.9. If the commercial oyster lease at Fern Bay ceases in the future, ensure associated infrastructure is removed or retained where appropriate for roosting shorebirds in conjunction with the relevant regulatory authority.
- 5.3.10. Continue to license areas of Ash Island. New licence areas may be permitted provided suitable proponents and proposals are approved and any use must be consistent with the objectives of the National Parks and Wildlife Act.
- 5.3.11. Seek to add the Part 11 land at Scotts Point on Ash Island to the park.
- 5.3.12. Continue to license the Rebel Model Flying Club to operate at the site on Ash Island and maintain facilities.
- 5.3.13. Where possible, remove cattle fencing and associated infrastructure on Ash Island where no longer required.

6. Implementation

This plan of management establishes a scheme of operations for the park. Implementation of this plan will be undertaken within the annual program of NPWS.

Identified activities for implementation are listed in Table 7. Relative priorities are allocated against each activity as follows:

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

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

Table 7: List of management responses

Management response	Priority
Geology, landscape and hydrology	
3.1.1 Actively manage the hydrology using water management structures. Manage specific areas of mangroves to minimise the effects of the tidal range changes on habitat loss.	Ongoing
3.1.2 Contribute to the preparation of emergency risk planning with NSW Ports Authority for the management of oil/chemical spills.	Ongoing
3.1.3 Establish and maintain oiled fauna rescue and rehabilitation preparedness with other stakeholders, in particular the port authority and wildlife rescue organisations.	Ongoing
3.1.4 Contribute to management strategies for the prevention of stormwater pollution of waterways in the Hunter Estuary with local councils.	Ongoing
3.1.5 Cooperate with other agencies in responding to pollution events, including testing and monitoring of contamination.	Ongoing
3.1.6 Manage the impact of acid sulfate soil on the park's waterways by flushing strategies including opening floodgates.	Ongoing
3.1.7 Contribute to strategic reviews of the Hunter Valley Flood Mitigation Scheme with the aim of improving wetland values.	Ongoing
Native plants	
3.2.1 Implement a strategic, project-based approach to shorebird habitat enhancement by way of wetland restoration, management of tidal flows and selected mangrove removal in the park.	High
3.2.2 Implement relevant strategies in the <i>Biodiversity Conservation Program</i> for threatened species, populations and ecological communities present in the park.	High
3.2.3 Support and encourage strategic rehabilitation works in the broader Hunter Estuary by agencies, conservation groups and not-for-profit organisations.	Medium

Management response	Priority
3.2.4 Encourage further research and planning on the park's vegetation, in particular, the distribution, migration pathways, ecology and management needs of threatened species and communities.	Low
Native animals	
3.3.1 Continue with the implementation of existing significant wetland restoration projects and seek opportunities to improve habitat through targeted restoration projects.	High
3.3.2 Implement relevant strategies in the <i>Biodiversity Conservation Program</i> for threatened animal species and populations.	High
3.3.3 Undertake strategic removal of mangroves in the park to rehabilitate bird habitat.	Ongoing
3.3.4 Support Hunter Bird Observers Club in their shorebird monitoring, habitat restoration and research activities throughout the park.	Ongoing
3.3.5 Support the research programs for green and golden bell frogs, including research on chytrid fungus.	Ongoing
3.3.6 Work with NSW Ports Authority to ensure a rapid and effective response should an oil spill or pollution incident occur.	Ongoing
Aboriginal heritage	
3.4.1 Encourage opportunities for the Awabakal and Worimi Aboriginal communities to be involved in rehabilitation work in the park.	High
3.4.2 Continue to consult and involve the Awabakal and Worimi local Aboriginal land councils, other relevant Aboriginal community organisations and custodial families in the management of their Country, including the management of Aboriginal sites and places, and cultural and natural values.	Medium
3.4.3 Ensure that any archaeological sites found are appropriately recorded and that information is shared with the local Aboriginal community.	Ongoing
3.4.4 Encourage further research into the Aboriginal cultural heritage values of the park with the Awabakal and Worimi local Aboriginal land councils and other relevant Aboriginal community organisations.	Low
3.4.5 Provide opportunities for Aboriginal people to access Country, to maintain, renew or develop cultural practices and associations.	Ongoing
3.4.6 Permit cultural resource use where in accordance with NPWS policy and legislation.	Ongoing
Historic heritage	
3.5.1 Record, conserve and manage historic sites and potential archaeological sites in accordance with their assessed level of significance.	Medium
3.5.2 Prepare and implement a conservation management plan for the state-listed World War II Radar Station buildings to guide their future care and use.	Medium
3.5.3 Increase understanding of heritage in the park including archaeological sites, through interpretive strategies and education programs such as NPWS Discovery.	Ongoing
Visitor experiences	
3.6.1 Provide public vehicle access on the park roads as shown on Figures 1 and 2.	Ongoing
3.6.2 Install an entrance gate at Ash Island Bridge, which will be open during the day.	High
3.6.3 Continue to restrict vehicle access on the Kooragang Dykes as the wall is unstable and is a risk to park users.	Medium

Management response	Priority
3.6.4 Continue to provide pedestrian access to Kooragang Dykes and Stockton Sandspit. Use signs and education to encourage pedestrians to stay on walking tracks and minimise disturbance to roosting shorebirds.	Ongoing
3.6.5 Avoid vehicle use of unsealed roads and if necessary close gates during periods of heavy rainfall to minimise damage to road surfaces.	Ongoing
3.6.6 Allow for expansion of the Schoolmasters House car park in cooperation with the relevant land management agency where demand is demonstrated.	Low
3.6.7 Manage day use areas in the park listed in Table 4.	Ongoing
3.6.8 Manage visitor use at Stockton Sandspit to minimise any impacts to roosting shorebirds.	Medium
3.6.9 Maintain and upgrade walking tracks in accordance with Table 5 and Figures 1 and 2.	Ongoing
3.6.10 Maintain the Stockton Sandspit Foreshore Walk and encourage people to use this track to keep off the saltmarsh.	Medium
3.6.11 Continue to involve the birdwatching community, in particular the Hunter Bird Observers Club, in management decisions related to shorebird conservation in the park.	Ongoing
3.6.12 Support Hunter Bird Observers Club to provide information to the community on opportunities for birdwatching in the park.	Ongoing
3.6.13 Continue to support access to the park for the Hunter Bird Observers Club to undertake birdwatching and bird monitoring.	Ongoing
3.6.14 In consultation with the waterway management agency investigate and, if feasible, undertake actions or place educational signs at Kooragang Dykes to reduce the impacts of boating, fishing and bait collection on roosting shorebirds and their habitats.	Medium
3.6.15 Assess the condition and options for future ownership of on-park boat ramps and associated infrastructure.	Low
3.6.16 Establish a works program to manage ramps and infrastructure or transfer ownership if beneficial to the park and users.	Low
3.6.17 Support and encourage any initiatives by DPI Fisheries to undertake research on native fish and crustaceans in the area, impacts of fishing and ways to manage fish populations and habitat.	Ongoing
3.6.18 Allow cycling on all roads, management trails and shared-use tracks as shown on Figures 1 and 2.	Ongoing
3.6.19 Work with the local council in the development of the cycling route(s) in the Hexham Swamp section of the park (see Figure 1), subject to an agreement between NPWS and council for route construction and ongoing maintenance. Ensure works are carried out in accordance with any necessary environmental impact assessment.	Medium
3.6.20 Work with neighbouring land managers to assist in providing cycling track networks that connect to the park from adjoining areas.	Ongoing
Information, education and research	
3.7.1 Promote visitor experiences that incorporate education on the park's values, its wetland environment and shorebird habitat (e.g. through NPWS Discovery).	Medium
3.7.2 Undertake and encourage events that highlight the park and its key conservation values.	Medium
3.7.3 Work with the Worimi and Awabakal communities to develop material and programs for interpretation of Aboriginal culture.	Medium

Management response	Priority
3.7.4 Work with local schools to encourage curriculum-based education opportunities for secondary and primary schools, particularly in the areas of ecology, biology and earth sciences.	Low
3.7.5 Work with universities to encourage academic research in the park, particularly in the areas of vegetation mapping, changes in tidal range, sedimentation processes, invertebrate and fish studies and the effects of climate change.	Ongoing
3.7.6 Promote and seek funding to research and implement maintenance and expansion of saltmarsh habitat.	Ongoing
3.7.7 Maintain existing relationships with the relevant land management agency, Hunter Bird Observers Club and universities, and work with other research organisations with an interest in education and research in the park.	Ongoing
Habitat loss and fragmentation	
4.1.1 Plan for strategic additions of land to the park to provide extensions to saltmarsh and shorebird habitat, taking into account predicted sea level rise and associated migration pathways.	High
4.1.2 Maintain cooperative arrangements with neighbouring landholders regarding access, fire and pest species management to minimise impacts on shorebirds.	Medium
4.1.3 Liaise with neighbours and local and state governments to encourage the protection and enhancement of native vegetation and key habitats and corridors on public and private lands in the vicinity of the park.	Low
Pests	
4.2.1 Manage pest species in accordance with pest management strategies relevant to the park. Pest control programs will be aimed at priority weeds such as spiny rush and other weeds species in saltmarsh.	High
4.2.2 Undertake strategic fox control programs in the park.	Medium
4.2.3 Monitor state level and regional level priority weeds and significant environmental weeds and their impacts. Treat any new outbreaks where possible.	High
4.2.4 Prepare and implement a site-specific pest management strategy for the park.	Medium
4.2.5 Seek the cooperation of neighbours in implementing weed and pest control programs. Undertake control in cooperation with local councils, the relevant land management agency and other neighbours.	Medium
4.2.6 When necessary, undertake pest control programs by participating in wild dog baiting with Hunter Local Land Services and neighbours at Tomago.	Medium
4.2.7 Investigate fire as a weed management tool for the park.	Low
4.2.8 Work with neighbours to minimise the impact of grazing on park values through the construction and maintenance of stock-proof boundary fencing. Fencing assistance may be provided in accordance with NPWS policy.	Low
Fire	
4.3.1 Manage the park in accordance with the fire management strategy and review the strategy as required.	High
4.3.2 Continue to be involved in the local bush fire management committee and maintain cooperative arrangements with local rural and urban fire rescue services and surrounding landowners regarding fuel management and fire suppression.	High
4.3.3 Suppress unplanned fires in the park in accordance with the fire management strategy.	High

Management response	Priority
4.3.4 Manage the park to protect biodiversity in accordance with the identified fire regimes in the fire management strategy.	High
4.3.5 Rehabilitate areas disturbed by fire suppression operations as soon as practical after the fire.	Medium
4.3.6 Monitor the ability of native plants and animals to recover between fires and review regimes where relevant.	Ongoing
Climate change	
4.4.1 Continue existing fire, pest and weed management programs to increase the park's ability to cope with future disturbances, including climate change, and encourage research into appropriate indicators to monitor the effects of climate change.	High
4.4.2 Continue with projects to stabilise and raise the height of structures used for shorebird roost habitat such as at Kooragang Dykes.	Medium
4.4.3 Undertake a study of important plant communities and habitat areas (e.g. threatened ecological communities) within coastal hazard zones to investigate priorities for managing permanent inundation due to sea level rise. Implement actions as required within the park.	Low
Access and infrastructure	
5.1.1 Maintain the network of management trails as shown on Figures 1 and 2. Realign sections of trail if required in response to modifications to the Hunter Valley Flood Mitigation Scheme levee.	Ongoing
5.1.2 Maintain the two workshops in the park. Expansion or improvements to these facilities may occur to support NPWS or lessee/licensee management operations and will be confined to existing precincts.	Ongoing
5.1.3 Gate management trails where necessary to prevent unauthorised vehicle access.	Low
5.1.4 Close trails no longer required for management and rehabilitate and manage weeds where required.	Low
5.1.5 Seek to formalise ongoing arrangements for access to the park via trails that cross neighbouring lands.	Low
5.1.6 If necessary, construct management trails to link to the proposed constructed habitat areas for green and golden bell frogs as part of the compensatory habitat works.	Ongoing
Other conservation management operations	
5.2.1 Continue to license other organisations to implement rehabilitation projects in the park as appropriate.	Ongoing
5.2.2 Coordinate with Hunter Local Land Services regarding their annual operational plan for Kooragang Wetland Rehabilitation Project and provide approvals where appropriate.	High
5.2.3 Ensure that NPWS infrastructure used by the Kooragang Wetland Rehabilitation Project, such as the Schoolmasters House and associated workshop, are appropriately maintained by the licensee in accordance with the licence.	Medium
5.2.4 Close informal walking tracks in the park used by the Kooragang Wetland Rehabilitation Project when no longer required for access.	Low
5.2.5 Oversee the implementation of on-park works where required for the Hexham Swamp Rehabilitation Project by Hunter Local Land Services.	High
5.2.6 Work with the local community to protect the park's natural and cultural values and support volunteers involved in a range of rehabilitation, research, education, bird and vegetation monitoring projects in the park.	Ongoing

Management response	Priority
5.2.7 Work cooperatively with companies that have planning approval to undertake habitat compensatory works on Ash Island and provide necessary consents, leases or licences for the works as required.	High
5.2.8 Work with Newcastle Coal Infrastructure Group to prepare an agreement to undertake compensatory habitat works to expand shorebird habitat in the area south of Bell Frog Track. Should an agreement be prepared, undertake actions which may include the management of mangroves including the physical removal of trees where necessary, the ongoing maintenance to ensure expansion of saltmarsh habitat, including removal of mangrove seedlings and the possible development of water management infrastructure.	Ongoing
Non-NPWS uses and operations	
5.3.1 Continue to liaise with TransGrid regarding access and maintenance needs in accordance with the existing agreement.	Ongoing
5.3.2 Continue to permit Ausgrid to maintain and access their existing power lines that traverse the park.	Ongoing
5.3.3 Investigate ways to reduce bird strike on transmission lines, particularly around Swan Pond and Wader Pond area.	Low
5.3.4 Continue to permit relevant authorities such as Hunter Water and Jemena to access and maintain pipelines in the park.	Ongoing
5.3.5 Work with Hunter Water regarding groundwater protection and extraction from the section of Tomago Sandbeds Special Area within the park.	Ongoing
5.3.6 Continue to allow the Hunter Valley Flood Mitigation Scheme to operate and permit modifications resulting from reviews of the scheme that improve park values.	Ongoing
5.3.7 Seek a review of the infrastructure corridor zone and, should it be no longer required, include this Part 11 land in the national park.	High
5.3.8 Work cooperatively with the relevant regulatory authority and user groups to ensure that activities licensed under the Fisheries Management Act have minimal impact on park values.	Medium
5.3.9 If the commercial oyster lease at Fern Bay ceases in the future, ensure associated infrastructure is removed or retained where appropriate for roosting shorebirds in conjunction with the relevant regulatory authority.	Low
5.3.10 Continue to license areas of Ash Island. New licence areas may be permitted provided suitable proponents and proposals are approved and any use must be consistent with the objectives of the National Parks and Wildlife Act.	Ongoing
5.3.11 Seek to add the Part 11 land at Scotts Point on Ash Island to the park.	Low
5.3.12 Continue to license the Rebel Model Flying Club to operate at the site on Ash Island and maintain facilities.	Ongoing
5.3.13 Where possible, remove cattle fencing and associated infrastructure on Ash Island where no longer required.	Low

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