

Information Sheet on Ramsar Wetlands

Categories approved by Recommendation 4.7 of the Conference of the Contracting Parties

1. **Date this sheet was completed/updated:** October 2002

2. **Country:** Australia

3. **Name of wetland:** Hunter Estuary Wetlands

4. **Geographical coordinates:**

Kooragang: Latitude: 32° 51'S; Longitude: 151° 46'E

Shortland: Latitude: 32° 53'S; Longitude: 151° 41'E

5. **Elevation:** 0-10m ASL

6. **Area:** **Kooragang** - 2,926 hectares; **Shortland** – 45 hectares

7. **Overview:**

The Hunter Estuary Wetlands Ramsar site comprises Kooragang Nature Reserve (designated to the Ramsar list in 1984) and Shortland Wetlands. The boundary of Shortland Wetlands is 2.5 km from Kooragang Nature Reserve and is connected to it by a wildlife corridor consisting of Ironbark Creek, the Hunter River and Ash Island.

Kooragang Nature Reserve lies in the estuarine section of the Hunter River. The Reserve and surrounding areas have become known as one of the most important bird study areas in New South Wales. The area is extremely important as both a feeding and roosting site for a large seasonal population of Palaearctic shorebirds and as a waylay site for transient migrants. The site also supports a significant number of birds that over-winter.

Shortland Wetlands is a small but unique complex of wetland types surrounded by urban development along three boundaries. Previously degraded, this urban wetland has been restored with the key objectives of wetland conservation, education and community involvement. The site provides habitat for a diverse range of wetland species, including waterbirds at a critical stage of their lifecycles and threatened species.

8. **Wetland Type:**

marine-coastal:	A	B	C	D	E	F	G	H	I	J	K	Zk(a)
inland:	L	M	N	O	P	Q	R	Sp	Ss	Tp	Ts	
	U	Va	Vt	W	Xf	Xp	Y	Zg	Zk(b)			
human-made:	1	2	3	4	5	6	7	8	9	Zk(c)		

Please now rank these wetland types by listing them from the most to the least dominant:

Kooragang Nature Reserve: I, F, H, G, J, K, E, D

Shortland Wetlands: Ts, Ss, Xf, Type 2

9. Ramsar Criteria: (please circle the applicable criteria; see point 12 below)

1	2	3	4	5	6	7	8
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These criteria are:

Criterion 1: Contains a representative, rare or unique example of a natural or near-natural wetland type found within the appropriate biogeographic region.

Criterion 3: Supports populations of plant and/or animal species important for maintaining the biological diversity of a particular biogeographic region.”

Criterion 4: Supports plant and/or animal species at a critical stage in their life cycles, or provides refuge during adverse conditions.

Criterion 6: Regularly supports 1% of the individuals in a population of one species or subspecies of waterbird.

Please specify the most significant criterion applicable to this site:

Criterion 4

10. Map of site included? Please tick **YES** --or-- **NO**

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12. Justification of the criteria

Criterion 1:

Shortland Wetlands is unique in that it has, within its 45ha site, a combination of high conservation value near-natural wetlands (Melaleuca Swamp Forest, freshwater reed marsh, coastal estuarine mangrove-lined creek) and high conservation value artificial wetlands (constructed freshwater lagoons, coastal estuarine Casuarina-lined channel, model farm dam). It is the only complex of this type found within the Sydney Basin biogeographic region. The Melaleuca Swamp Forest in particular represents a wetland type that, although once very widespread, is poorly represented in the Sydney Basin biogeographic region.

Criterion 3:

Kooragang Nature Reserve is ecologically diverse and represents a significant genetic pool for wetland species in the Sydney Basin biogeographic region. Winning (1996) identified 112 species of vascular plants at Kooragang Island (Appendix 4) which form many distinct habitat types (see Category 16). The Mangrove and Saltmarsh areas are particularly good examples of these plant communities.

The most significant wetland plant community at Shortland Wetlands is the Melaleuca Swamp Forest, dominated by Broad-leaved Paperbark (*Melaleuca quinquenervia*). The Swamp Forest is remnant of a plant community that was once very wide spread in this area and is now poorly represented in the Sydney Basin biogeographic region.

The Hunter Estuary Wetlands are also important for maintaining a high diversity of birds within the biogeographic region with over 250 species recorded (Appendix 1).

Criterion 4:

Kooragang Nature Reserve is widely recognised for its importance in the conservation of migratory birds (Geering 1995; NPWS 1998). At least 38 species of migratory birds recorded at Kooragang and 21 species of migratory birds at Shortland Wetlands are presently listed under International treaties including the Japan-Australia and China-Australia Migratory Bird Agreements (JAMBA and CAMBA) (Appendix 1).

In 2000, 4,800 migratory shorebirds were recorded in the Hunter Estuary (Straw 2000). Kooragang Nature Reserve regularly supports 15 species of migratory shorebird. Shortland Wetlands regularly provides habitat for at least seven species of migratory shorebird, particularly when muddy margins of the ponds become exposed (Appendix 1).

Kooragang and Shortland Wetlands also support a large number of species at a critical seasonal stage of their breeding cycle. Twenty-four of the 28 bird species recorded breeding at Shortland also occur at Kooragang (see Appendix 2).

The site provides refuge for a number of species during periods of critical inland drought. These species include Freckled Duck (*Stictonetta naevosa*); Pink-eared Duck (*Malacorhynchus membranaceus*); Australian Pelican (*Pelecanus conspicillatus*); and Glossy Ibis (*Plegadis falcinellus*) (Albrecht and Maddock 1985). The site is also important for local resident ducks, herons and other waterbirds, with up to 2000 ducks recorded at Shortland Wetlands during dry periods (Winning 1989).

Criterion 6:

Kooragang Nature Reserve regularly supports between 2% and 5% of the East Asian-Australasian Flyway population of Eastern Curlew (*Numenius madagascariensis*), with counts ranging from 320 to 900 birds between 1989 and 2000 (Straw 2000). The 1% population threshold for this species is 210 individuals (Rose and Scott 1997).

13. General location

The Hunter Estuary Wetlands Ramsar site comprises Kooragang Nature Reserve (designated to the Ramsar list in 1984) and Shortland Wetlands. Although the sites are not contiguous they have significant linkages.

Kooragang Nature Reserve is located in the estuary of the Hunter River, approximately 7km north of Newcastle on the coast of New South Wales. Shortland Wetlands are located in the Ironbark Creek Catchment in the suburb of Shortland, 12km northwest of Newcastle and 2.5 km from Kooragang Nature Reserve. The Ironbark Creek Catchment, which also includes Hexham Swamp, is a sub-catchment of the Hunter Estuary.

The two sites are linked hydrologically and by a wildlife corridor consisting of Ironbark Creek, the Hunter River and Ash Island (NPWS 1998). The sites are complementary as together they provide a representative range of wetland types found in coastal estuaries within the Sydney Basin biogeographic region. They provide habitat for a great diversity of flora and fauna species that are common to both sites and are highly used by numerous waterbird species for feeding and roosting.

The population of Newcastle in 2000 was over 140,000.

14. Physical features

Kooragang Nature Reserve

Kooragang Nature Reserve comprises Kooragang Island and Fullerton Cove, two areas that lie in the estuarine section of the Hunter River.

Kooragang Island originally consisted of several smaller islands or bars (NPWS 1998). Attempts to control deposition and siltation of the Newcastle port area resulted in the artificial filling of channels and the construction of training walls (NPWS 1998). Fullerton Cove is a large, shallow embayment north of Kooragang Island. It has a maximum depth of two to three metres at its centre and at low tide large areas of mudflats are exposed.

The lower Hunter River is a barrier estuary formed by the deposition of sediments in swamps and flats lying between the inner and outer coastal barrier sands (NPWS 1998). The sediments on Kooragang Island and adjacent estuarine areas comprise black silty and highly saturated soft clays to a depth of about 2m which are underlain by a light grey and silty sand (NPWS 1998). Salinities may vary from 70‰ in evaporative salt marsh areas to 8‰ behind levees where the soil is generally more fertile and regularly flooded by fresh water (NPWS 1998).

Most soils of Kooragang Island are only slightly acidic, although small areas of sandy clays supporting brackish swamps can reach significantly low pH and create the

potential for acid sulphates to occur, should they be permanently dried out or drained (NPWS 1998).

The tidal variation for Kooragang Island is 0.1m to 2m. Average annual rainfall at Williamstown (nearest gauging station) is 1088 mm. The mean temperature ranges from 22.7°C to 12.2°C.

Shortland Wetlands

Shortland Wetlands is a restored and remnant wetland bounded on the south by the suburb of Shortland, on the east by a major arterial road, on the north by an old landfill site and on the west by Ironbark Creek and Hexham Swamp. There are strong ecological links between Hexham Swamp, Shortland Wetlands and the western end of Kooragang Nature Reserve (NPWS 1998).

Shortland Wetlands is situated on Quaternary estuarine/lacustrine sediments including silts and clays (Matthei 1995). The site consists of seven discreet but interconnected ponds and a freshwater channel. Four of these ponds are natural and three are man-made. The man-made ponds have been constructed on old landfill sites that were subsequently used as sporting fields.

Water flows from adjacent urban areas into the wetlands and is controlled by various methods. It flows from south-east to north-west through the ponds and exits the site into Ironbark Creek. The average size of the ponds is 14m² and each pond varies in depth from 0.4m to 1m (Bischof and Brown 1996). Most ponds are permanent, with varying water levels, although the Reed Marsh dries bi-annually. Water may be pumped into ponds from a nearby channel but this is rarely done. There is no tidal variation. The catchment area is not known but includes the urban suburbs of Shortland, Waratah West and Warabrook.

Water quality is consistent with natural, freshwater ponds. Abiotic measurements indicate that pH is generally between 6.2 and 7.9. Water temperature varies seasonally between 14°C and 24°C and turbidity is usually less than 10ntu. Salinity is less than 1‰ (Grace and Francesconi 1997).

The water flowing from Shortland Wetlands enters Ironbark Creek and subsequently the Hunter River. At peak flood times Shortland Wetlands becomes a storage area for approximately 42,000m³ of water (Sinlaparommard 1999).

15. Hydrological values:

Kooragang Nature Reserve

Kooragang Island originally consisted of seven islands that were mostly separated by narrow mangrove lined channels. One of the larger channels was Moschetto Creek which linked the north and south arms of the river. In the 1950s the islands were reclaimed and as a result the hydrological regime of what became “Kooragang Island” and the Hunter Estuary was modified (NPWS 1998).

Restrictions in tidal, normal and flood river flows have resulted from the reclamation. Flows through the south arm of the Hunter River have increased. Moschetto was occluded at its southern end by an industrial railway to become tidal via the north arm only (NPWS 1998).

In 1970 a levee bank was built around Fullerton Cove in an effort to ameliorate flooding in low-lying areas of Newcastle, downstream of Kooragang Island (NPWS

- Rainforest communities exist in remnants on Kooragang Island. Isolated individual Fig trees (*Ficus spp.*) and Cabbage Tree Palms (*Livistona australis*) occur;
- Brackish swamps and standing open water containing Sedges (*Scirpus spp.*) and other aquatic species; and
- Other important habitats include standing open water, mudflats, sandy beaches and rock retaining walls.

Shortland Wetlands

Shortland Wetlands were originally part of the estuarine wetlands of lower Ironbark Creek, with saltmarsh and mangroves extending well into the present site.

Today the site represents a remnant wetland that maintains its ecological connections to fresh, brackish and saline wetlands elsewhere in the estuary through its connection to Ironbark Creek. Although the floodgates on Ironbark Creek are still in place, their management is to be modified in the near future, allowing increased tidal flows into the creek system. This may enhance the brackish wetland values on the site.

The main habitats and vegetation types on the site include restored semi-permanent/seasonal freshwater ponds and marshes, natural semi-permanent/seasonal brackish ponds and marshes, freshwater swamp forests and a coastal estuarine creek.

Variations in water levels in the ponds result in a significant range of vegetation succession across the site annually, contributing to biodiversity values, especially in macro-invertebrate populations.

Over 150 flora species occur on the site (Appendix 4) within 22 vegetation communities (Beretta 1998). Floral communities include: Closed *Commersonia* Forest, Closed Mangrove Forest, Open Planted Rainforest, *Casuarina* Forest, Open *Melaleuca* Swamp Forest, Open Woodland, Wet Heath, *Banksia* Shrubland, *Acacia* Shrubland, Water Couch Wet Meadow, Closed *Typha* Rushland, Closed *Phragmites* Reed Swamp, *Juncus* Rushland and several large remnant Eucalypts.

The site contains a high diversity of original and rehabilitated plant communities and has undergone a committed landscaping effort (see Category 17).

Since 1996 over 32,000 trees have been planted on the site into four zones:

1. Visitor Centre Zone (native Australian plants);
2. Constructed Wetlands (plants native to the local region);
3. Natural Wetlands (plants native to the site); and
4. Rainforest Zone (a rehabilitated rainforest).

These plantings have significantly changed the landscape, enhancing natural processes on the site. The distribution and abundance of these plant communities create a stable and complex ecosystem that contributes to hydrologic processes, soil stabilisation and fauna diversity. The reedy margins provide breeding and feeding areas for waterfowl and vegetation in shallow pool margins provides foraging sites for shorebirds.

17. Noteworthy flora

Kooragang Nature Reserve

A list of flora species compiled by Winning (1996) identified 112 species of vascular plants at Kooragang Island (Appendix 4) which form many distinct habitat types (see Category 16). The Mangrove and Saltmarsh areas are particularly good examples of these plant communities.

The estuarine herb *Zannechellia palustris* has been recorded immediately adjacent to the western end of the Reserve. This herb is only found in the Newcastle/Lake Macquarie area and along Ironbark Creek. The rainforest vine *Cynanchum elegans* is listed as Endangered under both State (TSC Act) and Commonwealth (EPBC Act) legislation. It occurs adjacent to the western boundary of the Reserve and has only been recorded in 40 other sites in NSW (NPWS 1998).

Shortland Wetlands

The most significant wetland plant community at Shortland Wetlands is the Melaleuca Swamp Forest, dominated by Broad-leaved Paperbark (*Melaleuca quinquenervia*). The Swamp Forest is remnant of a plant community that was once very wide spread in this area and is now poorly represented in the Sydney Basin bioregion.

Shortland Wetlands is significant for a range of plant communities that have been successfully re-introduced to the site, including:

- Open Rainforest developed around remnant rainforest species dominated by Turpentine (*Syncarpia glomulifera*), Lilly Pilly (*Acmena smithii*), Scentless Rosewood (*Synoum glandulosum*), Cheese Tree (*Glochidion ferdinandi*) and Bleeding Heart (*Omalanthus populifolius*);
- Open Eucalypt woodland dominated by Swamp Mahogany (*Eucalyptus robusta*), Red Bloodwood (*Eucalyptus gummifera*) and Grey Gum (*Eucalyptus punctata*);
- Melaleuca Shrubland dominated by Ball Honey Myrtle (*Melaleuca nodosa*), Swamp Paperbark (*Melaleuca ericifolia*), Prickly-leaved Paperbark (*Melaleuca styphelioides*), and Swamp Millet (*Isachne globosa*);
- Acacia Shrubland dominated by Sydney Golden Wattle (*Acacia longifolia*);
- Wet Heath dominated by *Callistemon citrinus*, *Banksia robur* and Christmas Bells (*Blandfordia grandiflora*); and
- Casuarina Forest dominated by Swamp Oak (*Casuarina glauca*).

18. Noteworthy fauna

The Hunter River Estuary is renowned for its birdlife. Over 250 species of birds have been recorded across the Hunter Estuary Wetlands site (Appendix 1). The occurrence of migratory waterbirds is of particular importance. In 2000, 4,800 migratory shorebirds were recorded in the Estuary (Straw 2000). At least 45 migratory species presently listed under the Japan-Australia Migratory Bird Agreement (JAMBA) and/or the China-Australia Migratory Bird Agreement (CAMBA) have been recorded at the site including 38 species at Kooragang and 21 species at Shortland, with 14 of these species common to both areas (Appendix 1).

The Estuary has supported more than one percent of the Australian populations of sixteen migratory wading species (Smith 1991) and based on this criterion has been ranked as the fifth most important site for shorebirds in Australia (Watkins 1993). It has also been recognised as the most important area for shorebirds in NSW (Smith 1991).

The site provides habitat for numerous threatened species listed under the NSW *Threatened Species Conservation Act 1995* (TSC Act) (see Appendix 1). The Green and Golden Bell Frog (*Litoria aurea*) is also listed as vulnerable nationally under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). A project is currently underway to re-introduce the Bell Frog to Shortland Wetlands. The Australasian Bittern (*Botaurus poiciloptilus*) is also listed as vulnerable globally (IUCN 2000) and the Red Goshawk (*Erythrorchis radiatus*) is vulnerable nationally (EPBC Act).

Threatened species (under the TSC Act) include Black-necked Storks (*Ephippiorhynchus asiaticus*), Australasian Bittern, Comb-crested Jacana (*Irediparra gallinacea*) and Magpie Geese (*Anseranas semipalmata*). Black-necked Storks regularly use the site during their nomadic movements throughout the lower Hunter region. Australasian Bittern occur as a small, probably breeding population, but are rarely seen because of their secretive nature. Comb-crested Jacana is a rare species within the lower Hunter region. It has been reported at Kooragang Island and is a rare visitor to Shortland Wetlands. In 1987, the Wetlands Centre initiated a re-introduction of the locally extinct Magpie Goose and now supports a breeding population of more than 100 Geese. The Centre is one of four centres hosting a Freckled Duck captive-breeding program.

A total of seven mammal species have been recorded at Shortland Wetlands with only two of these being native. Several species of frogs, tortoise, skinks and snakes have been recorded at the site, all of which are common to the region (Appendix 3). Records for these species are currently not available for Kooragang.

The Hunter Estuary contains about 15 species of commercially important fish, crustacea and molluscs. The industry has been estimated at around a half a million dollars annually with major components being mullet, jewfish, prawn and oyster fisheries which together provide about 8% of the NSW annual catch (NPWS 1998).

Pond life at Shortland Wetlands is abundant. Six species of fish have been recorded (see Appendix 3). A wide diversity of macro-invertebrates is present including many sensitive insect larvae. Macro-invertebrate surveys routinely record molluscs, bloodworms, caddisfly larvae, gastropods, beetles, bugs, water fleas, seed shrimps, copepods and nymph forms of dragonfly, damselfly, stonefly and mayfly (Bischof and Brown 1996).

19. Social and cultural values

Kooragang Nature Reserve

Kooragang Nature Reserve and the surrounding areas have become known as one of the most important bird study areas in New South Wales. The Reserve is used for both research and recreational birdwatching. Limited recreational fishing is also undertaken within the Reserve.

The Worimi and Awabakal Aboriginal tribes were the earliest inhabitants of the lower Hunter Estuary (NPWS 1998). There are numerous middens and campsites scattered throughout the lower Hunter but they occur particularly along the riverbanks and within the dunes along Stockton Bight. The nearest Aboriginal sites outside the Reserve come from the dunes and coastal forests between Fullerton Cove and Stockton Bight where many and varied sites are known to occur (NPWS 1998).

There are a few European historic sites within Kooragang Nature Reserve. These include concrete footings of an old munitions store on Sandy Island, a timber bridge, a mature Moreton Bay Fig associated with early farming and a half submerged timber drogher.

Shortland Wetlands

Historically the site now occupied by Shortland Wetlands would have been well-used by Aboriginal people as a food and materials source due to their productive and dynamic nature. The present site was occupied by the Pambalong people, a smaller tribe of the Awabakal People (Sokoloff 1974). Shortland Wetlands contains a significant archaeological site that is believed to have been a factory site for the production of stone tools (Bangent 1990; Winning 1989).

Shortland Wetlands have retained their importance in the fabric of the local community since a community campaign to save and restore the wetlands. In 1984 the actions of the local conservation group gained support for the restoration of the degraded wetlands and the development of Shortland Wetlands Centre. This was a very ambitious project at that time. Now trading as The Wetlands Centre Australia, the Centre continues to attract strong community support and involvement.

The Wetlands Centre promotes wetland conservation and wise use through communication and education, passive recreation and community involvement and acts as a focal point for community-based environmental interest groups that represent valuable partnerships. The Hunter Bird Observers Club, Australian Plant Society and the Society for Frogs and Reptiles contribute expertise and resources to the sustainable management of the site. The successful restoration of Shortland Wetlands has been supported by the investment of many thousands of volunteer man-hours and valuable partnerships with relevant interest groups such as those mentioned above.

20. Land tenure/ownership

Kooragang Nature Reserve

The site is Crown Land dedicated as a Nature Reserve under the NSW *National Parks and Wildlife Act 1974*. Surrounding lands are a mixture of Freehold and other public authority managed lands.

Shortland Wetlands

The site is owned by Shortland Wetlands Centre, Ltd, trading as The Wetlands Centre Australia, a company limited by guarantee and owned by its (600) members. It operates as a not-for-profit conservation organisation and is managed by a volunteer Board of Directors.

Land ownership in the surrounding area includes residential landholders, Newcastle City Council, Hunter Water Corporation, NSW Roads and Traffic Authority, Hunter Catchment Management Trust and NSW National Parks and Wildlife Service.

21. Current land use

Kooragang Nature Reserve

The site is permanently dedicated as a Nature Reserve and is used as a nature conservation area. A substantial amount of ornithological, wetlands ecology and fisheries research together with bird watching is undertaken within the Reserve. Surrounding areas are privately owned and used for heavy industry and pastoral activities.

Two areas adjoining Kooragang Nature Reserve are being rehabilitated (known as the Kooragang Wetland Rehabilitation Project) and are used for conservation purposes.

Shortland Wetlands

The Shortland Wetlands site is used for wetland conservation, education and passive recreation.

From 1984 the aim was to develop a wetland centre based on Slimbridge in the United Kingdom, to complement the restoration project. This project has matured alongside the restoration work. The site is well established as an education and eco-tourism destination. Providing public access for education purposes requires on-going management to assure that ecological values are not threatened.

The immediate surrounding area includes residential, water delivery infrastructure, a sports ground, roads, former local government landfill site, market gardens, railway line, a cemetery, as well as significant conservation areas adjacent to the site. It is important to note that approximately one-third of the Newcastle Local Government Area is classified as wetland. However, Newcastle also has an industrial economic base, including coal imports, a working port and small, medium and heavy manufacturing.

22. Factors (past, present or potential) adversely affecting the site's ecological character, including changes in land use and development projects

Kooragang Nature Reserve

Introduced animals are a moderate threat to the Reserve. Domestic dogs (*Canis familiaris*), foxes (*Vulpes vulpes*) and cats (*Felis catus*) affect bird populations through direct disturbance and predation. Black Rat (*Rattus rattus*), Brown Rat (*Rattus norvegicus*) and House Mouse (*Mus musculus*) compete with native species in the area. Rats are also known to take both waterfowl eggs and their hatchlings as food. There are limited numbers of hares and rabbits in the Reserve, however they are a minor threat due to lack of suitable habitat.

Introduced weeds are a moderate threat to the Reserve. Four weeds are established within the Reserve and include Bitou bush (*Chrysanthemoides monilifera*), Alligator Weed (*Alternanthera philoxeroides*), Water hyacinth (*Eichornia crassipes*) and Pampas Grass (*Cortaderia selloana*). Sharp Rush (*Juncus acutus*) occurs in part of the Reserve but is considered a minor threat.

The lower catchment of the Hunter River is highly industrialised and urbanised. The mouth of the River has been developed as one of Australia's most important ports. Further industrial expansion adjacent to the Reserve is proposed and potential impacts

on the Ramsar values are currently being assessed. Land development continues near the Reserve and upstream along the Hunter River and this could accelerate soil erosion and water pollution in the vicinity of the Reserve. Soil erosion and water pollution are considered moderate threats.

Air pollution from nearby aluminium and steel industries is a minor threat. Oil spills are considered a major threat but to date none have occurred within the Reserve.

Shortland Wetlands

In 1971, floodgates were installed in Ironbark Creek. The purpose of this installation was to mediate flood control for surrounding areas. The Hunter Catchment Management Trust is proposing to open the floodgates in an attempt to re-introduce natural water flows and a tidal influence. Modelling suggests that this will have an insignificant impact on Shortland Wetlands although it may impact slightly on the western edge of the site. Currently, the Hunter Catchment Management Trust is conducting a trial by opening the floodgates in a limited way in order to monitor change.

There is potential for development of the landfill site adjacent to Shortland Wetlands that is owned by Newcastle City Council and has been closed since 1992.

A proposed extension to the existing freeway to the east of the site could potentially impact on the wetland. There is, however, a buffer zone between the Ramsar site and the development proposal.

Many exotic plant species occur at Shortland Wetlands (see Appendix 4). The spread of weeds may be enhanced by local residents who dump rubbish on the site, clear vegetation near their fences and plant exotic tree species. The most serious aquatic weed species include Alligator Weed (*Alternanthera philoxeroides*), Dock (*Rumex spp.*) and Pennywort (*Hydrocotyle bonariensis*).

Introduced animals that pose the most serious threat to native fauna at the site include the Black Rat (*Rattus rattus*), House Mouse (*Mus musculus*), Red Fox (*Vulpes vulpes*), domestic Cat (*Felis catus*), Common Myna (*Acridotheres tristis*), Common Starling (*Sturnus vulgaris*) and Mosquito Fish (*Gambusia holbrooki*).

The Black Rat poses a threat to shore-breeding birds, shorebirds, and the Long-necked Tortoise by predated eggs and nestlings. Red Foxes have been recorded preying on juveniles of Egrets and pose a threat to other species such as ground nesting and ground feeding birds. Rabbits may enhance the effects of soil erosion and Brown Hares pose a threat to the regeneration of vegetation. Predation by Mosquito Fish is listed as a key threatening process under the NSW *TSC Act 1995*. It is considered a threat to the Green and Golden Bell Frog (Morgan and Butturner *in* NPWS 2002b) as well as macro-invertebrate communities.

Some of the remnant natural wetlands on the site have exhibited signs of eutrophication, such as emission of odorous gases (e.g. Hydrogen sulphide), algal blooms and dominance by eutrophytes (e.g. *Triglochin procera*, *Spirodela pusilla*, *Azolla spp.*). Eutrophication may occur as a result of a concentration of nutrients, changes in water quality parameters such as pH, urban run-off and a buildup of bird faeces. The substrate of the artificial ponds may also increase eutrophication as it contains high nutrient material which was previously dumped on the site as fill.

23. Conservation measures taken

Kooragang Nature Reserve

Since the gazettal of Kooragang Nature Reserve in 1983, 720ha have been added to the Reserve which currently totals 2,926ha. The Plan of Management (NPWS 1998) which aims to preserve and enhance the area for nature conservation has been implemented and includes:

- Water quality and catchment management;
- Management of native and introduced flora and fauna;
- Wetland rehabilitation;
- Cultural heritage;
- Fire management; and
- Use and promotion of the Nature Reserve.

Specific conservation measures currently being undertaken, or undertaken recently, include:

- Rehabilitation of Sandy Island for migratory shorebird roosting;
- Mangrove removal and ongoing management of the Stockton Sandspit for shorebird roosting;
- Artificial roost construction in Fullerton Cove;
- Monthly shorebird monitoring;
- Pampas grass control is anticipated in early 2003; and
- A management strategy for the control of Alligator weed.

Shortland Wetlands

The site was established as a conservation reserve in 1985. The site restoration has included the creation of two new ponds, development of tracks, building of structures and interpretation to support education uses. Management plans using a catchment management approach were developed and implemented to guide restoration work, on-going management and public access. A long-term revegetation plan has been implemented to improve degraded habitat and introduce new habitat types.

Management is under the direction of a volunteer site committee which meets quarterly and includes staff, volunteers and technical advisors.

Monitoring of a broad range of ecosystem functions and values has been intermittent. Monitoring of bird species, egret breeding and ibis roosting and recording of plant species have been maintained.

The Wetlands Centre is one of four centres hosting a Freckled Duck captive-breeding program. The program began with 17 ducks and since 1993, 52 ducklings have hatched and 36 have survived. Fifteen of these have been given to Tidbinbilla Nature Reserve as part of their captive-breeding program.

The restoration of the site has been used to promote broad conservation of all local wetlands. The involvement of the local community has played a major role in the

restoration project, site management, project development, plantings, programs and administration.

Some areas of Shortland Wetlands and Kooragang Nature Reserve (see Map 2) are covered by State Environmental Planning Policy 14, Coastal Wetlands (SEPP 14), which aims to ensure coastal wetlands are preserved and protected.

24. Conservation measures proposed but not yet implemented

Kooragang Nature Reserve

Rehabilitation of wetland areas within and adjacent to the Reserve have been undertaken under the auspice of the Kooragang Wetland Rehabilitation Project. The Project aims to restore and/or enhance the habitat for migratory birds and waterfowl and has proposed that:

- Lands within the Reserve previously reclaimed for agriculture and flood mitigation are to be rehabilitated to wetland;
- The hydrology created by artificial regulation devices on parts of Kooragang Island are to be modified; and
- Degraded vegetation communities in the Reserve are to be rehabilitated.

Tidal regimes will be introduced into the Tomago buffer lands to increase the wetland habitat in the Nature Reserve.

Shortland Wetlands

A Management Plan to guide the on-going management and wise use of Shortland Wetlands is currently being prepared. The Plan builds on and aims to enhance the management practices that have been in place since the start of the restoration project in 1984-85. The Plan is designed to accommodate the on-going involvement of local communities. The Wetlands Centre's focus on communication, education and public awareness has influenced the objectives and actions in the Plan. A key aim will be the development and implementation of a Monitoring Plan to identify changes in key factors relevant to the ecological character of the site.

25. Current scientific research and facilities

Kooragang Nature Reserve

The only research facility in the Nature Reserve is a small bird hide at Stockton Sandspit.

Kooragang Island has been the subject of a number of ecological studies undertaken by various parties including the University of Newcastle, Hunter Bird Observers Club, Shortland Wetlands Centre, Hunter Catchment Management Trust, Ironbark Creek Catchment Management Committee, Kooragang Wetland Rehabilitation Project, Hunter Water Corporation and various environmental consultancy companies.

Currently research is being undertaken in the following areas:

- Banding and plumage studies of wading birds, water bird counts, the success of waterbird breeding and changes in migration patterns;

- Geomorphological changes to the Hunter River Estuary;
- Water quality monitoring; and
- Alligator weed.

Shortland Wetlands

There are no active research facilities currently operating on the site. However, there is a significant body of work about the site, its development and Centre activities that has been produced by students and by technical staff employed as consultants in past years. The Wetlands Centre has produced 37 scientific publications, 4 reports, poster papers at international conferences and contributed to three books. An extensive bibliographical list of publications relating to The Wetlands Centre (Burgess 2002) is held in the Wetlands Centre Library.

Research related to the site forms part of the Wetlands Centre Library collection. The library is extensive and unique. It has grown over the past 17 years to form a detailed collection of resources which describe local wetlands and environmental issues. The library is available to the public and is staffed by volunteers who respond to community needs.

There is good potential for the on-going involvement of research students from nearby Newcastle University in projects relevant to the management of the site.

26. Current conservation education

Kooragang Nature Reserve

Kooragang Nature Reserve offers significant opportunity for environmental education since it is readily accessible to a large number of people from Newcastle and the lower Hunter Valley.

Shortland Wetlands Centre provides interpretation of the area. It also organises regular visits to the Nature Reserve for researchers and students of wetland conservation.

The Kooragang Wetland Rehabilitation Project also has interpretation facilities and a model environmentally sustainable farm adjacent to the Nature Reserve. The erection of education facilities in the bird hide at the Stockton Sandspit are also proposed.

Signs that outline the principles of the Ramsar Convention and the conservation values of the Ramsar Site have been erected at the site.

Shortland Wetlands

The Wetlands Centre uses communication and education as key processes to promote wetland values, conservation and wise use management. Development on the site to support education includes the Visitors Centre, an extensive system of tracks, viewing platforms, decks, boardwalks and interpretation signs. An elevated birdhide provides access to nesting and roosting birds. Canoe facilities allow access to tidal creeks adjacent to the site.

The Visitors Centre is a large building containing an interpretation display with live and static displays, free-standing binoculars, information booklets and brochures, a souvenir shop, café, facilities and offices. Disabled access is available in the Centre

and on some of the walks. A Sensory Trail provides access to the wetlands for visitors with sensory impairment.

The Wetlands Centre's school education program is underpinned by a valuable partnership with NSW Department of Education and Training (DET). The Wetlands Environmental Education Centre, a DET facility, manages the programs for approximately 8000 school visitors annually. Students from kindergarten to year 12 enjoy programs relevant to the NSW curriculum and their stage of schooling.

The Wetlands Centre programs and achievements have resulted in a greater understanding of wetlands in the Hunter region, increasing community support for other major wetland rehabilitation projects. This provides an excellent demonstration of the role education can play to build understanding of wetland values and functions.

27. Current recreation and tourism:

Kooragang Nature Reserve

Kooragang Nature Reserve is not promoted as a tourist destination. Some limited, low impact recreational uses are permitted within the Nature Reserve and include fishing, boating and bird watching. The Nature Reserve has approximately 5000 visitors per year.

Shortland Wetlands

Shortland Wetlands offer a range of outdoor recreation facilities with very easy access to high-conservation-value wetlands for visitors. Facilities include bush-walking trails, boardwalks, observation decks, elevated bird hide and canoes.

As an ecotourism facility, The Wetlands Centre complements other attractions in Newcastle and provides environment-focused tourism supported by environmental education.

28. Jurisdiction

Territorial: Government of New South Wales

Functional: NSW National Parks and Wildlife Service; Newcastle City Council.

29. Management authority

Shortland Wetlands Centre Ltd is responsible for management of Shortland Wetlands:

The Wetlands Centre Ltd

PO Box 292

Wallsend NSW 2287

Phone: 02 4951 6466

NSW National Parks and Wildlife Service is responsible for management of Kooragang Nature Reserve:

Manager

Hunter Coast Area

Locked Bag 99

Nelson Bay Delivery Centre NSW 2315

Phone: 02 4984 8200

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