



NSW National Parks
and Wildlife Service

Cockle Bay, Rileys Island, Pelican Island and Saratoga Island Nature Reserves Plan of Management



Department of **Environment & Climate Change** NSW



**COCKLE BAY NATURE RESERVE,
RILEYS ISLAND NATURE RESERVE,
PELICAN ISLAND NATURE RESERVE AND
SARATOGA ISLAND NATURE RESERVE
PLAN OF MANAGEMENT**

NSW National Parks and Wildlife Service

Part of the Department of Environment and Climate Change NSW

June 2009

This plan of management was adopted by the Minister for Climate Change and the Environment on 4th June 2009.

Acknowledgments

This plan of management is based on a draft plan prepared by staff of the Central Coast Hunter Range Region, Parks and Wildlife Group, Department of Environment and Climate Change.

Valuable information and comments were provided by members of the Central Coast Hunter Range Regional Advisory Committee and members of the public.

Cover photograph of Rileys Island by Liz Phelps, NPWS.

Inquiries about these nature reserves or this plan of management should be directed to the Nature Reserves Ranger at the NPWS Gosford Area Office, PO Box 1477, GOSFORD 2250 or by telephone on 4320 4200.

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FOREWORD

Cockle Bay, Rileys Island, Pelican Island and Saratoga Island Nature Reserves are located within Brisbane Water in the Gosford Local Government Area. Together they cover an area of around 115 hectares.

Cockle Bay Rileys Island, Pelican Island and Saratoga Nature Reserves play a significant role in the preservation of endangered ecological communities, seagrass beds, intertidal mudflats and extensive feeding and roosting habitat for a large number of waders, several of which are listed on international agreements for the protection of migratory birds.

The New South Wales *National Parks and Wildlife Act 1974* requires that a plan of management be prepared for each nature reserve. A plan of management is a legal document that outlines how an area will be managed in the years ahead.

A draft plan of management for the Cockle Bay, Rileys Island, Pelican Island and Saratoga Island Nature Reserves was placed on public exhibition from 18th January until 21st April 2008. The submissions received were carefully considered before adopting this plan.

This plan contains a number of actions to achieve “Better environmental outcomes for native vegetation, biodiversity, land, rivers, and coastal waterways” (Priority E4 in the State Plan) including annual monitoring of the endangered ecological communities and bush stone-curlew population, development of weed and pest control strategies, and implementation of bush regeneration programs in all the reserves.

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



Carmel Tebbutt MP
Deputy Premier
Minister for Climate Change and the Environment

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1. INTRODUCTION

1.1 LOCATION, GAZETTAL AND REGIONAL SETTING

Cockle Bay, Rileys Island, Pelican Island and Saratoga Island Nature Reserves are all located within Brisbane Water, a tidal arm of Broken Bay, approximately 50 kilometres north of Sydney (Figure 1 and 2). All four reserves protect important areas of estuarine wetland and remnant vegetation and are set against a backdrop of residential development around the foreshores of Brisbane Water. The reserves lie within the Gosford Local Government Area.

Cockle Bay Nature Reserve is located at Empire Bay, approximately 5 kilometres south-east of Woy Woy. The original reserve was gazetted in 1992 and included 26 hectares of land transferred to the NPWS from Gosford City Council. Another 18 hectares was added to the reserve in 1997 following further land transfers from Council, creating a reserve of just under 44 hectares, which is gazetted to mean high water mark. An additional 24.5 hectares was transferred to the Service by Gosford City Council in 2008 and is currently awaiting gazettal as part of the reserve. These additions have been included as part of Cockle Bay Nature Reserve in this plan of management.

Saved from development by strong community campaigns in the 1970s, Rileys and Pelican Islands have high social significance in addition to their natural and aesthetic values. Both islands were gazetted as nature reserves in 1989, with a subsequent small addition to Rileys Island from Gosford City Council in 1994. Rileys Island Nature Reserve (45.7 hectares) is gazetted to mean high water mark and lies between St Huberts Island and Saratoga-Davistown. Pelican Island Nature Reserve (40 hectares) is actually comprised of three islands, separated by mangrove channels, it lies just north of Woy Woy. It is gazetted to the seaward edge of the mangroves.

Saratoga Island Nature Reserve is a small (2 hectares) island originally created artificially from dredge spoil. It has been colonised by native vegetation and provides important feeding habitat and high tide roosts for a large number of wading birds. The reserve was gazetted to mean high water mark in November 2005.

The intertidal zones surrounding each reserve are not currently gazetted as part of the nature reserves. Each reserve is listed as a high priority under the DECC program for acquisition of intertidal zones.

In a regional conservation setting these four nature reserves complement the larger sandstone reserves of Bouddi and Brisbane Water National Parks which adjoin the waterway of Brisbane Water. While much larger, these national parks protect only small sections of the estuarine and intertidal habitats of Brisbane Water. Cockle Bay and the Island Nature Reserves play a significant role in the preservation of endangered ecological communities, seagrass beds, intertidal mudflats and extensive feeding and roosting habitat for a large number of waders, several of which are listed on international agreements for the protection of migratory birds.

All four of the reserves contain areas which are identified as significant coastal wetlands under State Environmental Planning Policy (SEPP) 14. All of Pelican Island Nature Reserve, the majority of Rileys Island and Cockle Bay Nature Reserves and the

eastern section of Saratoga Island Nature Reserve are mapped as wetlands under SEPP 14.

The nature reserves are within the area administered by the Darkinjung Local Aboriginal Council.

1.2 LANDSCAPE

Natural and cultural heritage and on-going use are strongly inter-related and together form the landscape of an area. Much of the Australian environment has been influenced by past Aboriginal and non-Aboriginal land use practices, and the activities of modern day Australians continue to influence bushland through recreational use, cultural practices, the presence of introduced plants and animals and in some cases air and water pollution.

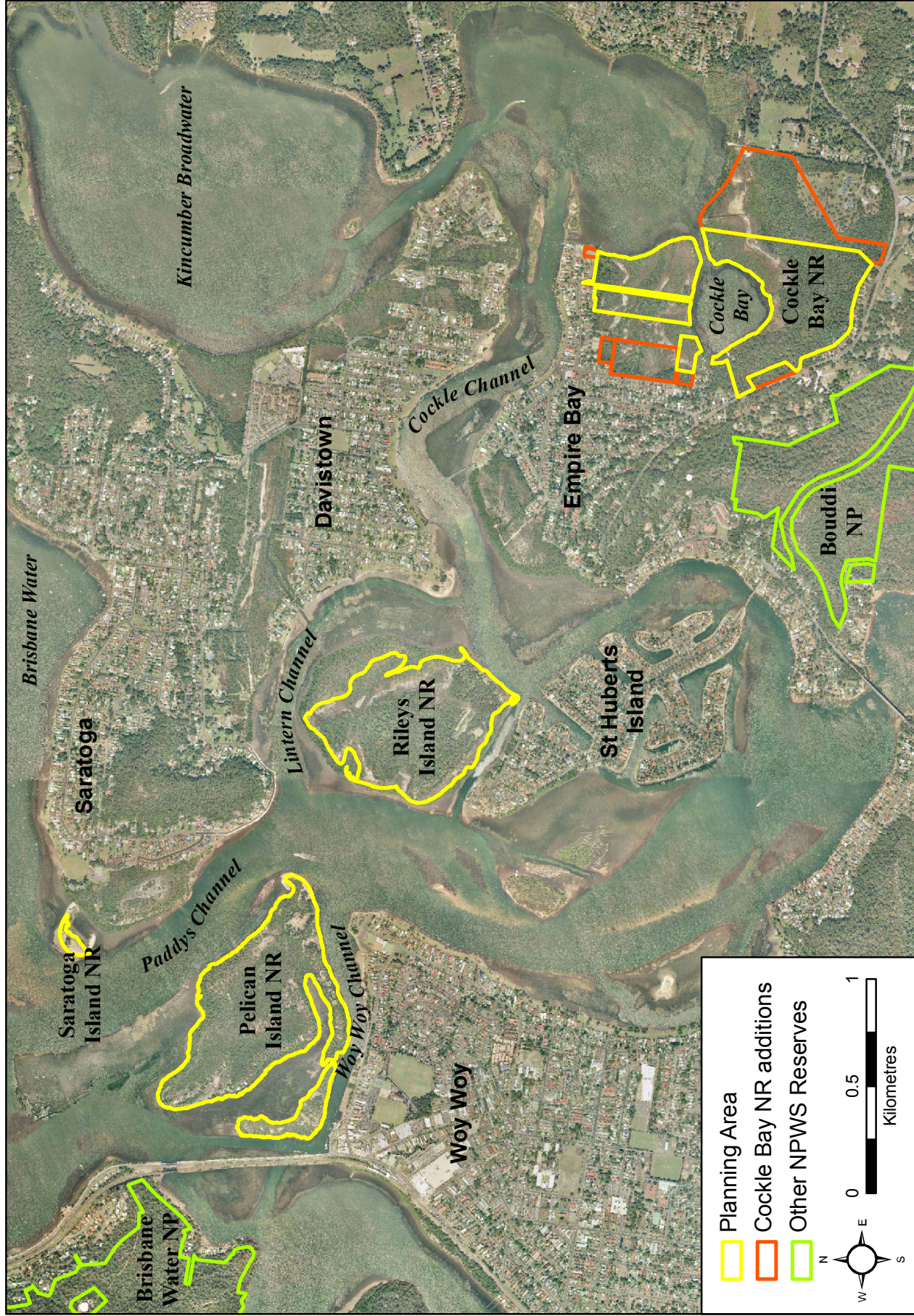
Cockle Bay, Rileys Island, Pelican Island and Saratoga Island protect areas of estuarine wetland and significant remnant vegetation within the Brisbane Water. The reserves provide an important natural visual backdrop to the residential development of the surrounding suburbs. In the past the reserves supported a range of human uses, including providing food and resources for Aboriginal people and later boat building, grazing and farming. Since the protection of the areas as nature reserves only some minor recreational use has occurred.

Both Aboriginal and non-Aboriginal people place cultural values on natural areas, including aesthetic, social, spiritual, recreational and other values. Cultural values may be attached to the landscape as a whole or to individual components, for example to plant and animal species used by Aboriginal people. This plan of management aims to conserve both natural and cultural values. For reasons of clarity and document usefulness, natural and cultural heritage, non-human threats and on-going use are dealt with individually, but their inter-relationships are recognised.

Figure 1. Local and Regional Context.



Figure 2. Local Context



2. MANAGEMENT CONTEXT

2.1 LEGISLATIVE AND POLICY FRAMEWORK

The management of nature reserves in NSW is in the context of a legislative and policy framework, primarily the *National Parks and Wildlife Act 1974* (NPW Act), the *NPW Regulation 2002*, the *Threatened Species Conservation Act 1995* (TSC Act) and the policies of the National Parks and Wildlife Service (NPWS), which is now part of the Department of Environment and Climate Change (DECC). Section 72AA of the NPW Act lists the matters to be considered in the preparation of a plan of management. The policies are based on the legislative background and on internationally accepted principles of park management. They relate to nature conservation, Aboriginal and historic heritage conservation, recreation, commercial use, research and communication.

Other legislation, international agreements and charters may also apply to management of the area. In particular, the *Environmental Planning and Assessment Act 1979* (EPA Act) requires the assessment and mitigation of the environmental impacts of any works proposed in this plan. The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) also applies in relation to threatened species listed under that Act.

A plan of management is a statutory document under the NPW Act. Once the Minister has adopted a plan, no operations may be undertaken within Cockle Bay, Rileys Island, Pelican Island and Saratoga Island Nature Reserves except in accordance with this plan. This plan will also apply to any future additions to Cockle Bay, Rileys Island, Pelican Island and Saratoga Island Nature Reserves. Should management strategies or works be proposed for the nature reserves or any additions that are not consistent with the plan, an amendment to the plan will be required.

2.2 MANAGEMENT PURPOSES AND PRINCIPLES

Nature reserves are declared under the NPW Act (s 30J) to protect and conserve areas containing outstanding, unique or representative ecosystems, species, communities or natural phenomena.

Under the Act, nature reserves are managed to:

- conserve biodiversity, maintain ecosystem functions, and protect geological and geomorphological features and natural phenomena;
- conserve places, objects, features and landscapes of cultural value;
- promote public appreciation, enjoyment and understanding of the reserve's natural and cultural values; and
- provide for appropriate research and monitoring.

Nature reserves differ from national parks in that promotion of visitor use is not identified as a management principle.

3. KEY VALUES AND MANAGEMENT DIRECTIONS

3.1 VALUES OF THE RESERVES

Cockle Bay, Rileys Island, Pelican Island and Saratoga Island Nature Reserves are of significance for their natural and cultural heritage and landscape values.

Natural values include:

- all four reserves protect important areas of estuarine wetland and remnant vegetation including three Endangered Ecological Communities;
- the reserves provide habitat for at least 17 fauna species listed on the TSC Act including two which are recognised as threatened on a national level under the EPBC Act;
- the reserves also provide habitat for several species of migratory wading birds which are protected under the Japan-Australia Migratory Bird Agreement (JAMBA) and China-Australia Migratory Bird Agreement (CAMBA) international treaties.

Landscape values include:

- the reserves provide an important natural visual backdrop to the residential development of the surrounding suburbs and related waterways.

Cultural heritage values include:

- Rileys and Pelican Islands Nature Reserves were created as outcomes of the rising environmental movement of the 1970s following public opposition to their development.
- historical relics on Rileys Island provide links to early settlement and the boat building industries connected with Brisbane Water.
- all four reserves potentially provided food, shelter and resources for Aboriginal people.

3.2 MANAGEMENT DIRECTIONS

In addition to the general management objectives for nature reserves specified in Section 2.2, the following specific management directions will apply to Cockle Bay, Rileys Island, Pelican Island and Saratoga Island Nature Reserves:

- the protection and enhancement of the ecological condition and functioning of the reserves so as to conserve species richness of native plants and animals;
- the protection and enhancement of threatened species and endangered ecological communities;
- close liaison with relevant authorities including DPI Fisheries, Maritime NSW, Gosford City Council and the Hunter-Central Rivers Catchment Management Authority to encourage appropriate and integrated land use planning and management practices within the Brisbane Water estuary and catchment which may impact on the nature reserves; and
- the promotion of educational opportunities to raise community awareness and understanding of the values of the nature reserves.

4. NATURAL AND CULTURAL HERITAGE

4.1 LANDFORM, GEOLOGY AND SOILS

The nature reserves lie within the Sydney Basin biogeographic region. This region draws its name from the Sydney Basin geological area that stretches from Port Stephens in the north, south to Batemans Bay and includes the Central Tablelands west of Sydney.

Cockle Bay Nature Reserve surrounds Cockle Bay, a small bay 400 metres across. The reserve forms part of a low lying area on Quaternary Alluvium and some minor Terrigal Formation outcrops. The reserve encompasses a deep alluvial floodplain landscape with level to very gently inclined plains on aeolian/marine deposits with local relief to 10 metres and slope gradients <5% (Murphy 1993).

The soils in Cockle Bay are mainly silty, sandy loams, deep sandy clays and alluvium with the upper layers rich in organic matter. In the higher areas covered by eucalypt forest the sandy soil in the top layer has a sub-stratum of compacted clayey soil. This lower clay layer is relatively impervious and the water table remains high throughout the reserve (Adderley *et al.* 1988).

Erosion and compaction of the saltmarsh areas in Cockle Bay Nature Reserve has occurred in the past due to illegal vehicle and horse access to the area. Fencing of these sensitive areas has allowed natural regeneration to occur and exclusion of such activities should limit any further erosion from occurring. There are also a number of stormwater channels draining into the reserve by which increased sediments and nutrient loads can impact on soils.

Rileys Island is a permanent sand island and was built up as a result of tidal patterns at the entrance to Brisbane Water. It is a low lying island with a maximum height above sea level of just over two metres. It lies across a narrow channel (formally called St Huberts Narrows but referred to locally as The Gutter) from St Huberts Island, a residential canal development to the south.

Pelican Island is a broad sand bank, which is perhaps only a half metre above water level at medium tide and is mostly inundated at high tide. The reserve is actually comprised of three islands separated by mangrove channels. The structure of the islands has probably been influenced by maintenance of the channel which separates the island from Woy Woy, and changes to water flow/sedimentation as a result of the construction of the Brisbane Water Drive Causeway, which also carries the main northern railway line across Woy Woy Bay.

Saratoga Island lies just off the western tip of the Saratoga Peninsula. Originally formed from spoil from the dredging of a former sandbar during the early part of the twentieth century, the island was further shaped by sand removal from the island in the 1960s. This sand was used to fill part of the Saratoga wetland for the construction of playing fields. A deep hole at the southern end of the island is probably evidence of this activity (Skinner 2005).

Saratoga Island is separated from the mainland by a very narrow channel, which has become increasingly shallow with the movement of sand and the tides. It is possible to access the island at low tide without wading.

The soils on the islands are mainly silty sandy loams, deep sandy clays and alluvium with the upper layers rich in organic matter on Rileys and Pelican Islands.

As the reserves adjoin a coastal estuary, most of the low-lying areas of all four reserves have been assessed as having a very high probability risk of containing acid sulphate soils (ASS) (NSW Department of Land and Water Conservation 1997). ASS are common in saltmarsh and mangrove areas as well as in other areas of coastal floodplain. If exposed to the air, oxidation of iron sulphides in the ASS produces sulphuric acid which can have devastating effects on both soil and water and the vegetative and aquatic life they support.

4.2 NATIVE PLANTS

Cockle Bay, Rileys Island, Pelican Island Nature Reserves, and to a lesser extent Saratoga Island Nature Reserve contain significant remnants of native vegetation that demonstrate excellent vegetation zonation with gradation from seagrass beds off shore, through mangroves, saltmarsh and swamp oak forests to sclerophyll forests further inland.

While the seagrass beds are not strictly part of the reserves, as they occur below mean high water mark, they are vitally important to the productivity of the whole Brisbane Water estuary and are naturally linked to the reserves. Seagrass supports a diverse range of fish and invertebrate fauna, such as flat worms and ribbon worms, which form a crucial part of the estuarine wetland food web. Extensive seagrass beds are found off all four islands and activities undertaken within the reserves have the potential to greatly impact on them. The seagrass beds are dominated by eelgrass (*Zostera capricorni*) on the intertidal mudflats and strap weed (*Posidonia australis*) below low tide level to about 2 metres depth.

Cockle Bay Nature Reserve is recognised as one of the largest and most valuable examples of estuarine wetland on the NSW Central Coast. The reserve contains the full suite of vegetation communities found in estuarine wetlands, from those occurring in sub-tidal saline conditions, to communities associated with fresh water ecosystems. Seven vegetation communities have been identified in the reserve (Adderley *et al.* 1988; Bell 2004).

Grey mangroves (*Avicennia marina* var. *australasica*) fringe the shoreline at Cockle Bay, with river mangrove (*Aegiceras corniculatum*) growing on the landward side of the Grey. Saltmarsh, dominated by samphire (*Sarcocornia quinqueflora*) and creeping brookweed (*Samolus repens*), inhabits the next zone inland. This community has the highest soil salinity and can be completely inundated by high spring tides or rain, or completely dried out over the summer months. Coastal saltmarsh has been in rapid decline on the Central Coast since the 1950s. At Cockle Bay there is evidence that the mangroves are slowly invading the saltmarsh. There are a number of potential causes of mangrove encroachment, including rises in sea level, decreased salinity in Cockle Bay from catchment run-off and sediment deposition in the Saltmarsh encouraging mangrove colonisation (Payne 1997).

The vegetation fringing the saltmarsh is largely Swamp Oak (*Casuarina glauca*) Forest and generally correlates with a small, but abrupt rise in elevation. In some areas where fresh water ponds occur, small thickets of swamp paperbark (*Melaleuca ericifolia*) also occur (Adderley *et al.* 1988), particularly in the new additions in the eastern area of the reserve.

In Cockle Bay Nature Reserve Swamp Mahogany – Paperbark Forest occurs at higher elevation and is dominated by swamp mahogany (*Eucalyptus robusta*), bangalay (*E. botryoides*), swamp oak (*Casuarina glauca*) and a number of paperbarks, including *Melaleuca quinquenervia*, *M. linariifolia* and *M. styphelioides*. A dense understorey also occurs and is dominated by shrubs, sedges, ferns, climbers and grasses including *M. ericifolia*, saw sedge (*Gahnia clarkei*), swamp water fern (*Blechnum indicum*) and wombat vine (*Eustrephus latifolius*). Smaller areas of Blackbutt (*E. pilularis*) Forest are found on the higher ground along the south-western boundary of the reserve. Here blackbutt dominates the canopy over a sparse to moderate understorey of shrubs and grasses.

Cockle Bay Nature Reserve protects three Endangered Ecological Communities (EECs) listed under the TSC Act. The vegetation communities in the reserve as described by Bell (2004) and the EECs they represent are shown in Table 1.

Table 1: Vegetation communities and Endangered Ecological Communities in Cockle Bay Nature Reserve.

Vegetation Community	Endangered Ecological Community
Estuarine Mangrove Scrub	Coastal Saltmarsh EEC
Estuarine Saltmarsh/Grassland	Coastal Saltmarsh EEC
Estuarine Swamp Oak Forest	Swamp Oak Floodplain Forest EEC
Coastal Sand Swamp Forest	Swamp Sclerophyll Forest on Coastal Floodplains EEC
Swamp Paperbark Thicket	Swamp Sclerophyll Forest on Coastal Floodplains EEC
Swamp Mahogany-Paperbark Forest	Swamp Sclerophyll Forest on Coastal Floodplains EEC
Narrabeen Coastal Blackbutt Forest	N/A

The Swamp Sclerophyll Forest EEC occurring in Cockle Bay Nature Reserve is the largest protected stand of swamp mahogany (*Eucalyptus robusta*) on the southern Central Coast of NSW. Largely due to clearing for residential development, this community now only occurs in isolated pockets around coastal waters between Gosford and Lake Macquarie. It is not well represented in conservation reserves in the Sydney Basin bio-region and few remnants other than Cockle Bay retain an intact understorey (Payne 1996).

Swamp mahogany is recognised as a ‘keystone’ resource species on the Central Coast (Payne 1997). As the region’s major winter flowering tree species it is an important seasonal food source for a number of nectivorous fauna, including arboreal mammals and bird species. During winter, species such as the yellow-bellied glider (*Petaurus australis*) migrate down from the blackbutt forests on Daleys Point, to the south-west, to feed on the swamp mahogany at Cockle Bay. This winter nectar resource is also critical for species such as the regent honeyeater (*Xanthomyza phrygia*) and swift parrot (*Lathamus discolor*) which have been recorded in the reserve. Individual trees also provide denning hollows for gliders, and casuarinas and acacias present in the understorey provide food resources for species such as the squirrel glider and glossy black cockatoo (Payne 1997).

No individual threatened plant species have been recorded from the reserve, however three plant species of special conservation significance have been identified (Payne 1997). These are: swamp banksia (*Banksia robur*) which has been significantly reduced in the region by development, swamp mahogany (*Eucalyptus robusta*) a keystone resource species for nectivorous fauna, and *Lepidosperma quadrangulatum* which is considered to be rare in eastern NSW.

Forest Red Gum (*Eucalyptus tereticornis*) is found in the Swamp Sclerophyll Forest on Rileys Island. This species is considered locally significant, as it is an isolated occurrence, and is an important winter flowering species (R. Payne, personal communication).

Similar to Cockle Bay Nature Reserve, Rileys Island Nature Reserve demonstrates a clear vegetation succession from seagrass beds, through mangroves and saltmarsh to swamp oak and sclerophyll forest in the centre. The latter three communities fall within the EECs detailed in Table 1, though the remnants are less extensive than those occurring at Cockle Bay.

Pelican Island Nature Reserve also protects some small fragments of saltmarsh and swamp oak forest, but is most valuable as one of the largest mangrove stands in Brisbane Water.

On Saratoga Island, the dominant vegetation is mangroves with a small stand of swamp oaks on the north of the island which forms part of the Swamp Oak Floodplain Forest EEC. The most significant areas on Saratoga Island are actually the unvegetated sand bars on the southern side of the island. These areas provide high tide roosts for a number of wading birds and similar habitats are scarce in the whole of Brisbane Water. Encroachment by mangroves is a threat to these habitats as waders prefer not to roost on the sand in areas close to vegetation due to the risk of predation from species such as foxes, dogs and cats.

4.3 NATIVE ANIMALS

The vegetation communities in the nature reserves support a diverse range of fauna. The intertidal, mangrove/saltmarsh and swamp mahogany forest habitats in particular display important flora and fauna relationships.

Fauna surveys of the Cockle Bay Nature Reserve were undertaken in the early 1990s (Andrews.Neil 1991; Payne 1996), and small ground mammal trapping and microbat surveys were undertaken on Rileys and Pelican Islands in March 2006. A total of 110 fauna species have been recorded within Cockle Bay Nature Reserve (94 birds, 12 mammals, 4 reptiles), and 75 species (56 birds, 14 mammals, 3 reptiles, 2 amphibians) have cumulatively been recorded on Rileys Island, Pelican Island and Saratoga Island Nature Reserves. Of these, 2 species in Cockle Bay Nature Reserve are listed on Schedule 1 (Endangered) and 10 species are listed on Schedule 2 (Vulnerable) of the TSC Act. Ten threatened species have been recorded on Rileys, Pelican and Saratoga Islands (1 Endangered, 9 Vulnerable).

4.3.1 Birds

Ninety-four species of birds have been recorded in Cockle Bay Nature Reserve and 56 species in and around the islands. At Cockle Bay, six bird species listed under the TSC

Act have been recorded in the reserve. These are the endangered regent honeyeater (*Xanthomyza phrygia*) and bush stone-curlew (*Burhinus grallarius*) and the vulnerable osprey (*Pandion haliaetus*), glossy black-cockatoo (*Calyptorhynchus lathamii*), pied oystercatcher (*Haematopus longirostris*) and speckled warbler (*Pyrrholaemus sagittatus*). The bush stone-curlew and pied oystercatcher have also been recorded on Rileys and Pelican Islands, along with the osprey and vulnerable terek sandpiper (*Xenus cinereus*) on Rileys Island.

Swamp mahogany forests provide an important winter feeding habitat for the regent honeyeater. Cockle Bay is included in the biannual survey for this species, however the last sighting in the reserve was in 2000. A recovery plan has been prepared for the regent honeyeater. Other birds which rely on the swamp mahogany include lorikeets and honeyeaters and there is a marked increase in bird numbers in the reserve during the winter flowering period.

The bush stone-curlew has also been known to nest on private land adjoining the south-eastern boundary of the Cockle Bay Nature Reserve in recent years. It has also been recorded on both Rileys and Pelican Islands as well as at the nearby locations of St Huberts Island and the Saratoga wetlands. A recovery plan for this species is in place and known nesting locations of the small Central Coast population are closely monitored during the breeding season.

Other species of high conservation significance found in the reserves include several species listed under international migratory bird protection agreements with China (CAMBA) and Japan (JAMBA). Many of these species are waders which rely on the abundant food resources found in the seagrass beds, mudflats and mangroves adjoining the reserves and include the eastern curlew (*Numenius madagascariensis*), cattle egret (*Ardea ibis*), great egret (*Ardea alba*), whimbrel (*Numenius phaeopus*), Latham's snipe (*Gallinago hardwickii*), bar-tailed godwit (*Limosa lapponica*), crested tern (*Sterna bergii*) and caspian tern (*Sterna caspia*). The white-bellied sea eagle (*Haliaeetus leucogaster*) is also commonly seen fishing off the islands and has been known to nest on Rileys Island.

4.3.2 Mammals

Cockle Bay supports 12 species of native mammals, including six species that are listed as vulnerable under the TSC Act. These include the yellow-bellied glider (*Petaurus australis*), squirrel glider (*P. norfolcensis*), little bentwing-bat (*Miniopterus australis*), eastern bentwing-bat (*M. schreibersii*), eastern chestnut mouse (*Pseudomys gracilicaudatus*) and the grey-headed flying fox (*Pteropus poliocephalus*). Recovery Plans have been prepared for the yellow bellied glider and grey-headed flying fox.

Other more common mammal species found in the reserve include the brown antechinus (*Antechinus stuartii*), the common brush-tail possum (*Trichosurus vulpecular*), common ring-tail possum (*Pseudocheirus peregrinus*) and the sugar glider (*Petaurus breviceps*).

Small ground mammal and bat surveys were undertaken on Rileys and Pelican Islands in March 2006 (Payne 2006). Two bush rats (*Rattus fuscipes*) were recorded on Pelican Island and a scat of the brown antechinus (*Antechinus stuartii*) was collected from Rileys Island. It is likely that there a number of reasons for the low number of ground dwelling mammals recorded, including habitat isolation and predation by foxes (*Vulpes vulpes*). Foxes were seen on the islands during the surveys. Conversely, no black rats (*Rattus rattus*) or house mice (*Mus musculus*) were trapped on the islands and the

absence of these species may assist native small mammal numbers to rise if fox numbers on the island can be controlled.

Microbat surveys on the two islands yielded high bat numbers and species diversity. Twelve microbat species were recorded in the vicinity of the natural and artificial water bodies on Rileys Island including 6 species listed as vulnerable under the TSC Act. Eight species were recorded from Pelican Island including 4 threatened species. All bat species recorded from the reserves are listed in Table 2.

Table 2: Microbat species recorded from Rileys Island (R) and Pelican Island (P) and Cockle Bay (C) Nature Reserves. Legal Status: Protected (P) and Vulnerable (V).

Species name	Common Name	Legal status	Reserve recorded
<i>Chalinolobus gouldii</i>	Gould's wattled bat	P	R, P, C
<i>Falsistrellus tasmaniensis</i>	Eastern false pipistrelle	V	R
<i>Miniopterus australis</i>	Little bentwing-bat	V	R, P, C
<i>Miniopterus schreibersii</i>	Eastern bentwing-bat	V	R, C
<i>Mormopterus sp2</i>	(undescribed – a free-tail bat)	P	R, P
<i>Mormopterus norfolkensis</i>	Eastern freetail-bat	V	R, P
<i>Mormopterus loriae</i>	Little northern freetail-bat	P	C
<i>Myotis adversus</i>	Large-footed myotis	P	R, P
<i>Nyctophilus gouldi</i>	Gould's long-eared bat	P	R, P, C
<i>Saccolaimus flaviventris</i>	Yellow-bellied sheath-tailed bat	V	R, P
<i>Scoteanax rueppellii</i>	Greater broad-nosed bat	V	R
<i>Vespadelus pumilus</i>	Eastern forest bat	P	R
<i>Vespadelus vulturinus</i>	Little forest bat	P	R, P, C

4.3.3 Reptiles and Amphibians

A small number of reptiles have been recorded in or adjacent to the Cockle Bay Nature Reserve, including a number of skinks, the swamp snake (*Hemiaspis signata*) and the diamond python (*Morelia spilota ssp. spilota*). Two frog species have also been recorded – the eastern froglet (*Crinia signifera*) and the striped marsh frog (*Limnodynastes peronii*).

The green tree frog (*Litoria caerulea*), striped marsh frog (*Limnodynastes peronii*), garden skink (*Lampropholis delicata*), and weasel skink (*Saproscincus mustelinus*) have been recorded on Rileys Island. The garden skink has also been recorded on Pelican Island.

4.3.4 Fish and Marine Invertebrates

The intertidal mangrove mudflats and seagrass beds adjoining the reserves are rich in animal life and are known to be nursery areas for many fish and prawn species. These provide food for larger marine animals and sea birds.

The mangroves provide shelter for many species such as mussels, flatworms, ribbon worms, prawns and crabs such as blue swimmers and mud crabs. In the saltmarshes are estuarine sea slugs, snails, red-nippered marsh crabs and semaphore crabs.

4.4 ABORIGINAL HERITAGE

The nature reserves lie within the traditional boundaries of the Guringai Aboriginal people. The Guringai inhabited the coast between Port Jackson and somewhere north of Wyong where they met the Awabakal (Threlkeld in Gunson 1974; Mann 1885). The Darkinjung occupied land to the north of the Hawkesbury River and to the west of Mooney Mooney Creek. The Guringai had a close and cordial relationship with the Darkinjung including reciprocal visits between tribes, trade and sharing feasts in either area, depending upon season (Vinnicombe 1980).

Aboriginal communities have an association and connection to the land. The land and water biodiversity values 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 and strengthening social bonds. Aboriginal heritage and nature are inseparable from each other and need to be managed in an integrated manner across the landscape.

Aboriginal occupation around the foreshores and higher slopes of Brisbane Water is evident by the presence of numerous sites, including grinding grooves, rock engravings, camp sites and middens. The abundant marine life in Brisbane Water was an important food source for Aboriginal people and the seasonal availability of marine species greatly influenced the pattern of Aboriginal occupation of the area, with a greater reliance on terrestrial resources during the leaner winter months. Local Aboriginal people were easily able to go between the mainland and islands in bark canoes and it is likely that both the plant and associated fish and animal life provided a rich food source for Aboriginal people in the area (Vinnicombe 1980).

There have been no recorded Aboriginal sites within the boundaries of any of the reserves although a number of middens have been recorded on dry ground surrounding Cockle Bay Nature Reserve. In Empire Bay and Daleys Point, to the west and south of Cockle Bay, numerous middens and rock shelters occur, including an important complex of engravings with associated midden deposits and grinding grooves (Vinnicombe 1980). Based on the findings of Vinnicombe (1980) there is a strong likelihood that cockles from Cockle Bay were an important resource for the local Aborigines and there may be middens buried in the foreshore area of the nature reserve.

Today, the nature reserves lie within the area of the Darkinjung Local Aboriginal Land Council. Close liaison in regard to the ongoing management of Aboriginal values is maintained with the Land Council through the Central Coast Hunter Range Aboriginal Co-Management Committee.

4.5 HISTORIC HERITAGE

European occupation of the Brisbane Water area occurred from around the 1820s and 1830s with settlers venturing north from Sydney in search of suitable farming land. When these settlers realised that the land around the Brisbane Water foreshores was marginal farming land at best, they established new industries such as timber harvesting, boat building and lime production from burning sea shells.

The history of the various parcels of land comprising Cockle Bay Nature Reserve and the proposed additions is detailed in Adderley *et al.* (1988). The lands have had a varied history of use including residential subdivision, grazing, various home sites and water reserve. A mining lease for sea shells was granted between 1928 and 1942. This remained active up until 1967. This activity impacted on the foreshore environment, while clearing for farming and the construction of holiday houses impacted on the forested areas. However, the predominantly low lying nature of the wetlands made the area unattractive for ongoing development and is the main reason this area remains vegetated today.

Rileys Island was originally known as Shell Island but after a long association with the Riley family, who settled on the island in the 1830s, it was renamed Rileys Island. The Riley family operated a small boat building business for much of the nineteenth century and the island was also used for some cropping and grazing from the 1880s onwards. Some relics of these former uses, including old rusted water tanks and house foundations remain on the island today.

In the 1960s the Hooker Rex Corporation proposed a canal type housing development on Rileys Island, similar to what appears on the nearby St Huberts Island today, and some clearing and test trenching was undertaken. The presence on the island today of three artificially created waterbodies and a number of large rusted buoyancy tanks from the dredge that was used to create them, remain as evidence of this activity.

A strong community campaign against this proposal was initiated by a group of university students and concerned local residents who together formed the Central Coast Environmental Protection Council to fight the development. By 1975, the campaign was led by the Save Rileys Island Committee and had widened to include involvement by the Central Coast Trades and Labour Council who placed a green ban on any work on the proposed development, and local primary school children who took up a petition to save Rileys Island. In 1980 Rileys Island was purchased by the Crown and the vast majority of the island was finally gazetted on 9 June 1989 as Rileys Island Nature Reserve. A small lot on the northern tip of the island owned by Gosford City Council was transferred to the NPWS and added to the nature reserve on 20 May 1994.

Probably due to the fact that most of Pelican Island becomes inundated at high tide, there is little information on, or evidence of, any former uses of the island prior to 1970. In May 1970 Gosford City Council announced plans to build a new sewerage treatment plant on Pelican Island and a cleared area remaining on the eastern side of the island today is thought to have been associated with this proposal. Soon after, the Pelican Island Preservation Committee was formed with the support of approximately 30 service clubs and progress associations, to oppose the treatment plant. Following much debate, Council resolved in September 1973 to locate the proposed treatment plant at South Kincumber and at the same time requested the Minister for Lands to dedicate the island as a nature reserve under the care and control of the NPWS. Pelican Island Nature Reserve was finally gazetted on 9 June 1989.

Saratoga Island is an artificial island, formed from the dredging of a former sandbar, during the early part of the twentieth century, to create the Saratoga Channel. An area of vacant crown land for most of its relatively short existence, it was proposed as a nature reserve in 2003 and formally gazetted as Saratoga Island Nature Reserve on 11 November 2005.

5. USE OF THE RESERVES

5.1 PUBLIC USE

The primary purposes of nature reserves are the conservation of wildlife, natural and cultural environments, and environmental education, including scientific research. All of the reserves contain habitats which are sensitive to disturbance from inappropriate use, and recreational opportunities are very limited. Ample recreational opportunities are provided for in the nearby Bouddi and Brisbane Water National Parks.

There are no recreational facilities in Cockle Bay, Rileys Island, Pelican Island and Saratoga Island Nature Reserves and visitation to all four reserves is low, particularly to Rileys and Pelican Islands where access is by boat only. Visitation is higher to Saratoga Island, with its sandy beaches and accessibility at low tide from the mainland attracting picnickers, swimmers and fisherpersons. Some sporadic illegal camping occurs on all three islands and illegal dog walking occurs on Saratoga Island which impacts on the island's value as roosting and feeding habitat for wading birds.

At Cockle Bay Nature Reserve walkers occasionally use the fire trails to access the waterfront. Illegal activities include some (infrequent) dog walking and some dumping of green waste and other household discards in the reserve behind neighbouring properties in Empire Bay Drive. Fencing of the new additions adjoining Palmers Lane in the east of the reserve appears to have halted continuing damage to saltmarsh in this area caused by vehicles, trail bikes and horses.

Local school students participate in annual environment day activities and are also involved in the propagation and planting of native seedlings in the reserve. Hunter Institute of TAFE (Ourimbah campus) students also regularly participate in bush regeneration activities at Cockle Bay and on the islands and bush regeneration days are held with community volunteers on a biannual basis on Rileys Island.

5.2 OTHER USES

The only other use affecting the reserves is that associated with oyster farming activities in the adjacent Brisbane Water. In Cockle Bay Nature Reserve there is a current access licence between the Minister for the Environment and Climate Change and a private oyster farmer (associated with the 'Oyster Shed' on Empire Bay Drive Lot 420 DP 802682) to support the operation of an oyster lease in Cockle Bay. This licence was executed in 1996 to allow continuation of an existing interest. It is personal to the licensee and is not transferable to any other party. The licence requires the licensee to maintain the access road and facilities associated with the oyster farming and retail operation. The lease area is securely fenced and the road access secured by a locked gate.

As the operation of this licence and existing infrastructure is not consistent with the management principles for nature reserves and is located within an Endangered Ecological Community, no new licence will be issued on termination of the current one. Upon termination of the licence, all associated infrastructure is to be removed and the area left in a clean and tidy condition by the licence holder. The trail will then be maintained by the Service for fire management purposes and the remaining area will be rehabilitated.

Both Rileys and Pelican Island have numerous oyster farm leases in the waters adjacent to them and material associated with oyster farming activities is sometimes stored or discarded on the islands. On Rileys Island, this practice has been minimal and liaison with DPI Fisheries and the relevant oyster farmer has led to the removal of this material. However, the problem is more acute on Pelican Island, particularly within the mangrove areas fringing the channel which separates the narrow section of the island to the south from the rest of the island.

6. THREATS TO RESERVE VALUES

6.1 INTRODUCED PLANTS

Cockle Bay, Rileys Island and Pelican Island Nature Reserves all suffer from heavy infestations of introduced weeds. Only Saratoga Island is relatively weed free following the removal of a large patch of bitou bush (*Chrysanthemoides monilifera*) when the island was first transferred to the NPWS in 2005.

At Cockle Bay, the main weed species found throughout the reserve include lantana (*Lantana camara*), blackberry (*Rubus fruticosus*), asparagus fern (*Asparagus aethiopicus*), camphor laurel (*Cinnamomum camphora*) and honeysuckle (*Lonicera japonica*). Smaller, more isolated infestations of bridal creeper (*Asparagus asparagoides*), black-eyed susan (*Thunbergia elata*), crofton weed (*Ageratina adenophora*) and wisteria (*Wisteria sinensis*) also occur. An infestation of alligator weed (*Alternanthera philoxeroides*), a weed declared noxious throughout NSW, has been treated in Cockle Bay Nature Reserve and has been eradicated from the reserve.

On Rileys Island, bitou bush, lantana and asparagus weed are widespread, with smaller infestations of blackberry, whiskey grass (*Andropogon virginicus*) and a variety of annuals. A substantial infestation of pampas grass (*Cortaderia selloana*) across the island has all but been eradicated. Bitou bush and lantana have been progressively removed from Pelican Island but relatively large areas of asparagus fern and bridal creeper remain, particularly on the western end of the island opposite Woy Woy wharf.

Weed control and bush regeneration programs exist in all of the reserves and involve a combination of work by volunteer groups, target weed spraying programs, NPWS staff weeding days and projects carried out by professional bush regenerators contracted by the NPWS supported by external grants. An integrated approach to weed management is pursued involving a range of techniques including: hand pulling of weeds, cut/scrape and paint techniques, spot and broad scale spraying and revegetation with provenance seedlings. Preparation of a weed management plan is underway for Cockle Bay Nature Reserve and similar plans will also be completed for the island reserves.

Under the *Noxious Weeds Act 1993*, the NPWS is obligated to control noxious weeds on areas that it manages to the extent necessary to prevent such weeds spreading to adjoining lands. Within the Gosford City Local Government Area alligator weed, lantana, bitou bush, blackberry, bridal creeper, crofton weed, mistflower (*Ageratina riparia*) and pampas grass are listed as noxious. These species are given a high priority in on-ground bush regeneration programs. Four weed species with heavy infestations in the reserves (bitou bush, blackberry, bridal creeper and lantana), have also been listed as Weeds of National Significance by the Federal Government. These species are also prioritised in weed control programs.

Areas containing threatened species and endangered ecological communities are also given priority for control of introduced plants. In Cockle Bay Nature Reserve, weed control programs in recent years have concentrated on alleviating the acute weed infestation affecting the Swamp Sclerophyll Forest EEC and inhibiting successful regeneration of the keystone swamp mahogany species. According to Payne (1997) this forest needs to be retained in a prime condition in order for it to perpetuate through its natural processes and to continue to support the populations of threatened fauna species located within the reserve.

6.2 INTRODUCED ANIMALS

The most common vertebrate pest species known to occur in both Cockle Bay and the island reserves is the European red fox (*Vulpes vulpes*). Fox prints are regularly sighted on sandy areas around the island foreshores and a number of fox sightings have been reported by nearby residents. Infrequent trapping programs have been conducted on both Pelican and Rileys Island over the last few years, though to date these have been largely unsuccessful.

Predation by the Red Fox is listed as a key threatening process under the TSC Act because of the threat it poses to biodiversity. To date there has been no ongoing monitoring of fox populations in these reserves and their impact on native species. Observations undertaken during small mammal trapping in March 2006 indicated that foxes are present on the islands and are potentially the most significant factor contributing to the low density of small native mammals on the islands (Payne 2006). Evidence from fox scat collection during these surveys revealed that foxes are feeding on a number of waterbird species including white faced heron, ibis and pelican, and a number of other species such as kookaburra, rosella, and spotted turtle-dove. Scats have been sent for further analysis to determine if small mammals are also being consumed by this species.

1080 poison baiting of foxes on the islands has now become a more feasible alternative to trapping following the recent easing of distance restrictions between residential areas and fox baiting sites and a targeted and sustained fox baiting program can now be implemented on the islands.

The apparent absence of introduced rodents (house mouse and black rat) on the islands was a notable outcome of the small mammal trapping, particularly given the proximity of Pelican Island to Woy Woy. These species would be expected to occur in these habitats and their absence may also be attributed to fox predation.

Other pest species expected to occur in Cockle Bay Nature Reserve include cat (*Felis catus*) and rabbit (*Oryctolagus cuniculus*). Small numbers of fallow deer (*Dama dama*) have also been sighted in lands adjacent to the reserve.

6.3 FIRE MANAGEMENT

Fire is a natural feature of many environments and is essential to the survival of some plant communities. Inappropriate fire regimes, however, can lead to loss of particular plant and animal species and communities. Fire can also damage cultural heritage, recreation and management facilities and can threaten visitors and neighbouring land.

The management of fire is a critical component of land management across the NSW landscape. As both a fire authority and conservation agency, the NPWS plays an important role in protecting life and property and in conserving natural and cultural heritage.

The primary objectives of fire management by the NPWS are to:

- protect life, property and community assets from the adverse impacts of fire;
- develop and implement cooperative and coordinated fire management arrangements with other fire authorities, reserve neighbours and the community;

- manage fire regimes within reserves to maintain and enhance biodiversity;
- protect Aboriginal sites and places, historic places and culturally significant features known to exist within NSW from damage by fire; and
- assist other fire agencies, land management authorities and landholders in developing fire management practices to conserve biodiversity and cultural heritage across the landscape.

The maintenance of biodiversity to avoid the extinction of natural species, populations and communities within the landscape underpins fire management activities within the NPWS.

The bush fire behaviour potential in all four reserves is considered to be low by virtue of the predominant vegetation communities. The greater area of the reserves is characterised by moist vegetation including mangroves, saltmarsh, swamp oaks and swamp sclerophyll forest. The open Blackbutt forest at Cockle Bay has a medium bush fire behaviour potential.

Only three unplanned fire events are known to have occurred in recent years in Cockle Bay Nature Reserve. The larger of these burnt approximately 20 hectares in 1991 in the south-western area of the reserve adjoining Empire Bay Drive, with two much smaller fires, approximately one hectare in size, occurring in 1998 and 2002. A large area of Rileys Island (approx. 38 hectares) has twice been fire affected, in 1991 and 1994, with four smaller fires (approximately 3-4 hectares in size) occurring in the south-eastern area of the island in 1987, 1996, 2000 and 2007. The majority of Pelican Island has no record of fire as far back as 1964, with only four very small, isolated fires occurring in the southern half of the reserve in the 1990s. No fires have been recorded on Saratoga Island. All wildfires documented for the reserves are thought to have been caused by arson or escaped camp fires.

Cockle Bay Nature Reserve is the only reserve with significant assets adjoining it. Residential housing backs onto the reserve along a 700 metre section of Empire Bay Drive and also off Shelley Beach Rd and Kendall Road at Empire Bay. A strategic fire management zone behind properties in Empire Bay Drive is maintained through a biannual slashing program. The only asset located within the reserve is the Oyster Shed on Empire Bay Drive.

A draft Fire Management Strategy has been prepared for Bouddi National Park and Cockle Bay Nature Reserve. This strategy identifies the bushfire threat, identifies requirements for the conservation of native plants and animals, and provides the basis for fire management strategies and prescriptions.

Fire Management Strategies have been adopted for Rileys Island and Pelican Island Nature Reserves. These reserves have no infrastructure or assets and there are no threats to life or property from fire. These strategies identify requirements for the conservation of native plants and animals, and provide the basis for fire management strategies.

A fire management strategy has not been prepared at this stage for Saratoga Island Nature Reserve. However, due to the small size of the reserve and the sensitivity of the vegetation communities to fire, all fire is to be avoided.

7. MANAGEMENT ISSUES AND STRATEGIES

Current Situation	Desired Outcomes	Strategies	Priority
<p>SOIL AND WATER CONSERVATION</p> <p>All four reserves have a very high risk of containing acid sulphate soils (ASS). Exposure of ASS can cause severe environmental damage and degrade water quality, habitat and aquatic organisms.</p> <p>There is erosion of the saltmarsh area in east Cockle Bay NR, caused by past vehicle damage. Access to this area has now been fenced off.</p> <p>Several stormwater channels drain into Cockle Bay NR from Empire Bay Drive bringing sediment, rubbish, nutrients and weed seed into the reserve.</p> <p>The reserves are all located within Brisbane Water.</p>	<p>Soil erosion is minimised and exposure of ASS is prevented.</p> <p>Existing eroded areas are rehabilitated.</p> <p>Water quality and general health of reserves are improved.</p> <p>Estuarine processes and water quality within Brisbane Water catchment are maintained.</p>	<p>Undertake any future drainage, excavation or clearing works in a manner that minimises erosion and avoids disturbance of areas of potential acid sulphate soils.</p> <p>Survey areas of potential acid sulphate soils prior to conducting works that may disturb the soil.</p> <p>Monitor the natural rehabilitation of the saltmarsh and ensure that barriers to vehicle access are maintained.</p> <p>Continue liaison with Gosford City Council to improve stormwater design in order to prevent large quantities of sediment, rubbish, nutrients and weed seed from entering the reserve.</p> <p>Maintain close liaison with relevant authorities including DPI Fisheries, Maritime NSW, Hunter-Central Rivers CMA and Gosford City Council to encourage appropriate and integrated land use planning and management practices within the Brisbane Water estuary and catchment.</p> <p>Pursue acquisition of the intertidal zones surrounding each reserve.</p>	<p>High</p> <p>Low</p> <p>High</p> <p>Medium</p> <p>High</p> <p>Medium</p>

Current Situation	Desired Outcomes	Strategies	Priority
<p>NATIVE PLANT AND ANIMAL CONSERVATION</p> <p>The structural and floristic diversity, habitat values and ongoing viability of the three Endangered Ecological Communities (EECs) found in the reserves is largely unknown.</p> <p>The Swamp Sclerophyll Forest EEC in Cockle Bay NR is a particularly important remnant containing the 'keystone' swamp mahogany species.</p> <p>Coastal saltmarsh is in rapid decline on the Central Coast. Mangrove encroachment of saltmarsh habitat is occurring at Cockle Bay, and Rileys and Pelican Islands.</p> <p>More comprehensive data is required on the vegetation of the island reserves – to date no flora surveys have been undertaken.</p>	<p>Increase understanding of the EECs.</p> <p>Improve ecological condition of the EEC.</p> <p>Protection of saltmarsh ecosystems</p> <p>Conservation and management of island vegetation based on best information.</p>	<p>Undertake initial assessment of overall health of the EECs, and then institute annual monitoring to establish ongoing viability and conservation values.</p> <p>Establish monitoring plots and survey annually to assess recruitment in the Swamp Sclerophyll Forest EEC.</p> <p>Survey and monitor extent of mangrove encroachment.</p> <p>Liaise with DPI Fisheries to ascertain feasibility and methods to manage mangrove encroachment.</p> <p>Undertake vegetation surveys of island reserves. In order of priority: Rileys Island, Pelican Island and Saratoga Island.</p>	<p>High</p> <p>High</p> <p>Medium</p> <p>High</p> <p>Medium</p>

Current Situation	Desired Outcomes	Strategies	Priority
<p>NATIVE PLANT AND ANIMAL CONSERVATION (continued)</p> <p>A number of threatened fauna species have been recorded in the reserves.</p> <p>The endangered bush stone-curlew (BSC) has been recorded nesting on land adjoining Cockle Bay NR, on Rileys Island and Pelican Island and in the Saratoga wetlands.</p> <p>Comprehensive fauna surveys have not been undertaken in any of the reserves. Recent small mammal and microbat surveys were undertaken on Rileys and Pelican islands.</p> <p>Saratoga Island provides significant high tide wader roosts, particularly on the southern sand spit.</p> <p>The number of bird species in the area appears to have declined in recent years, and species decline may accelerate with climate change.</p>	<p>Maintain viable populations of threatened species.</p> <p>Protection and conservation of the BSC.</p> <p>Comprehensive data regarding native fauna is available for all reserves and forms a basis to determine management priorities.</p> <p>High tide wader roosts maintained.</p> <p>Wildlife habitat in the local area is improved.</p>	<p>Implement relevant actions in threatened species recovery plans and priority action statements for threatened species occurring within the reserves.</p> <p>Continue support for annual BSC surveys around Brisbane Water and biannual surveys for the regent honeyeater and swift parrot in Cockle Bay Nature Reserve.</p> <p>Develop and implement management strategies in consultation with DECC specialist staff for specifically identified areas in the reserves, particularly Cockle Bay and Rileys Island, to maximise potential BSC habitat.</p> <p>Undertake and/or encourage additional fauna surveys in the reserves with a focus on threatened species in Cockle Bay and on arboreal fauna on the islands.</p> <p>Subject to environmental impact assessment, consider mangrove control on Saratoga Island in conjunction with DPI Fisheries and Gosford City Council to prevent mangrove encroachment onto sand roosting areas.</p> <p>Liaise with Gosford City Council, the local community and neighbours to conserve and improve habitat in the local area and to minimise adverse impacts on ecosystems.</p>	<p>High</p> <p>Medium</p> <p>Medium</p> <p>Medium</p> <p>Low</p> <p>High</p>

Current Situation	Desired Outcomes	Strategies	Priority
<p>INTRODUCED SPECIES</p> <p>Cockle Bay, Rileys Island and Pelican Island all contain severe weed infestations threatening native vegetation communities and habitat values.</p> <p>On ground weed control and bush regeneration programs are in place at all of the reserves and include bush regeneration work by community volunteers, NPWS weed spraying programs and staff weed days, and projects carried out by professional bush regeneration contractors under external grants.</p> <p>Weed management strategies, including comprehensive mapping of weed infestations are required for Cockle Bay, Rileys Island and Pelican Island Nature Reserves.</p> <p>The most common introduced animal in the reserves is the fox. Fox predation is the suspected cause of low numbers of native ground mammals. The presence and impacts of other pest animals such as rabbits, cats and deer in Cockle Bay NR is unknown.</p>	<p>The impact of introduced weed species on native vegetation, species of high conservation significance and EECs, is minimised.</p> <p>Staff, community and contractor involvement in bush regeneration programs in the reserves remains strong.</p> <p>Future weed management is guided by weed management strategies.</p> <p>Reduce the impact of fox predation on native animal populations, particularly threatened species.</p>	<p>Continue weed control and bush regeneration programs in all reserves. Priority will be given to noxious weeds, Weeds of National Significance, and weeds impacting on threatened species populations or communities.</p> <p>In Cockle Bay Nature Reserve, the highest priority for weed control programs will continue to be within the Swamp Sclerophyll Forest EEC.</p> <p>Continue to promote and facilitate community involvement in bush regeneration in the reserves and source external funding to employ contractors.</p> <p>Continue to employ integrated program of weed control measures, including herbicide spraying, bush regeneration techniques and biological control agents.</p> <p>Prepare weed management strategies identifying specific priorities for weed control and bush regeneration programs and establishing ongoing monitoring of effectiveness.</p> <p>Prepare a pest control strategy for the reserves outlining appropriate methods and programs, including ongoing monitoring of pest impacts and effectiveness of control programs. Priority will be given to fox control.</p> <p>Implement fox baiting program on Rileys and Pelican Islands.</p> <p>Seek the cooperation of Gosford City Council, local community and neighbours in implementing weed and pest animal control programs.</p>	<p>High</p> <p>High</p> <p>High</p> <p>High</p> <p>High</p> <p>High</p> <p>High</p> <p>High</p> <p>Medium</p>

Current Situation	Desired Outcomes	Strategies	Priority
<p>FIRE MANAGEMENT</p> <p>None of the four reserves are fire prone. All the islands have a low bush fire behaviour potential by virtue of their relatively moist vegetation communities. Cockle Bay has low bush fire behaviour potential in the moist vegetation communities except in extreme conditions and a moderate bush fire behaviour potential in the blackbutt forest.</p> <p>The majority of vegetation communities found in all the reserves have a low tolerance to fire.</p> <p>A draft fire management strategy for Cockle Bay NR has been completed. Fire management strategies have been adopted for Rileys and Pelican Island.</p> <p>Cockle Bay NR is the only reserve with significant assets adjacent to it, though the fire risk to these assets is considered to be low.</p> <p>A fire management strategy has not yet been prepared for Saratoga Island.</p>	<p>Life, property and natural and cultural values are protected from bushfire.</p> <p>Fire regimes are appropriate for conservation of plant and animal communities.</p> <p>Fire management in reserves is undertaken in accordance with fire management strategies.</p> <p>Strategic Fire Management Zones adequately maintained.</p> <p>Adoption of Saratoga Island NR Fire Management Strategy.</p>	<p>Continue to participate in Gosford Bush Fire Management Committee. Maintain coordination and cooperation with NSW Rural Fire Service, Council fire management officers and neighbours with regard to fuel management and fire suppression.</p> <p>As far as is possible, adhere to fire interval guidelines outlined in the reserve fire management strategies.</p> <p>Immediate suppression of all wildfires in the reserves.</p> <p>Encourage further research into the ecological effects of fire in the reserves.</p> <p>Implement the Fire Management Strategies for Cockle Bay NR, Rileys Island NR and Pelican Island NR.</p> <p>Management trails in Cockle Bay NR needed for fire management purposes, including the Strategic Fire Management Zone behind properties in Empire Bay Drive, will be maintained by slashing on a biannual basis. No new trails will be constructed.</p> <p>Prepare a fire management strategy for Saratoga Island NR. Until the plan is finalised exclude all fire from the reserve as far as possible.</p>	<p>High</p> <p>High</p> <p>High</p> <p>Low</p> <p>High</p> <p>High</p> <p>Low</p>

Current Situation	Desired Outcomes	Strategies	Priority
<p>CULTURAL HERITAGE</p> <p>No Aboriginal sites have been recorded in any of the four reserves, though there is extensive evidence of former Aboriginal occupation in the Cockle Bay area and around Brisbane Water.</p> <p>The cultural significance of historic relics on Rileys Island (large rusted steel tanks and house foundations) is unknown.</p> <p>The European history of the islands is incomplete and further research is warranted in this area.</p>	<p>Both Aboriginal and historic features and values are identified and protected.</p> <p>Aboriginal people are involved in management of any Aboriginal cultural values identified in the reserves.</p> <p>Understanding of the cultural significance of the reserves is improved.</p>	<p>Surveys for Aboriginal sites in the reserves are a low priority as no ground disturbance is proposed. Should any works with the potential to impact on cultural sites be proposed, an archaeological assessment will precede such works.</p> <p>Consult and involve the Darkinjung LALC and other relevant Aboriginal community organisations through the Central Coast Hunter Range Aboriginal Co-management Committee in the ongoing management of the reserves, particularly of any identified Aboriginal sites and values.</p> <p>Assess the cultural heritage significance of the historic relics on Rileys Island and prepare an ongoing management strategy.</p> <p>Record existing information about historic heritage sites within NPWS historic heritage information databases.</p> <p>Encourage further research into the past European association and use of the island reserves.</p>	<p>Low</p> <p>High</p> <p>Medium</p> <p>Medium</p> <p>Low</p>

Current Situation	Desired Outcomes	Strategies	Priority
<p>VISITOR AND OTHER USE</p> <p>All four reserves contain habitats which are sensitive to disturbance from inappropriate use and recreational opportunities are very limited. No recreational facilities are provided in any of the four reserves.</p> <p>Actual visitation to the reserves is low, particularly to Rileys and Pelican Islands where access is by boat only. Saratoga Island is accessible by foot at low tide.</p> <p>Illegal activities in the reserves include dog walking, sporadic camping and campfires, neighbour encroachments and rubbish dumping.</p> <p>There is currently no interpretative signage in any of the reserves.</p> <p>Current educational relationships with the local primary school and TAFE college are in place for Cockle Bay NR.</p>	<p>The local community is aware of the significance of the reserves and management programs.</p> <p>Visitor use is maintained at ecologically sustainable levels.</p> <p>Overall reduction in incidence of illegal activities occurring.</p> <p>Interpretation of reserves reflects community expectations.</p> <p>Increased awareness of Cockle Bay values.</p>	<p>Educational and reserve information material will continue to be disseminated to Cockle Bay NR neighbours on a regular basis.</p> <p>Do not provide new recreation facilities, access or visitor facilities in the reserves apart from signage.</p> <p>Ongoing monitoring of visitation to the reserves and identification of visitor impacts.</p> <p>Illegal activities in the reserves will be monitored and law enforcement action taken as required.</p> <p>Liaise with Gosford City Council regarding strategies to reduce dog walking adjacent to and on Saratoga Island.</p> <p>The installation of interpretative signage will be considered at Cockle Bay, Rileys Island and Saratoga Island NRs to promote the conservation significance of the areas.</p> <p>Current relationships with local primary school and TAFE college at Cockle Bay NR will be maintained.</p>	<p>Medium</p> <p>High</p> <p>High</p> <p>High</p> <p>High</p> <p>Low</p> <p>Medium</p>

Current Situation	Desired Outcomes	Strategies	Priority
<p>VISITOR AND OTHER USE (continued)</p> <p>There is only one licensed commercial activity in the reserves – the ‘Oyster Shed’ farming and retail operation at Cockle Bay NR.</p> <p>Encroachments of oyster lease refuse onto Rileys and Pelican Island.</p>	<p>Ongoing minimal impact on reserve values.</p> <p>Removal of all oyster lease refuse from islands.</p>	<p>Ongoing monitoring will be undertaken of the ‘Oyster Shed’ licence to ensure that licence conditions are complied with.</p> <p>No new licences will be issued.</p> <p>Upon termination of the current licence, the licence holder must remove all infrastructure and rehabilitate the area.</p> <p>Liaise with DPI Fisheries and oyster farmers to initiate a co-operative removal program. Ongoing monitoring and prosecution as required.</p>	<p>Medium</p> <p>High</p> <p>Medium</p> <p>High</p>

<p>RESEARCH</p> <p>Further research will improve understanding of the reserve's natural and cultural heritage, the processes that affect them and the requirements for management of particular species.</p> <p>NPWS resources for research purposes are limited.</p>	<p>Research enhances the management information base and has minimal environmental impact.</p>	<p>Undertake and encourage research to improve knowledge and management of natural and cultural heritage, particularly of threatened species.</p> <p>Prepare a research prospectus to encourage and guide research by educational organisations and others. Research priorities will include species and community dynamics, threats to conservation values and cultural heritage significance.</p>	<p>Medium</p> <p>Medium</p>
<p>MANAGEMENT OPERATIONS</p> <p>There are no tracks or trails on any of the islands. Cockle Bay NR contains three short management trails (<300m) and one slashed area (approx 650m long) behind properties on Empire Bay Drive which is maintained as a Strategic Fire Management Zone (SFMZ).</p>	<p>Management facilities adequately serve management needs and have acceptable impact.</p>	<p>Management trails will be maintained for purposes of fire management and access by walkers. No new trails will be developed in any of the reserves.</p> <p>Continue to restrict vehicle use of trails to authorised management purposes only.</p>	<p>High</p> <p>High</p>

High priority activities are those imperative to achievement of the objectives and desired outcomes. They must be undertaken in the near future (within 2-3 years) 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 (within 3-5 years).

Low priority activities are desirable to achieve management objectives and desired outcomes but can wait until resources become available.

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