

BERKELEY NATURE RESERVE

PLAN OF MANAGEMENT

NSW National Parks and Wildlife Service

Part of the Department of Environment and Conservation (NSW)

July 2005

This plan of management was adopted by the Minister for the Environment on 26 July 2005.

Acknowledgments

This plan of management is based on a draft plan prepared by staff of the Illawarra Area of NPWS.

Valuable information and comments were provided by:

- Sydney South Region Advisory Committee members, particularly Mirian Verbeek;
- Members of the public and organisations who provided submissions in response to the exhibition of the Issues Paper and/or who participated in the community workshops; and
- Dr Ian Armstrong.

Cover photograph of Gooseberry Island from Hooka Island by Helen Jessup, NPWS.

Inquiries about Berkeley Nature Reserve should be directed to the NPWS Illawarra Area office at 4/55 Kembla Street (PO Box 5436) Wollongong NSW 2520, telephone 4225 1455, email: illawarra@npws.nsw.gov.au

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FOREWORD

Berkeley Nature Reserve consists of two small islands in the north west of Lake Illawarra, adjacent to the Wollongong suburb of Berkeley. Gooseberry Island and Hooka Island are approximately 0.25 kilometres apart and are a significant feature of the landscape of the Illawarra, being close to the shore of Lake Illawarra and visible from many points on the mainland.

Berkeley Nature Reserve contains a remnant of the Illawarra Subtropical Rainforest (the 'Berkeley Brush') which is listed as an endangered ecological community and contains one plant which is thought to exist in only one other site worldwide, one endangered plant and two regionally rare plants. It also provides habitat and breeding sites for the white-bellied sea-eagle.

Berkeley Nature Reserve is also of importance to the Aboriginal community due to continuing cultural associations and past occupation of the area, and important as part of the European settlement history of the Illawarra region.

The *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 the area will be managed in the years ahead.

A draft plan of management for Berkeley Nature Reserve was placed on public exhibition from 7 May until 23 August 2004. The exhibition of the plan of management attracted 4 submissions that raised 3 issues. All submissions received were carefully considered before adopting this plan of management.

This plan of management establishes the scheme of operations for Berkeley Nature Reserve. In accordance with Section 73B of the *National Parks and Wildlife Act 1974*, this plan of management is hereby adopted.

Bob Debus

Minister for the Environment

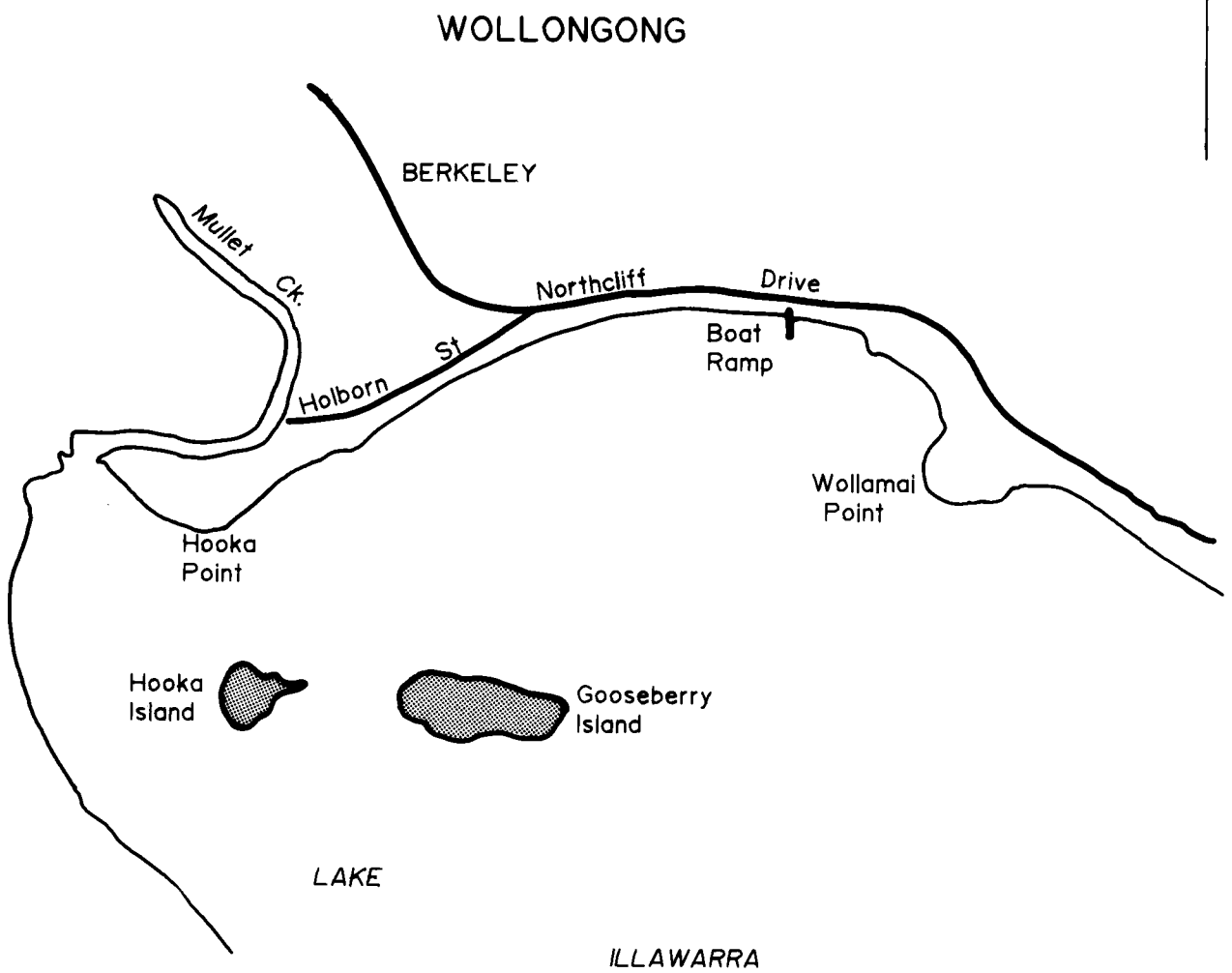
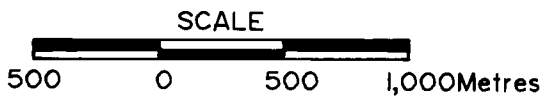
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BERKELEY NATURE RESERVE

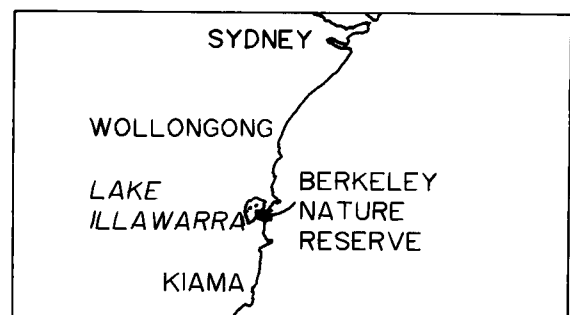


LEGEND



NATURE RESERVE

LOCALITY DIAGRAM



1. INTRODUCTION

1.1 LOCATION, GAZETTAL AND REGIONAL SETTING

Berkeley Nature Reserve (BNR) consists of two small islands in the north west of Lake Illawarra, adjacent to the suburb of Berkeley within the Wollongong local government area. The location and setting of BNR is shown on Map 1.

BNR encompasses a total area of approximately 8 hectares and comprises Gooseberry Island (6 ha) and Hooka Island (2 ha). The islands are approximately 0.25 kilometres apart and are located within 0.4 kilometres of the nearest lake foreshore at Hooka Point.

Island	Area (hectares)	Distance from Mainland (boat ramp)	Highest elevation
Gooseberry	~ 6.1	600m (1.1Km)	~1m
Hooka	~ 2.0	400m (1.6Km)	~1m

The islands were originally dedicated in 1890 for public recreation. In 1972 the islands were proclaimed as Berkeley Nature Reserve under the *Fauna Protection Act 1948*. The *National Parks and Wildlife Act 1974* subsequently replaced this Act and the NSW National Parks and Wildlife Service (NPWS) assumed management responsibility. The boundary of BNR extends to the mean high water mark of each island.

The adjacent mainland comprises foreshore open space and residential areas to the north, and open space to the west. Hooka Creek flows into the lake at Langs Point, less than 0.75 km north west of the reserve.

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.

BNR protects remnants of an ancient ridge system covered with rainforest and is a prominent visual feature within Lake Illawarra.

The geology, landform, climate and plant and animal communities of the area, plus its location, have determined how humans have used the islands. During the Ice Age, up to about 6,000 years ago, the nature reserve would have been continuous with the mainland, forming part of a continuous habitat for many species. With the rise in sea level and the creation of Lake Illawarra the islands were left as isolated outliers of the once extensive rainforest of the "Berkeley Brush".

The islands would have been easily accessible to Aboriginal people and evidence of their occupation remains. Europeans were attracted primarily to the rich coastal plain of the Illawarra and it was not until 1836 that settlers used the islands. Initial agricultural and extractive industries (logging, lime making) were eventually superseded by recreation. The islands remained a popular recreation site for many

years but suffered from neglect and vandalism, until their conservation significance was recognised.

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.

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*, the *National Parks and Wildlife Regulation*, the *Threatened Species Conservation Act 1995* and the policies of the NPWS. NPWS policies relate to nature conservation, cultural heritage conservation, recreation, commercial use, research and communication and reflect legislative requirements and internationally accepted principles of park management.

Other legislation, international agreements and charters may also apply to management of the area. In particular, the *Environmental Planning and Assessment Act 1979* requires the prior assessment and mitigation of the environmental impact of all activities and works proposed to be undertaken in the nature reserve.

International Agreements

The NPWS has obligations relating to the management of migratory sea birds breeding on BNR under international agreements ratified by the Australian Government. These agreements are:

- The Agreement between the Government of Australia and the Government of Japan for the Protection of Migratory Birds and Birds in Danger of Extinction and their Environment (JAMBA); and
- The Agreement between the Peoples Republic of China and the Government of Australia for the Protection of Migratory Birds and their Environment (CAMBA).

The agreement with China lists at least one species that utilises BNR. A similar agreement is currently being negotiated with the Russian Government.

The presence of “Listed Migratory Species” brings into effect the Commonwealth’s *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). This Act regulates actions that will, or are likely to, have significant impacts on matters of national environmental significance (NES matters). The Commonwealth and the NSW State Government are negotiating a bilateral agreement whereby most State environment assessment processes will be accredited under the Commonwealth legislation. In the interim the NPWS needs to consider, in addition to the normal environmental assessment process for on-park activities, the possibility of requiring the Commonwealth approval under the EPBC Act.

Plan of Management

The plan of management is a statutory document under the NPW Act. Once the Minister has adopted a plan, no operations may be undertaken within BNR except in accordance with the plan. The plan will also apply to any future addition to BNR. Where management strategies or works are proposed for the nature reserve or any additions that are not consistent with the plan, an amendment to the plan will be required.

2.2 NATURE RESERVES IN NEW SOUTH WALES

Nature reserves are “Protected Areas” as defined under the International Union for the Conservation of Nature and Natural Resources (IUCN, 1994). A Protected Area is defined as:

An area of land and/or sea especially dedicated to the protection and maintenance of biological diversity, and of nature and associated cultural resources, and managed through legal or other effective means.

Berkeley Nature Reserve equates to the IUCN Category 1a, “Strict Nature Reserve” that is:

An area of land and/or sea possessing some outstanding or representative ecosystems, geological or physiological features, and/or species, available primarily for scientific research and/or environment monitoring.

Nature reserves are reserved under the NPW Act to identify, protect and conserve areas containing outstanding, unique or representative ecosystems, species, communities or natural phenomena. Under the Act, nature reserves are to be managed in accordance with the following principles:

- the conservation of biodiversity, the maintenance of ecosystem function, the protection of geological and geomorphological features and natural phenomena,
- the conservation of places, objects, features and landscapes of cultural value,
- the promotion of public appreciation, enjoyment and understanding of the nature reserve’s natural and cultural values,
- provision for appropriate research and monitoring.

Nature reserves differ from national parks in that they do not have as a management principle to provide for visitor use.

3. KEY VALUES AND MANAGEMENT DIRECTIONS

3.1 VALUES OF THE NATURE RESERVE

Berkeley Nature Reserve is of international and national significance for its biological values, and of regional value for its cultural heritage and landscape values.

Key **natural values** include:

- Evidence of geological and geomorphologic processes related to the formation of the Sydney Basin and subsequent landscape evolution;
- Habitat and breeding site for the White-bellied Sea-Eagle (*Haliaeetus leucogaster*), listed under CAMBA;
- Remnant of the Illawarra Subtropical Rainforest (the 'Berkeley Brush') which is classified as an endangered ecological community under the *TSC Act 1995*; and
- Contains populations of *Cynanchum elegans*, which is listed as an endangered species under the *TSC Act* and the Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999*; *Celtis paniculata* and *Dendrobium teretifolium*, both of which are regionally rare; and *Haloragis exalata* subsp. *exalata* var. *laevis*, which is thought to exist in only one other site worldwide.

The key **cultural heritage values** comprise:

- Importance to the Aboriginal community due to continuing cultural associations and past occupation of the area; and
- Important as part of the European settlement history of the Illawarra region.

Landscape values include:

- The islands are a significant feature of the landscape of the Illawarra, being close to the shore of Lake Illawarra and visible from many points on the mainland. BNR has been included on the City of Wollongong Local Environment Plan 1990 Heritage Schedule as a Landscape Item of local heritage significance.

3.2 MANAGEMENT DIRECTIONS

In addition to the general objectives of management, the following specific objectives apply in the management of BNR:

- To protect and conserve the full range of species, populations and ecological communities representative of the original condition of the islands, with particular emphasis on those of conservation significance, in as undisturbed state as possible;
- To reduce threats and assist the recovery and maintenance of natural ecosystems and established ecological processes;
- To minimise disturbance by careful planning and execution of research, management and other approved activities; and
- To limit public access.

4. CONSERVATION OF NATURAL AND CULTURAL HERITAGE

4.1 GEOLOGY AND LANDFORM

BNR is comprised of Budgong sandstone, a sedimentary rock that underlies the Illawarra coal measures. The Budgong sandstone was deposited as layers of mud and clay about 250 million years ago (the Permian era). They are part of the "undifferentiated Berry Formation within the Shoalhaven Group" which is made up of siltstones, shales and sandstones. They appear to have been modified by heat and/or pressure effects, probably due to the Gerringong Volcanics (mostly latite and trachyte) which fringe the Lake, and are an important part of the landscape and vegetation patterns of the areas around Wollongong and Lake Illawarra. Fossils and boulders in the sandstone indicate that the depositional environment was a shallow coastal basin.

Gooseberry and Hooka Islands originated as rocky ridges that were drowned when sea levels rose and flooded the coastline after the last Ice Age. As the sea level rose, sand was carried on shore filling in the lower parts of the river systems and creating dune systems. Sand carried inland from the sea combined with sediments from the river systems to fill in behind a coastal dune barrier forming the large shallow Lake Illawarra. Being comprised of rock, BNR is distinct from the other islands (Bevans, Cudgerree, Picnic and Berageree) in Lake Illawarra that are formed from sand.

The outer layers of the sandstone of BNR have weathered into blocks, which give the islands the appearance of a rock-strewn quarry. The soils are high in nutrients and very thin. As such, the scattered rocks are important in providing anchoring for plants and as a mulch layer that protects the soil and plant root systems.

Intended Outcomes

- The natural geology and landform of the islands maintained and protected from avoidable disturbance.
- Soils protected from erosion and with soil structure and nutrient status that favours original ecology.

Strategies

- *Avoid, and where essential for management minimise, activities likely to have adverse impacts on the soils, geology, or landform of the islands.*

4.2 NATIVE PLANTS

Prior to sea level rises, BNR would have been contiguous with the mainland. The dry subtropical rainforest vegetation on the islands is a rare remnant of that which extended across the coastal plain before the sea reached its present level about 6,000 years ago. It is estimated that this vegetation, known as the 'Berkeley Brush', originally occupied about 1,600 ha of the coastal plain. The Brush was surrounded by open forests or woodlands dominated by *Casuarina glauca* on the moister soils; and this vegetation association still occurs on BNR today.

The dry subtropical rainforest remnants are part of a larger association known as the Illawarra Subtropical Rainforest, which has been recorded from the local government

areas of Wollongong, Shellharbour, Shoalhaven and Kiama (within the Sydney Basin Bioregion). This vegetation community includes subtropical rainforest, moist subtropical rainforest and the dry subtropical rainforest that is found on BNR. The greater percentage of the Illawarra Subtropical Rainforest has been cleared and it is poorly represented in conservation reserves.

The vegetation association that makes up this type of dry subtropical rainforest is composed of three layers. Large emergent trees usually occur above a lower closed canopy about 20 metres in height with a sparse shrub layer, except in moister places. The ground is largely covered by rock. Both Gooseberry and Hooka Islands conserve dry subtropical rainforest (Mills and Jakeman 1995).

In view of the small size of existing remnants, the threat of further clearing and other threatening processes, the Scientific Committee considered that the Illawarra Subtropical Rainforest in the Sydney Basin Bioregion is likely to become extinct in NSW unless the circumstances and factors threatening its survival or evolutionary development are mitigated. As such the Illawarra Subtropical Rainforest has been listed as an endangered ecological community under the *Threatened Species Conservation Act 1995* (NPWS 2002b).

A distinct pattern of vegetation is evident on both islands:

- an outer fringe of saltmarsh and swamp oak (*Casuarina glauca*), which protects the rainforest from salt-laden winds off the lake. Port Jackson figs (*Ficus rubiginosa*) also occur on outer margins of the islands;
- a larger zone of dry rainforest where the Giant Stinging Tree (*Dendrocnide excelsa*) and Whalebone Tree (*Streblus brunonianus*) are relatively common; and
- an innermost zone dominated by Moreton Bay Figs (*Ficus macrophylla*), Black Apple (*Planchonella australis*) and Brush Bloodwood (*Baloghia inophylla*).

Swamp Oak Floodplain Forest and Coastal Saltmarsh have also been listed as endangered ecological communities under the Threatened Species Conservation Act.

The islands contain a number of rare plants, including:

- *Cynanchum elegans*, which is listed as an endangered species on Schedule 1 of the *Threatened Species Conservation Act 1995* and the Commonwealth's *Environmental Protection and Biodiversity Conservation Act 1999*;
- *Celtis paniculata* and *Dendrobium teretifolium*, which are regionally rare in the Illawarra;
- *Haloragis exalata* subsp. *exalata* var. *laevis*, which is thought to exist in only one other site worldwide.

Plants identified on the islands are listed in Appendix 1

The vegetation on Hooka Island has been degraded by the presence of goats during the 1800s, tree felling, and fires. Trees on both islands, including Moreton Bay Figs and Giant Stinging trees, have been damaged by visitors in more recent times. The rainforest vegetation is also particularly sensitive to trampling, damaging plants and hampering natural regeneration.

Although the vegetation communities on Gooseberry Island are threatened, they appear to be in good condition and are likely to continue as a viable community with

appropriate management. However, the area of rainforest on Hooka Island appears to be undergoing senescence, with little or no natural regeneration and recruitment due to extensive weed infestation.

Intended Outcomes

- Protection and conservation of the islands' natural floristic and structural diversity in as natural state as possible.
- Reduction of threats and recovery, where possible, of pre-European established ecological processes.

Strategies

- *Survey, map and monitor the current distribution, abundance and health of plant species and communities on Gooseberry and Hooka Islands.*
- *Prepare and implement a native vegetation regeneration plan for the islands.*

4.3 NATIVE ANIMALS

BNR provides an important refuge for fauna, including native mammals, birds and reptiles. Eight species of reptiles, eighty-two species of birds, and one species of mammal have been recorded in the reserve (see Appendix 2).

The islands have been noted as habitat for the Water Rat (*Hydromys chrysogaster*). White-bellied Sea-eagles, listed under CAMBA, nest on Gooseberry Island, and rainforest pigeons rest and feed on the islands during their migrations along the NSW coast. Numerous lizards live in the sandstone rubble that litters the rainforest floor and the Black-bellied Swamp Snake or Marsh Snake (*Hemiaspis signata*) and the Golden Crowned snake (*Cacophis squamulosus*) have been reported on Gooseberry Island.

Information on invertebrate species and the presence of pest animal species is poor. An increased knowledge and understanding of fauna is required for the identification of potential threats, which might lead to declines in fauna species, and the presence or establishment of introduced fauna.

Intended Outcomes

- More informed and improved management through better understanding of all fauna with the reserve protecting, where possible, a full range of historically recorded natural habitats.

Strategies

- *Collate all existing native fauna data and initiate research and monitoring to redress knowledge gaps.*
- *Ensure that all access and activities minimise disturbance to native fauna and the protection of habitats is addressed in the preparation and implementation of native vegetation regeneration plan and introduced species management plan.*

4.4 ABORIGINAL HERITAGE

BNR is located within an area that was occupied by the Wadi Wadi people who spoke a variant of the Dharawal language. Dharawal descendants lived and live in the country from Botany Bay and Campbelltown in the north through the Nepean, Wollondilly, Georges and Cataract catchments¹, west to Moss Vale and south to the Shoalhaven River and Jervis Bay. Dharawal people are distinguished as fresh water or salt water depending on whether they occupied the coastal regions or the plateaus and inland river valleys. Traditional stories tell of their arrival at the mouth of Lake Illawarra in canoes when the Ancestors were animals. They brought the Dharawal or Cabbage Tree palm with them from the north and are named for this sacred tree.

The islands are important to the Aboriginal people of the Illawarra today, who have a continuing association with the area. Both islands are named after Aboriginal people who occupied and utilised the Lake Illawarra area in the 1800s. There is a diversity of opinion about the history of Charley Hooka, after whom Hooka Island is named. The European record suggests that he was an important Aboriginal warrior and leader, custodian of western Lake Illawarra, particularly the Hooka islands (Brown 1893 in Organ 1990: 354), Hooka Creek and Kanahooka. It is typical on the south coast for custodians to be given the name of the place or group of people for whom they had responsibility. In this tradition Charley Hooka would have been named for the Hooka lands rather than vice versa. Geroone alias Charley Hooker (born circa 1811) and his younger brother Berraway (or Berrywong) alias Billy Hooker (born circa 1814) were named as recipients of blankets from 1829 to 1842 being of the Five Islands, Illawarra or Wollongong tribe and residing at Hooker's Creek. Both Berraway and Geroone had wives and Geroone had a daughter Eliza (born circa 1835). Neither man appears in the 1844 blanket lists for Wollongong. Three stories exist about Geroone's death. Either he was murdered in May 1842 just below the Figtree bridge by two men from the Broughton Creek (Organ 1990: 274) or Pigeon House (Organ 1990: 485) tribe² or killed in a battle with the Broughton Creek tribe near Albion Park (Organ 1990: 494).

One Aboriginal oral tradition tells a different story which was handed down through descendants of Queen Rosie Johnston. Queen Rosie's father was said to have killed Geroone in retribution for his part in the defence of white settlers (Illert 2003: 15-16).

There is little information available about the life of the Aboriginal woman known as Gooseberry. She does not appear by that name in the blanket census records for any Dharawal country between 1827 and 1844. However, the wife of Bungaree of the Broken Bay tribe was named Matora and known as Queen Cora Gooseberry. She was painted by Charles Rodius in the 1830s (Parbury 1986: 62) and William Fernyhough circa 1836 (Troy 1990: 9). She was described on her gorgets as 'Gooseberry, Queen of Sydney to South Head' and 'Cora Gooseberry, Freeman Bungaree, Queen of Sydney and Botany' (Troy 1990: 8). Gooseberry may have had origins in the Illawarra as there was a tradition of shared ceremonies between the Illawarra and Sydney peoples.

¹ 'History of the D'harawal people (rbgsyd.gov.au/mount_annan_botanic_garden)

² A contradictory story is presented by Francis McCaffrey (1910-1930 in Organ 1990: 476) that Kanahooka was a Fijian Chief who was sheltered by the Pigeon House tribe from whom he stole a gin and then settled on Lake Illawarra. The account does not concur with any other European record.

Intended Outcomes

- The Illawarra Local Aboriginal Land Council and other relevant Aboriginal communities in the Illawarra are actively involved in the management, particularly of Aboriginal places, objects and values, of BNR.
- Better informed and improved management of Aboriginal cultural heritage through increased knowledge and understanding of Aboriginal cultural heritage of BNR, including activities, traditional uses and the location of Aboriginal sites.

Strategies

- *Review the name of BNR to determine whether it should be renamed utilising an Aboriginal name and to identify an appropriate name.*
- *Identify opportunities and develop and implement programs to involve the local Aboriginal community in the management and interpretation of BNR.*
- *Finalise the research project to record the Aboriginal history of the Illawarra which includes an inventory of sites of significance to Illawarra Aboriginal people in the Illawarra and adjacent regions.*
- *Protect identified Aboriginal places and objects in conjunction with the local Aboriginal community.*

4.5 HISTORIC HERITAGE

In 1830 settlement took place around the shores of Lake Illawarra with settlers taking up grants of various areas. In about 1836 goats were landed on Hooka Island, and Gooseberry Island, also known as Garden Island, was used for market gardening. Commercial salt was also produced on Gooseberry Island and lime was made from shells from the lake's shore.

By the 1870s, Gooseberry Island had become a picnic site, which was regarded as being one of the most charming spots of the Illawarra. In 1877, Rachel Henning wrote that:

"Lake Illawarra is a ... beautiful sheet of water about the size of Lake Windermere. There are two wooded islands on it ... we went for a picnic ...[and]... dined on one of the islands under the shade of an enormous fig tree ..." (Bayley, 1963, p. 9).

In the 1880s, landing places were erected on the islands, which were visited regularly by large numbers of people. Trustees were elected to 'improve' the islands and two piers were provided for boats and a spacious pavilion was erected on Gooseberry Island. Fishermen's picnics were often held on the islands (Bayley, 1963) and Gooseberry Island remained a popular picnic site at least until the 1930s and photographic evidence shows that the pavilion or "dance hall" remained on the island until the 1940s.

Although there has been no archaeological survey of BNR to identify historic sites, there appears to be very little obvious historical evidence of past European use that remains. Known sites include the remains of the piers erected on Gooseberry Island, and rock-lined paths and garden beds and a beehive in one of the Morton Bay Fig trees on Hooka Island.

Intended Outcomes

- Significant historic places and relics recorded, researched and conserved where appropriate.

Strategies

- *Identify, record, and assess significance of historic sites.*
- *All activities with the potential to impact on historic heritage sites will be preceded by an archaeological assessment and appropriate controls and safeguards implemented.*

5. PARK PROTECTION

5.1 SOIL EROSION

Soil erosion is not currently a problem on BNR. If senescence of the vegetation continues and expands, especially around the shores of the islands, soil could be exposed and subject to both wind and rain erosion.

Soil compaction, primarily caused by trampling, can adversely effect native plant regeneration.

Intended Outcomes

- Soils protected from erosion and with soil structure and nutrient status that favours original ecology.

Strategies

- *Periodically monitor vegetation condition for initiation or expansion of senescence or dieback and develop and implement assisted regeneration to prevent soil exposure where possible.*
- *Design, undertake and manage all access and activities on BNR in a manner that avoids, and where necessary for management minimises, soil erosion, and compaction.*

5.2 HYDROLOGY AND WATER QUALITY

No permanent surface water occurs on BNR and the islands hydrologic characteristics are likely to be dominated by groundwater and the water level of Lake Illawarra. The water level and salinity in Lake Illawarra naturally varies with rainfall, catchment inflows, evaporation, and the periodic opening of the entrance to the Lake. The impact of changes in hydrology and salinity are unknown but a permanently open lake, which is being considered, could result in lower water table and increased salinity in the lake. The water levels of the outer margins of the islands will be important in determining the location and extent of the fringing Casuarina and seagrass communities.

Pollution, such as oil spills, rubbish from stormwater and litter left by unauthorised visitors, also poses a threat to the fauna and habitats of BNR.

Intended Outcomes

- The natural hydrology of the islands is maintained and island habitats and ecosystems protected from pollution.

Strategies

- *Design and undertake all access and activities to avoid, and where necessary for management minimises, adverse impacts on water quality and natural hydrology.*
- *All human wastes to be removed from BNR to the mainland for proper treatment.*

- *Liaise with the Lake Illawarra Authority and other relevant agencies regarding the management of the hydrology of Lake Illawarra to ensure the potential for adverse impact on island habitats and ecosystems is avoided or minimised.*
- *Identify potential pollution sources that may adversely impact on BNR and liaise with and encourage the Environment Protection Authority, Wollongong City Council and other relevant agencies to develop and implement programs to protect BNR and the lake.*

5.3 INTRODUCED SPECIES

Introduced species are adversely affecting the natural and cultural heritage values of BNR and considerable potential exists for additional species to spread to the islands from the mainland and vice versa. The *Noxious Weeds Act 1993* places an obligation upon public authorities to control noxious weeds on land that they occupy to the extent necessary to prevent such weeds spreading to adjoining lands. Visitor access to the islands is a potential source of additional weed infestation and the relatively fertile soils of BNR are conducive to rapid weed establishment.

Past use of BNR, including market gardening, domestic animal grazing and recreational activities, has resulted in significant habitat disturbance and the introduction of a variety of non-native plant species. By 1997, ninety-seven introduced species had been identified on the islands (NPWS 1997). Introduced species are a particular threat to the viability of the rainforest ecosystem as they can aggressively compete with and block the natural regeneration of rainforest species. Past, *ad hoc* control practices such as extensive weed clearing may have compounded the adverse effects of introduced species.

The current structure, floristics and integrity of the native vegetation on Gooseberry Island appears to be in a reasonable condition and likely to remain viable in the long term. In contrast, the native vegetation on Hooka Island appears to be undergoing senescence, primarily due to a significant population of introduced species including Lantana, Kikuyu and Wandering Jew.

The smaller size of Hooka Island makes it more vulnerable to degradation and threatened viability in the long term. Human access and disturbance to the island has initiated and encouraged significant establishment and dispersal of introduced species, resulting in a predominately over mature remnant native vegetation with little or no native species recruitment or regeneration.

Casuarina forest occupies a low-lying area on Hooka Island in association with saltmarsh and other wet/salt tolerant species. Extensive Kikuyu and other introduced grass and climbing species populations in these areas are suppressing the regeneration of the Casuarinas. The continued decline of the Casuarina Forest may threaten the populations of the regionally rare *Dendrobium teretifolium*, which is dependent upon mature Casuarina trees to survive.

Lantana is the dominant weed on both Gooseberry and Hooka Islands. This species displaces the original, more complex, native shrub strata and suppresses the establishment and growth of other species. In the absence of the native shrub stratum, Lantana thickets provide refuge for small fauna species.

Lantana now forms part of the outer fringe of vegetation on both islands and provides some protection to rainforest vegetation from drying, salt-laden winds. In this respect,

removal or treatment of Lantana should initially be concentrated on the landward side before tackling shoreline infestations.

The presence of vigorous climbing introduced species also presents a threat to rainforest vegetation, particularly native climber species. Native climber species are essential for maintaining rainforest canopy integrity, which in turn protects the rainforest's understorey and ecological functioning.

In recent years, the NPWS has undertaken a limited bushland regeneration program on BNR, primarily on Gooseberry Island, to reduce the population and extent of introduced species and assist native vegetation regeneration. This has largely been a supervised community-based volunteer program conducted regularly but infrequently. A number of issues have arisen in the course of this program including the potential for native species to be mistaken for introduced species, and the need to progress incrementally so as not to exacerbate problems.

Intended Outcomes

- The number and extent of introduced plant species is reduced and, where possible, totally eradicated from BNR.

Strategies

- *Prepare and implement an introduced plant species management plan with initial priority for the control of Kikuyu, Wandering Jew, Cape Ivy, Bitou Bush, Moth Vine, Turkey Rhubarb and Coastal Morning Glory.*
- *Design, establish, promote and manage a regular and frequent on-going supervised and appropriately skilled community-based volunteer bush regeneration program to assist native vegetation regeneration.*
- *Identify and comprehensively map introduced plant species populations.*
- *Develop and implement a program of regular monitoring of the extent and nature of introduced species populations and the performance of control programs.*

5.4 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 and management facilities.

Fire is not believed to be an integral part of the BNR ecosystems. A number of areas of Gooseberry Island show signs of damage from past visitor campfires and arson.

Intended Outcomes

- Unplanned fire excluded from BNR.

Strategies

- *Manage access and activities to minimise the potential for human ignition of unplanned fires.*
- *Non-management related use of fire shall not be permitted on BNR.*

5.5 ACCESS

Gooseberry and Hooka Islands are well known in the Illawarra region and, due to their close proximity to the edge of Lake Illawarra, they may be appealing to people as a place to visit. The islands have a history of recreational use since their original dedication as a Reserve for Public Recreation in 1890. However, also recorded is the associated damage and neglect resulting from the years of recreational use.

The rainforest remnants on BNR are threatened, and uncontrolled access in the past has contributed to impacts such as the compaction of soils, suppression of natural regeneration, proliferation of introduced species and disturbance to fauna. Since the islands' dedication under the NPW Act, unauthorised access has not been permitted to ensure the protection of the conservation values of the reserve.

Periodic unauthorised access continues to occur including instances of the deliberate felling of trees, which have created gaps in the rainforest canopy and localised breakdown of ecological processes and exacerbating native vegetation decline. In addition, well meaning but unauthorised introduced plant species control efforts on Gooseberry Island have impacted on native plants, including damage to threatened species. The wholesale removal of an obvious weed such as Lantana without any strategy or knowledge of the potential ecological impacts can exacerbate degradation, exposing the rainforest to salt laden winds and eventual die back.

Intended outcomes

- Conservation values protected from unnecessary human access and disturbance.

Strategies

- *Public access to BNR shall generally only be permitted for authorised management-related purposes. Strictly limited non-management related access may be authorised subject to satisfactory environmental assessment and compatibility with BNR management directions and intended outcomes.*
- *Install and maintain signs on BNR, nearby mainland sites and other relevant locations to inform the public of access restrictions.*
- *Develop and implement appropriate access protocols and minimal impact requirements for all authorised visitors to BNR to reduce adverse impacts of access.*
- Prepare and distribute information regarding access restrictions to appropriate authorities and stakeholder associations.

6. EDUCATION AND INFORMATION PROVISION

Promoting public awareness and understanding of the NPWS's conservation responsibilities, the natural and cultural values of the reserve, and appropriate access is a major aspect of visitor education that will assist the protection of the values of BNR.

Reserve interpretation is currently limited to reserve identification signs on each of the islands and a simple brochure. The nearby mainland lake shore, including Hooka Point Park, Holborn Park, Wollamai Park and the Tuggerah Bay boat ramp, provide suitable vantage points for establishing reserve interpretive displays so as to raise community awareness and understanding of the conservation significance of BNR.

Provision of information about BNR will involve three levels:

- information to increase community awareness of the existence of BNR, its conservation importance and reasons for controlling access;
- interpretation material, to be used either from foreshore vantage points, such as along Northcliffe Drive, or from boats, describing its landscape and importance as a refuge, interpretation of individual components of the environment of BNR and of the environment in general; and
- provision of minimal impact use information for authorised visitors.

Intended outcomes

- Increased public appreciation and understanding of the natural and cultural heritage values and management requirements of BNR.

Strategies

- *Prepare and periodically update a high quality interpretive brochure for BNR.*
- *Establish and periodically update and maintain reserve identification and regulatory signage on both Hooka and Gooseberry Islands.*
- *Develop, install and periodically update and maintain high quality reserve interpretive displays at appropriate mainland lakeside vantage points.*
- *Regularly liaise with lake and waterway management authorities and key lake recreational user groups, and keep informed of the values and management requirements of BNR.*
- *Develop a collaborative, strategic approach to information provision with the Department of Primary Industries: Fisheries and the NSW Maritime Authority.*
- *Regularly promote opportunities for authorised community volunteer involvement in BNR management programs, particularly bush regeneration.*

7. RESEARCH AND MONITORING

There has been little research into either the natural and cultural values of Gooseberry and Hooka Islands or the long-term effects of threats, such as introduced species, on these values. Research into the flora, fauna and cultural heritage of BNR, their management requirements, and threatening processes such as introduced species, vegetation senescence and lake hydrology changes is essential for the development of an effective management regime. Important research and monitoring projects for BNR include:

- Potential effect of permanent lake hydrological changes on BNR ecosystems;
- The impact of introduced species on BNR ecosystems, particularly the effect of Kikuyu on the Casuarina Forest, and appropriate management strategies;
- Native vegetation senescence and methods to promote native vegetation regeneration; and
- Identification of all significant species and habitats, and their management requirements.

Research activities need to be carefully managed and researchers need to work collaboratively and in close contact with the NPWS to minimise potential adverse impacts on the conservation values of BNR. The development of a Memorandum of Understanding, based on clearly articulated research goals and programs, with each research organisation would assist with the coordination and management of research activities. A peer review process for each proposal and the interpretation of data would assist in the credibility of the program and ensure consistency.

Intended outcomes

- Research that contributes to improved understanding and management of the natural and cultural heritage of BNR, and the processes that affect them, and which have minimal negative impacts on the ecology and environment of BNR.
- Minimal built research and management facilities and which only serve the needs of management and which have acceptable environmental impact.

Strategies

- *Develop a research prospectus for BNR identifying high priority research opportunities that relate directly to issues of concern to the management of the reserve, and promulgate with tertiary education and other relevant research organisations.*
- *Establish formal agreements with non-NPWS persons or research institutions undertaking research that includes, but is not limited to, requirements such as access protocols, approved research methods and materials, environmental impact assessment, and the provision of research data and results to the local NPWS office.*
- *Review the appropriateness and environmental acceptability of individual research programs annually before renewal of access permits and review the overall program and priorities at least every five years.*

8. PLAN IMPLEMENTATION

Under the NPW Act, where the Minister has adopted a plan of management for a nature reserve it shall be carried out and given effect to by the Director-General. No operations shall be undertaken in relation to the nature reserve unless they are in accordance with the plan.

Implementation of this plan will be undertaken within the annual programs of the NPWS Illawarra Area. Relative priorities for identified activities are set out in the table below. These priorities are determined in the context of NPWS directorate and regional strategic planning, and are subject to the availability of necessary staff and funds and to any special requirements of the Director-General or Minister. The implementation of the plan will be monitored and its success in achieving the identified outcomes will be assessed.

The environmental impact of all proposed activities to be undertaken in the reserve will be formally assessed at all stages and any necessary investigations will be undertaken in accordance with the requirements of the *Environmental Planning and Assessment Act 1979* and other relevant statutes. This requirement applies to all activities and works proposed whether undertaken by the NPWS or others.

Strategies

- *Ensure that all activities on BNR are in accordance with this plan of management and that there is effective communication between all relevant parties to assist management activities.*
- *Undertaken an annual review and prepare a report of progress in implementing this plan of management.*
- *Undertake an assessment after 5 years of the effectiveness of managing BNR in accordance with this plan and of the degree of success in implementing the strategies and in achieving the plan's management directions and intended outcomes.*

PLAN IMPLEMENTATION SHEDULE

Priority	Activity	Plan reference
High	Avoid, and where essential for management minimise, activities likely to have adverse impacts on the soils, geology, or landform of the islands.	4.1
	Survey, map and monitor the current distribution, abundance and health of plant species and communities on Gooseberry and Hooka Islands.	4.2
	Prepare and implement a native vegetation regeneration plan for the islands.	4.2
	Ensure that all activities minimise disturbance to native fauna and the protection of habitats is addressed in the preparation and implementation of native vegetation regeneration plan and introduced species management plan.	4.3
	Protect identified Aboriginal places and objects in conjunction with the local Aboriginal community.	4.4
	All activities with the potential to impact on historic heritage sites will be preceded by an archaeological assessment and appropriate controls and safeguards implemented.	4.5
	Design, undertake and manage all access and activities on BNR in a manner that avoids, and where necessary for management minimises, soil erosion and compaction.	5.1
	Design and undertake all access and activities to avoid, and where necessary for management minimise, adverse impacts on water quality and natural hydrology.	5.2
	All human wastes to be removed from BNR to the mainland for proper treatment.	5.2
	Identify and comprehensively map introduced plant species populations.	5.3
	Prepare and implement an introduced plant species management plan with initial priority for the control of Kikuyu, Wandering Jew, Cape Ivy, Bitou Bush, Moth Vine, Turkey Rhubarb and Coastal Morning Glory.	5.3
	Design, establish, promote and manage a regular and frequent on-going supervised and appropriately skilled community-based volunteer bush regeneration program to assist native vegetation regeneration	5.3
	Manage access and activities to minimise the potential for human ignition of unplanned fires.	5.4
	Non-management related use of fire shall not be permitted on BNR	5.4
	Public access to BNR shall generally only be permitted for authorised management-related purposes. Strictly limited non-management related access may be authorised subject to satisfactory environmental assessment and compatibility with BNR management directions and intended outcomes.	5.5
	Establish and periodically update and maintain reserve identification and regulatory signage on both Hooka and Gooseberry Islands.	6
	Develop a research prospectus for BNR identifying high priority research opportunities that relate directly to issues of concern to the management of the reserve, and promulgate with tertiary education and other relevant research organisations.	7
	Ensure that all activities on BNR are in accordance with this plan of management and that there is effective communication between all relevant parties to assist management activities.	8

Medium	Review the name of BNR to determine whether it should be renamed utilising an Aboriginal name and to identify an appropriate name.	4.4
	Identify opportunities and develop and implement programs to involve the local Aboriginal community in the management and interpretation of BNR.	4.4
	Finalise the research project to record the Aboriginal history of the Illawarra.	4.4
	Develop and implement a program of regular monitoring of the extent and nature of introduced species populations and the performance of control programs.	5.3
	Install and maintain signs on BNR, nearby mainland sites and other relevant locations to inform the public of access restrictions.	5.5
	Develop and implement appropriate access protocols and minimal impact requirements for authorised visitors to BNR to reduce adverse impacts of access.	5.5
	Develop, install and periodically update and maintain high quality reserve interpretive displays at appropriate mainland lakeside vantage points.	6
	Regularly promote opportunities for authorised community volunteer involvement in BNR management programs, particularly bush regeneration.	6
	Develop a collaborative, strategic approach to information provision with the Department of Primary Industries: Fisheries and NSW Maritime.	6
	Establish formal agreements with non-NPWS persons or research institutions undertaking research that includes, but is not limited to, requirements such as access protocols, approved research methods and materials, environmental impact assessment, and the provision of research data and results to the local NPWS office.	7
	Undertake an annual review and prepare a report of progress in implementing this plan of management.	8
Low	Collate all existing native fauna data and initiate research and surveys to redress knowledge gaps.	4.3
	Identify, record and assess significance of historic sites.	4.5
	Periodically monitor vegetation condition for initiation or expansion of senescence or dieback and develop and implement assisted regeneration to prevent soil exposure where possible.	5.1
	Liaise with the Lake Illawarra Authority and other relevant agencies regarding the management of the hydrology of Lake Illawarra to ensure the potential for adverse impact on island habitats and ecosystems is avoided or minimised.	5.2
	Identify potential pollution sources that may adversely impact on BNR and liaise with and encourage the Environment Protection Authority, Wollongong City Council and other relevant agencies to develop and implement programs to protect BNR and the lake.	5.2
	Prepare and distribute information regarding access restrictions to appropriate authorities and stakeholder associations.	5.5
	Prepare and periodically update a high quality interpretive brochure for BNR.	6
	Regularly liaise with lake and waterway management authorities and key lake recreational user groups, and keep informed of the values and management requirements of BNR.	6
	Undertake an assessment after 5 years of the effectiveness of managing BNR in accordance with this plan and of the degree of success in implementing the strategies and in achieving the plan's management directions and intended outcomes.	8

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APPENDIX 1 – Vascular plants recorded in Berkeley Nature Reserve
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Class	Family	Species	
Falicopsida	Adiantaceae	<i>Adiantum aethiopicum</i>	
		<i>Cheilanthes sieberi</i>	
	Davalliaceae	<i>Nephrolepis cordifolia</i> *	
Magnoliopsida – Magnoliidae	Podocarpaceae	<i>Podocarpus elatus</i> #	
	Acanthaceae	<i>Pseuderanthemum variabile</i>	
	Aizoaceae	<i>Tetragonia tetragonoides</i>	
	Amaranthaceae	<i>Alternanthera denticulata</i>	
	Anacardiaceae	<i>Harpephyllum caffrum</i> *	
	Apiaceae	<i>Centella asiatica</i>	
		<i>Hydrocotyle acutiloba</i>	
		<i>Hydrocotyle bonariensis</i> *	
		Apocynaceae	<i>Parsonsia straminea</i>
		Asclepiadaceae	<i>Cynanchum elegans</i> #
	<i>Marsdenia flavescens</i>		
	<i>Tylophora barbata</i> #		
	Asteraceae	<i>Bidens pilosa</i> *	
		<i>Chrysanthemoides monilifera</i> spp.	
		<i>Rotundata</i> *	
		<i>Chrysanthemoides monilifera</i> spp.	
		<i>monilifera</i> *	
<i>Conyza albida</i> *			
<i>Delairea odorata</i> *			
<i>Hypochoeris radicata</i> *			
<i>Lactuca serriola</i> *			
<i>Senecio hispidulus</i> var. <i>dissectus</i>			
<i>Senecio hispidulus</i> var. <i>hispidulus</i>			
<i>Senecio linearifolius</i>			
<i>Senecio tamoides</i> *			
<i>Sonchus oleraceus</i> *			
Basellaceae	<i>Anredera cordifolia</i> *		
Bignoniaceae	<i>Pandorea pandorana</i> spp. <i>pandorana</i>		
Brassicaceae	<i>Cakile edentula</i> *		

	<i>Capsella bursa-pastoris</i> *
	<i>Lepidium bonariense</i> *
	<i>Lepidium pseudotasmanicum</i> #
	<i>Lobularia maritima</i> *
	<i>Raphanus raphanistrum</i> *
Cactaceae	<i>Opuntia stricta</i> *
Caryophyllaceae	<i>Stellaria flaccida</i>
Cassythaceae	<i>Cassytha glabella</i>
Casuarinaceae	<i>Casuarina glauca</i>
Celastraceae	<i>Cassine australis</i> var. <i>australis</i>
Chenopodiaceae	<i>Atriplex australiasica</i>
	<i>Atriplex cinerea</i>
	<i>Atriplex semibaccata</i>
	<i>Einadia hastata</i>
	<i>Sarcocornia quinquefolia</i>
	<i>Suaeda australia</i>
Commelinaceae	<i>Commelina cyanea</i>
	<i>Tradescantia albiflora</i> *
Convolvulaceae	<i>Ipomoea cairica</i> *
Cunoniaceae	<i>Aphanopetalum resinosum</i>
Dilleniaceae	<i>Hibbertia dentata</i>
Escalloniaceae	<i>Polyosma cunninghamii</i> #
Euphorbiaceae	<i>Baloghia inophylla</i>
	<i>Breynia oblongifolia</i>
	<i>Claoxylon australe</i>
	<i>Euphorbia peplus</i> *
	<i>Phyllanthus gasstroemii</i>
Fabaceae: Faboideae	<i>Glycine clandestina</i> species complex
	<i>Kennedia rubicunda</i>
Fabaceae: Mimosaceae	<i>Acacia implexa</i>
	<i>Acacia longifolia</i>
	<i>Acacia sophorae</i>
	<i>Pararchidendron pruinatum</i> #
Flacourtiaceae	<i>Scolopia braunii</i> #
Goodeniaceae	<i>Selliera radicans</i>
Haloragaceae	<i>Haloragis exalata</i> subsp. <i>exalata</i> var. <i>laevis</i> #

Icacinaceae	<i>Pennantia cunninghamii</i>
Lauraceae	<i>Cryptocarya microneura</i> <i>Endiandra sieberi</i> #
Lobeliaceae	<i>Pratia purpurascens</i> <i>Lobelia alata</i>
Loranthaceae	<i>Ameyema cambagei</i> <i>Muellerina celastroides</i>
Malvaceae	<i>Hibiscus heterophyllus</i> # <i>Lagunaria patersonia</i> * <i>Sida rhombifolia</i> *
Menispermaceae	<i>Legenophora moorei</i> <i>Stephania japonica</i> var. <i>discolor</i>
Moraceae	<i>Ficus coronata</i> <i>Ficus macrophylla</i> ssp. <i>macrophylla</i> # <i>Ficus obliqua</i> var. <i>henneana</i> # <i>Ficus rubiginosa</i> <i>Malaisia scandens</i> <i>Streblus brunonianus</i> #
Myoporaceae	<i>Myoporum acuminatum</i>
Myrsinaceae	<i>Rapanea howittiana</i> <i>Rapanea variabilis</i> #
Myrtaceae	<i>Acmena smithii</i> <i>Rhodamnia rubescens</i> #
Oleaceae	<i>Notolaea venosa</i>
Papaveraceae	<i>Argemone ochroleuca</i> ssp. <i>ochroleuca</i> *
Pittosporaceae	<i>Citriobatus pauciflorus</i> <i>Pittosporum revolutum</i> <i>Pittosporum undulatum</i>
Plantaginaceae	<i>Plantago lanceolata</i> *
Polygonaceae	<i>Rumex sagittatus</i> * <i>Persicaria decipiens</i>
Ranunculaceae	<i>Clematis glycinioides</i>
Rhamnaceae	<i>Alphitonia excelsa</i>
Rubiaceae	<i>Coprosma quadrifida</i> #
Rutaceae	<i>Acronychia oblongifolia</i>
Sapindaceae	<i>Alectryon subcinereus</i>
Sapotaceae	<i>Planchonella australis</i> #

	Solanaceae	<i>Physalis peruviana</i> *
		<i>Solanum mauritianum</i> *
		<i>Solanum nigrum</i> *
	Sterculiaceae	<i>Brachychiton acerifolius</i>
		<i>Commersonia fraseri</i>
	Ulmaceae	<i>Celtis paniculata</i> #
	Urticaceae	<i>Dendrocnide excelsa</i>
		<i>Urtica incisa</i>
	Verbenaceae	<i>Clerodendrum tomentosum</i> #
		<i>Lantana camara</i> *
	Vitaceae	<i>Cayratia clematidea</i> #
		<i>Cissus antartica</i>
Magnoliopsida-Liliideae	Amaryllidaceae	<i>Crinum pedunculatum</i>
	Asparagaceae	<i>Protasparagus aethiopicus</i> *
	Cyperaceae	<i>Cyperus polystachyos</i>
		<i>Isolepis cernua</i>
		<i>Isolepis nodosa</i>
	Juncaceae	<i>Juncus krausii</i> subsp. <i>Australiensis</i>
		<i>Juncus usitatus</i>
	Juncaginaceae	<i>Triglochin striata</i>
	Lomandraceae	<i>Lomandra longifolia</i>
	Philesiaceae	<i>Geitonoplesium cymosum</i>
	Orchidaceae	<i>Dendrobium teretifolium</i> #
	Philesiaceae	<i>Geitonoplesium cymosum</i>
	Phormiaceae	<i>Dianella caerulea</i> var. <i>producta</i>
		<i>Dianella revoluta</i> var. <i>revoluta</i>
	Poaceae	<i>Agrostis avenacea</i>
		<i>Anisopogon avenaceus</i>
		<i>Avena fatua</i> *
		<i>Bromus catharticus</i> *
		<i>Chloris gayana</i> *
		<i>Cynodon dactylon</i>
		<i>Ehrharta erecta</i> *
		<i>Microlaena stipoides</i>
		<i>Oplismenus aemulus</i>
		<i>Paspalum dilatatum</i> *
		<i>Paspalum distichum</i> *

	<i>Pennisetum clandestinum</i> *
	<i>Phalaris aquatica</i> *
	<i>Setaria pumila</i> *
	<i>Stenotaphrum secundatum</i> *
Posidoniaceae	<i>Posidonia australis</i>
Smilacaceae	<i>Smilax glyciophylla</i>
Zosteraceae	<i>Zostera capricorni</i>

Key: # Conservation significant species

* Introduced species

Sources: NPWS (1997)

NPWS Staff, Sydney South Region.

APPENDIX 2 – Fauna Species List for Berkeley Nature Reserve

Common Name	Scientific Name
Birds	
Chestnut Teal	<i>Anas castanea</i>
Pacific Black Duck	<i>Anas superciliosa</i>
Australian Shoveller	<i>Anas rhynchotis</i>
Grey Teal	<i>Anas gracilis</i>
Hardhead (White-eyed Duck)	<i>Aythya australis</i>
Australian Wood Duck	<i>Chenonetta jubata</i>
Australian Shelduck	<i>Tadorna tadornoides</i>
Musk Duck	<i>Biziura lobata</i>
Plumed Whistling Duck	<i>Dendrocygna eytoni</i>
Black Swan	<i>Cygnus atratus</i>
Intermediate Egret	<i>Ardea intermedia</i>
Cattle Egret	<i>Ardea ibis</i>
Great Egret	<i>Ardea alba</i>
Little Egret	<i>Egretta garzetta</i>
Striated Heron	<i>Butorides striatus</i>
White-faced Heron	<i>Egretta novaehollandiae</i>
Buff-banded Rail	<i>Gallirallus philippensis</i>
Lewin's Rail	<i>Rallus pectoralis</i>
Australian (Spotted) Crake	<i>Porzana fluminea</i>
Dusky Moorhen	<i>Gallinula tenebrosa</i>
Eurasian Coot	<i>Fulica atra</i>
Pied Currawong	<i>Strepera graculina</i>
Black-faced Cuckoo-shrike	<i>Coracina novaehollandiae</i>
Australian Raven	<i>Corvus coronoides</i>
Brush Cuckoo	<i>Cacomantis variolosus</i>
Shining Bronze-Cuckoo	<i>Chrysococcyx lucidus</i>
Grey Fantail	<i>Rhipidura fuliginosa</i>
Rufous Fantail	<i>Rhipidura rufifrons</i>
Willie Wagtail	<i>Rhipidura leucophrys</i>
Golden Whistler	<i>Pachycephala pectoralis</i>

Striated Thornbill	<i>Acanthiza lineata</i>
Yellow Thornbill	<i>Acanthiza nana</i>
Brown Thornbill	<i>Acanthiza pusilla</i>
Brown Gerygone	<i>Gerygone mouki</i>
White-browed Scrubwren	<i>Sericornis frontalis</i>
Large-billed Scrubwren	<i>Sericornis magnirostris</i>
Eastern Yellow Robin	<i>Eopsaltria australis</i>
Silvereye	<i>Zosterops lateralis</i>
Grey Shrike-thrush	<i>Colluricincla harmonica</i>
Tawny Grassbird	<i>Megalurus timoriensis</i>
Silver Gull	<i>Larus novaehollandiae</i>
Kelp Gull	<i>Larus dominicanus</i>
Pacific Gull	<i>Larus pacificus</i>
Australian Pelican	<i>Pelecanus conspicillatus</i>
Darter	<i>Anhinga melanogaster</i>
Great Cormorant	<i>Phalacrocorax carbo</i>
Little Black Cormorant	<i>Phalacrocorax sulcirostris</i>
Pied Cormorant	<i>Phalacrocorax varius</i>
Grey-tailed Tattler	<i>Heteroscelus brevipes</i>
Australian White Ibis	<i>Threskiornis molucca</i>
Sacred Ibis	<i>Threskiornis aethiopica</i>
Straw-necked Ibis	<i>Threskiornis spinicollis</i>
Royal Spoonbill	<i>Platalea regia</i>
Yellow-billed Spoonbill	<i>Platalea flavipes</i>
Painted Snipe	<i>Rostratula longirostris</i>
Great Crested Grebe	<i>Podiceps atratus</i>
Hoary-headed Grebe	<i>Poliiocephalus poliocephalus</i>
Bar-tailed Godwit	<i>Limosa lapponica</i>
Curlew Sandpiper	<i>Calidris ferruginea</i>
Broad-billed Sandpiper	<i>Calidris acuminata</i>
Pectoral Sandpiper	<i>Calidris melanotus</i>
Marsh Sandpiper	<i>Tringa stagnatilis</i>
Pied Oyster Catcher	<i>Haematopus longirostris</i>
Red-necked Stint	<i>Calidris ruficollis</i>
Grey-tailed Tattler	<i>Heterocelus brevipes</i>
Common Greenshank	<i>Tringa nebularia</i>
Masked Lapwing	<i>Vanellus miles</i>

Grey Plover	<i>Pluvialis squatarola</i>
Mongolian Plover	<i>Charadrius mongolus</i>
Red Kneed Dotterel	<i>Erythronyx cinctus</i>
Double-banded Dotterel	<i>Charadrius bicinctus</i>
Eastern Curlew	<i>Numenius madagascariensis</i>
Little Curlew	<i>Numenius minutus</i>
Black-winged Stilt	<i>Himantopus himantopus</i>
Red-necked Avocet	<i>Recurvirostra novaehollandiae</i>
Caspian Tern	<i>Hydroprogne caspia</i>
Common Tern	<i>Sterna hirundo</i>
Crested Tern	<i>Sterna bergii</i>
Whistling Kite	<i>Haliastur sphenurus</i>
White-bellied Sea-eagle	<i>Haliaeetus leucogaster</i>
Little Eagle	<i>Hieraaetus morphnoides</i>
Brown Falcon	<i>Falco berigora</i>

Reptiles

Striped Skink	<i>Ctenotus robustus</i>
Grass Skink	<i>Lampropholis delicata</i>
Eastern Water Skink	<i>Eulamprus quoyii</i>
Garden Skink	<i>Lampropholis guichenoti</i>
Three-toed Skink	<i>Saiphos equalis</i>
Weasel Skink	<i>Saproscincus mustelina</i>
Black-bellied Swamp Snake	<i>Hemiaspis signata</i>
Golden-Crowned snake	<i>Cacophis squamulosus</i>

Mammals

Water Rat	<i>Hydromys chrysogaster</i>
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Source – Gibson (1989)
 NPWS (1997)
 NPWS Wildlife Atlas (2002a)