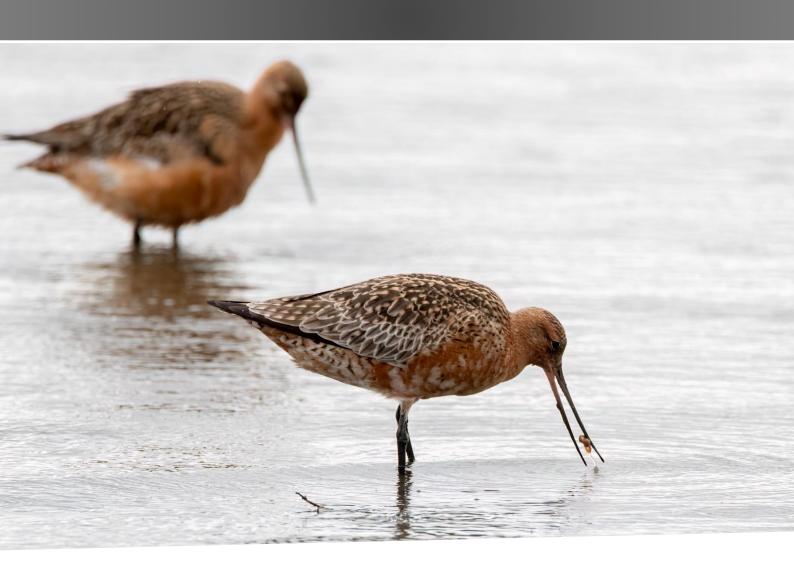


# FLORA AND FAUNA MONITORING STUDY

December 2023 - May 2024

PREPARED FOR CITY OF CANADA BAY COUNCIL MAY 2024



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Cover: Bar-tailed Godwits in breeding plumage – Hen and Chicken Bay March 2024

IMAGES: Note the majority of species images are from the the Canada Bay LGA, taken during the survey by Applied Ecology staff and are for use by Council.

"It's surely our responsibility to do everything in our power to create a planet that provides a home not just for us, but for all life on Earth." Sir David Attenborough

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Acronym/Term	Definition
BC Act	NSW Biodiversity Conservation Act 2016
Biodiversity	Variety and number of different species living in an ecosystem or a defined geographic area
Biosecurity Act	NSW Biosecurity Act 2015
Catchment	The area of land draining to a waterway. May also refer to areas served by a wastewater or stormwater system
CEEC	Critically Endangered Ecological Community (listed under BC Act or EPBC Act)
dB	Decibel
DBH	Diameter at Breast Height
DCCEEW	NSW Department of Climate Change, Energy, the Environment and Water
DPIE	Department of Planning, Industry and Environment
Ecologically sustainable development (ESD)	Development that improves the quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends
Ecosystem	A community of organisms, interacting with one another, and the environment in which they live. Processes occurring within an ecosystem are the flow of energy by food chains and food webs and nutrient cycling.
EP&A Act	NSW Environmental Planning and Assessment Act 1979
EPA	Environmental Protection Authority
EPBC Act	Commonwealth Environment Protection and Biodiversity Conservation Act 1999
FM Act	NSW Fisheries Management Act 1994
Freshwater	Water found in lakes, rivers, streams; generally containing less than 1,000 mg/L of dissolved solids (salts)
Groundwater	Water found below the surface, usually in porous rock or soil or in underground aquifers (natural underground formations that contains sufficient saturated, permeable material to yield significant quantities of water)
ha	hectare
LGA	Local Government Area - an administrative division that local government is responsible for
Nomenclature	Nomenclature, in biological classification, system of naming organisms
NPWS	NSW National Parks and Wildlife Service
OEH	NSW Office of the Environment and Heritage (Now DCCEEW)
PCT	Plant community type -are the master community-level typology used in NSW planning and assessment tools and vegetation mapping and management programs. The PCT classification is maintained in the BioNet Vegetation Classification application.
Pollutants	Contaminants in water, soil or air that, when in sufficient quantity, may cause environmental degradation
RHSEPP	NSW State Environmental Planning Policy (Resilience and Hazards) 2021
Sediment	Soil or other particles that settle to the bottom of waterways/bodies
SEPP	State Environmental Planning Policy – a statutory environmental planning instrument under the EP&A Act (NSW)
Stakeholder	A stakeholder is any individual or group, which can affect or is affected by an organisation's activities
TEC	Threatened Ecological Community (communities listed under BC Act or EPBC Act)
TS	Threatened species (species listed under BC Act or EPBC Act)
Waterways	All streams, creeks, rivers, estuaries, inlets and harbours
Wetland	A wetland is a low-lying area of land often inundated or permanently covered by shallow water. They play a major role in the water cycle by storing and filtering water and replenishing underground water supplies. Wetlands can also be effective in cleaning polluted water by reducing aquatic plant nutrients, suspended solids and oxygen demands.

# 1 SUMMARY

This Flora and Fauna Study (the Study) and report was commissioned by the City of Canada Bay Council to assess terrestrial flora and vertebrate fauna diversity within selected parks and reserves in the LGA during 2023 - 2024. The survey had two primary aims:

- To provide a current assessment of the range and abundance of wildlife in the LGA; and
- To provide reference data that can be used to assess future changes to the abundance of wildlife in the LGA.

# Additional objectives were:

- Analyse in field the current state of flora and fauna and compare to historical data to provide trends:
- Identify biodiversity value areas through desktop analysis and field surveys; and
- Identify organisational opportunities for biodiversity enhancement and conservation

#### Summary results include:

#### **Vertebrate Fauna**

The following species were documented during the study:

Total vertebrate species recorded	Threatened species	Introduced species
111	8	12

By class; 84 bird species, 17 mammals, 3 amphibians and 7 reptiles were recorded.

The fauna survey was conducted over five months, from December 2023 to April 2024, with additional observations made in May. Each month of on-ground surveys yielded unique species, indicating ongoing potential for species accumulation.

Consistent with the findings of previous surveys, lands held by NSW Health and the privately owned Concord Golf Club had comparatively high species richness and abundance. This is in part due to unique habitats on these lands, including freshwater wetlands at the Golf Club, and also proximity, rather than good connectivity, to reserved natural areas to the west of the LGA that allows for some local movement of species.

Birds were the primary contributors to overall species richness, followed by mammals, reptiles, and frogs. Most of the birds recorded are fairly sedentary with seasonal migrants, such as some honeyeater species observed in autumn, using available habitats in the LGA as stepping stone habitats on their passage north across the city.

There has been some species turnover between this survey and previous surveys but the number of species recorded is fairly similar. Flowering events, widespread rainfall or drought can all play a role in the number of species of birds detected in a given year.

Avifauna (birds) in the LGA is dominated by larger birds, both urban adapted species such as Australian Magpies and Sulphur-crested Cockatoos, and the large piscivorous (carnivorous animal that primarily eats fish) species that hunt in the river. The most abundant species recorded were the highly social Rainbow Lorikeet and Noisy Miner. The latter species, in particular, is known to mob and harass other species reducing species diversity in many areas where they occur. Aggressive exclusion of birds from

woodland and forest habitat by abundant Noisy Miners is listed as a Key Threatening Process under the NSW BC Act. Small birds were largely restricted to areas around Yaralla Estate where vegetation has better structure, providing foraging resources and nesting opportunites for small birds not found in parks and reserves where vegetation has been simplified to canopy and mown grass.

Sadly, the area used by migratory waders has largely contracted to the eastern shores of Hen and Chicken Bay. Hobcroft (2003) noted that the LGA contains the most valuable migratory shorebird habitat remaining in the Parramatta River estuary. It is unclear why the western shore around Prince Edward Park, and other previously important locations such as Rodd Point are no longer frequented by the birds that do arrive, albeit in far fewer numbers than observed in the 2003 survey. Increased use by people, light and noise pollution, reduction in good sight lines and changes in invertebrate assemblages in the mudflats likely influence current patterns of usage by shorebirds.

#### Flora and vegetation

A total of 51 sites were surveyed, including two golf courses and 5 schools. Many of the reserves included areas of playing fields or other mown open space, and several are on land owned by NSW Health. Surveys were conducted between November 2023 and May 2024 and were broadly divided into two categories:

- Species inventories for reserves and ground truthing of extant vegetation
- Foreshore surveys for saltmarsh along all the publicly accessible foreshores

A total of 270 species of native flora were recorded in the current study. Greatest floristic diversity was observed in Brett Park, largely as a result of extensive revegetation planting. Queen Elizabeth 2 Park had a similar level of diversity but started with more natural vegetation and this was supplemented with species appropriate for the extant vegetation community. The diversity was very high in a number of reserves with minimal management in areas of vegetation, including all the land currently managed by NSW Health. Species richness recorded in reserves was primarily influenced by several factors: size of the vegetated area, area and health of remnant vegetation, extent and appropriateness of revegetation planting. Foreshore areas have inherently lower levels of species richness because of the nature of the vegetation communities found in these areas.

Seven Plant Community Types (PCTs) are mapped as present in the LGA on the current State Vegetation Type Mapping (SVTM). Each of these relate directly to the vegetation communities (Map Units) provided by OEH in 2016 in mapping that is more accurate and comprehensive for the LGA. The OEH mapping also provides diagnostic criteria for each Map Unit. Native vegetation mapping was used to identify patches of vegetation within reserves to identify which vegetation communities that may be present. Three of these are estuarine communities and are limited to the immediate foreshore areas. Two others were very rarely present in the LGA, leaving two main terrestrial PCTs/Map Units most commonly occurring.

Species inventories for native flora were compared to the diagnostic criteria for each mapped PCT/Map Unit within each reserve. Many of the reserves had more than one PCT mapped and/or present, and some had multiple patches of several PCTs. Where appropriate these were also tested against diagnostic criteria. Vegetation patches with extensive planting did not always comply with the diagnostic criteria for the relevant PCT. Several of the PCTs recorded are listed as threatened ecological communities in NSW.

The species inventory from the current study was compared with publicly available databases, specifically Atlas of Living Australia (which includes iNaturalist observations) and NSW Wildlife Atlas

(BioNET). These included results from outside the study sites, and gave a total of 361 native flora species in the LGA.

A total of 151 patches of saltmarsh were recorded along City of Canada Bay foreshores, which included several patches located west of the shared path in Bicentennial Park (part of Sydney Olympic Park) and beside Homebush Bay Drive. There are more and larger patches that have been mapped nearby. The main areas for saltmarsh in the LGA are on the western side of the Rivendell peninsula, at the upper end of Brays Bay, on the northwestern side of Yaralla Estate, at the upper end of Yaralla Bay, and on the northern foreshore of Iron Cove. The first two have saltmarsh on the upper side of mangroves while the Iron Cove habitat is developing beside Henley Marine Drive in response to changes in sea levels. *Wilsonia backhousei*, a threatened species, has been sporadically recorded in the LGA (although not in the current survey). Wilsonia was recorded in Brays Bay near Lovedale Place in 2008 (although this record has not been accurately mapped in current records). All three of these areas have a high potential to be colonised by Wilsonia.

# 2 OVERVIEW AND BACKGROUND

The Canada Bay Local Government Area is 19.79km² and located on the southern banks of the Parramatta River and the western extent of Port Hacking. The Parramatta River is a tide dominated drowned valley estuaries with open entrances. The Parramatta River has a catchment area of 252.4 km² and 13.7km² of estuary. The context of the Canada Bay LGA (in red) in relation to other Council areas in the region is illustrated below.

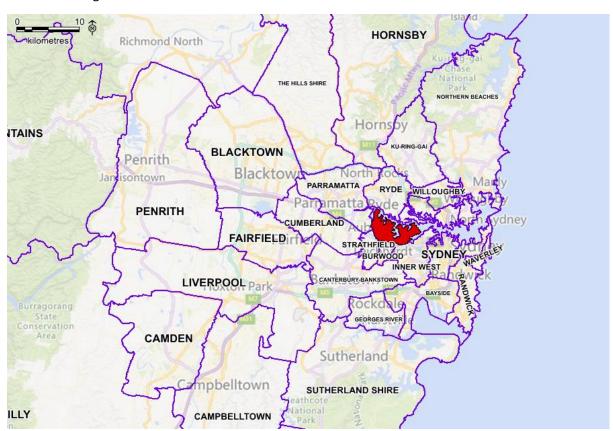


Figure 1 Canada Bay LGA (red) - regional context

The LGA has approximately 36.4 kilometres of foreshore and 3.6 kilometres of frontage to Powells Creek in the west and Iron Cove Creek in the east (**Figure 1**). The foreshore meanders around a series

of bays and coves, many of which have been modified through reclamation and construction of seawalls.



Figure 2 Foreshore and creek frontage

Foreshore Parramatta River & Port Hacking
Frontage Powells Creek
Frontage Iron Cove Creek

The LGA is underlain by a number of soil landscapes that largely determine the native vegetation communities that were, and will be, present (Figure 3).

Reserves and parks within the LGA largely fall on areas of mapped disturbed terrain (reclamation/fill) or four soil landscapes<sup>1</sup> (Table 1).

Table 1 Soil landscapes & parks & reserves

	Parks & Reserves
Landscape Name	Area m2
Disturbed Terrain	1,463,766
Blacktown	1,455,519
Lambert	307,572
Oxford Falls	203,223
Gymea	117,352
Water	1,220

**Blacktown Soil Landscape** The largest single soil landscape is the Blacktown landscape which is underlain by the Wianamatta Group Ashfield Shale and Bringelly Shale formations. Land is used for urban residential sites over much of this soil landscape and Sydney Turpentine-Ironbark Forest and Blue Gum High Forest, two communities that occur on this soil landscape, are critically endangered. It occurs extensively on the Cumberland Lowlands between the Georges and Parramatta Rivers in the south-west. Local topography is gently undulating rises on Wianamatta Shale with shallow to moderately deep yellow, Red and Brown Podzolic Soils - moderately reactive highly plastic subsoil with

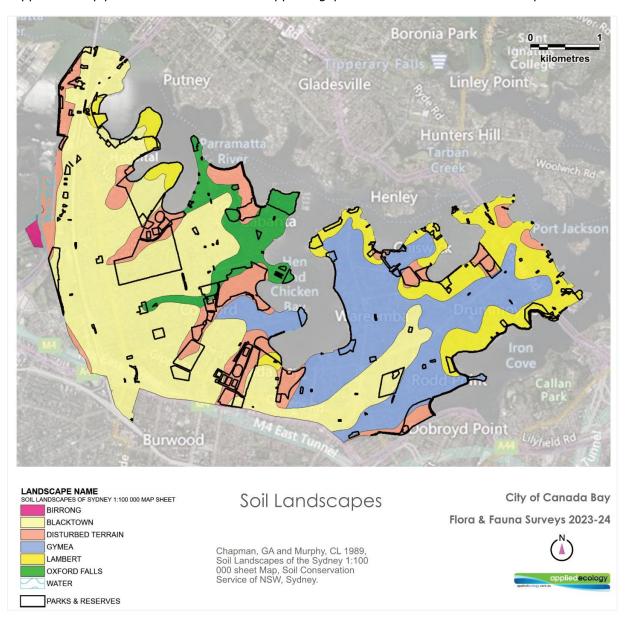
<sup>&</sup>lt;sup>1</sup> Chapman, GA and Murphy, CL 1989, Soil Landscapes of the Sydney 1:100 000 sheet Map, Soil Conservation Service of NSW, Sydney.

low soil fertility and poor soil drainage. Almost completely cleared through the Sydney Basin – previously tall open-forest (wet sclerophyll forest) and open-woodland (dry sclerophyll forest).

**Lambert Soil Landscape** Undulating to rolling rises and low hills on Hawkesbury Sandstone. Exposed plateau surfaces, convex ridges and coastal headlands with very high soil erosion hazard, rock outcrop, seasonally perched watertables, shallow, highly permeable soil, and very low soil fertility. Vegetation is typically heathlands and scrublands, often exposed to strong winds.

**Oxford Falls Soil Landscape** Hanging valleys on Hawkesbury Sandstone, very high soil erosion hazard with perched watertables and swamps, highly permeable soils, very low to low soil fertility, and localised rock outcrops. Considerable variation in vegetation occurs within this soil landscape depending on site drainage.

**Gymea Soil Landscape** — erosional, on Hawkesbury sandstone medium to coarse-grained quartz sandstone with minor shale and laminite lenses. The original dry sclerophyll woodland and open forest have been extensively cleared for residential development. Low, dry sclerophyll open woodland dominates ridges and upper slopes. On the more sheltered slopes, Black Ash *E. sieberi*, Sydney Peppermint *E. piperita* and Smooth-Barked Apple *Angophora costata* are common tree species.



The LGA contains 185 parks and reserves. Many are mixed use open space, such as spaces containing sports fields, shared paths, parkland and off leash dog areas. Council owns or manages the majority of these (Table 2).

The combined total area of parks and reserves is approximately 3.5km<sup>2</sup>, or approximately 18% of the LGA.

Table 2 Parks & Reserves tenure

Owner	Area m²
Council managed Crown Land	2 371 085
Private	560 907
Roads and Maritime	274
Council	91 786
Crown Land managed by Health Administration Corporation	162 200
Crown	362 400

The State Vegetation Type Map (2023) contains 0.63 km<sup>2</sup> of remnant native vegetation in the LGA, including mangroves that grow below the mean high tide mark at the LGA boundary (Table 3).

Table 3 SVTM - area of PCTs mapped in the LGA

PCT		
ID#	PCT name	Area m <sup>2</sup>
3262	Sydney Turpentine Ironbark Forest	184,022
4091	Grey Mangrove-River Mangrove Forest	273,207
4097	Samphire Saltmarsh	782
4028	Estuarine Swamp Oak Twig-rush Forest	8019

OEH vegetation mapping (Sydney Metro Area v3 2016) includes areas of revegetation and younger areas of natural or assisted regeneration, as well as street and park plantings. The latter are classed and mapped as *Urban exotic/native*. This map set also includes seagrasses that grow in many of the bays and coves just beyond the mangroves. The area and legal status of these communities are provided in Table 4 below.

Table 4 OEH 2016- area of mapped PCTs in the LGA

	PCT			
Map unit name	code	TEC NSW	TEC EPBC	Area m <sup>2</sup>
			Subtropical and	
			Temperate Coastal	
S_SW02: Estuarine Saltmarsh	1126	Coastal Saltmarsh	Saltmarsh (possible)	9,030
S_SW01: Estuarine Mangrove Forest	920			340,813
S_FoW08: Estuarine Swamp Oak Forest	1234	Swamp Oak Floodplain Forest		25,582
S_SW03: Seagrass Meadows	1913			41,024
S_WSF09: Sydney Turpentine-Ironbark		Sydney Turpentine Ironbark	Turpentine Ironbark	
Forest	1281	Forest	Forest (possible)	203,938
S_DSF04: Coastal Enriched Sandstone				
Dry Forest	1776			370

S_FoW05: Riverflat Paperbark Swamp		Swamp Sclerophyll Forest on	
Forest	1798	Coastal Floodplains	4,880
Urban_E/N: Urban Exotic/Native	N/A		1,137,276

A comparison of aerial photography from 1940, 1986, 2003 and 2021 is provided over the following pages () and establishes, that while much of the LGA was highly modified and developed by 1930, there has been a considerable loss of wetlands and formalization of waterways in the past 100 years. Large areas of reclamation occurred at Majors Bay, Exile Bay and Canada Bay. Cintra Park and St Lukes, for example, was a coastal wetland and mudflats where the creek braided through a wide mouth at its confluence with, a then, considerably larger Canada Bay. These areas of reclamation are illustrated in Figure 3 (soil landscape map) as disturbed terrain.

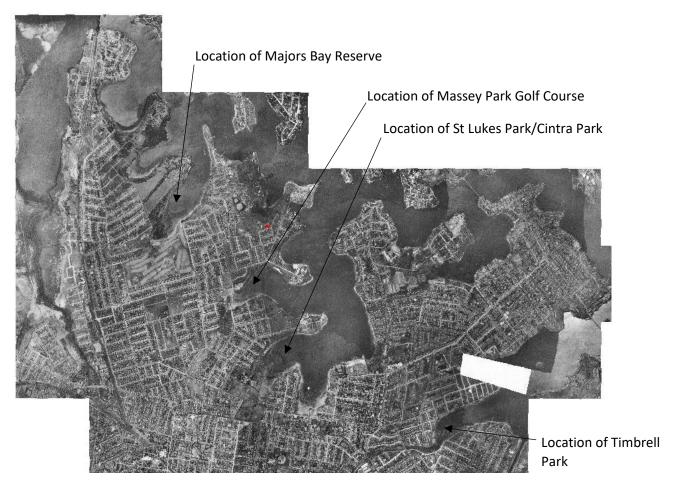


Figure 4 Aerial photography 1930 https://www.canadabay.nsw.gov.au/eservices/publicmappingservice

Other changes to note are the changes in location of commercial and heavy industry that were traditionally around the foreshore and changes to vegetation cover on private and public lands through the different decades. Between 1986 and 2004, for example, vegetation cover on private lands increased, with revegetation works on public lands becoming noticeable through the 2000s. Unsurprisingly, with increased housing density and larger houses, vegetation cover is now decreasing on privately owned lands.



Figure 5 Aerial imagery 1986



Figure 6 Aerial imagery 2004



Figure 7 Aerial photography 1930 vs 2021 https://www.canadabay.nsw.gov.au/eservices/publicmappingservice

Community groups have played an important role in preserving the remnant bushland in the LGA and improving its condition, with bushcare active and ongoing in many reserves (Image 1 & Image 2).



Image 1 Queen Elizabeth Park Bushcare group (with Doug Benson).



Image 2 Prince Edward Park Bushcare group

#### 2.1 Literature Review of Previous Studies

# 2.1.1 City of Canada Bay Fauna Survey 2002-2003 - Dion Hobcroft - Dion Hobcroft Natural History Service 2003

This study focused on both delivering an understanding of the current status of vertebrate fauna in the LGA and describing key habitats, the issues and pressures these habitats face and actions to conserve existing biodiversity values. Many of the recommendations are applicable in 2024. A checklist of fauna was developed for the LGA with observation notes for each family. The report drew upon the Bats of the Sydney Olympic Parklands, Homebush Bay written by Glenn Hoy as no microbat trapping or recording was undertaken. The report details observations and records of 86 bird, 11 mammals, 8 reptiles and 6 frog species.

# 2.1.2 The Fauna of City of Canada Bay Local Government Area: 2013-2014 - InSight Ecology

The study systematically surveyed the occurrence, relative abundance, species richness and habitat use of vertebrate terrestrial and aquatic avifauna present at 36 sites across the LGA in two consecutive seasons – spring 2013 and autumn 2014. Other fauna were recorded opportunistically during the bird surveys and records from local residents included in the inventory. The survey included Bicentennial Park within the LGA including the "Billabong" a known birding hotspot. For bird species, location co-ordinates, counts and notes are provided for each species for each sighting. For other classes the report draws on public databases, previous studies and records provided by local residents and volunteers.

# 2.1.3 Register of significant trees - Concord Council 2000

Trees were considered for inclusion in the register on the basis of one or more of the following Categories of Significance.

- a) Any tree of outstanding aesthetic significance;
- b) Any tree outstanding for its height, truck circumference, or canopy spread;

- c) Any tree which is particularly old or venerable (but not hazardous);
- d) Any tree commemorating or having associations with an important historic event or significantly associated with a well known public figure or ethnic group;
- e) Any tree which occurs in a unique location or context and so provides a contribution to the landscape, including remnant native vegetation, important landmarks and trees which form part of an historic garden, park or area.
- f) Any tree of species or variety that is rare or of very localised distribution;
- g) Any tree of horticultural or genetic value which could be an important source of propagating stock;
- h) Any tree which exhibits a curious growth form, and;
- i) Any stand or avenue of trees which is significant.

The trees may be indigenous or exotic, wild or cultivated.

Ironically this register also included mention of important indigenous vegetation including saltmarshes, sedges and mangroves, although it predominantly listed street tree plantings. It is likely that, 40+ years later, many of these are no longer present as recorded.

# 2.1.4 The Native Vegetation of Concord Municipality - Doug Benson Royal Botanic Gardens Sydney 1980

This is a short but interesting report by Doug Benson from the Royal Botanic Garden. He notes the occurrence of *Eucalyptus siderophloia* (Grey Ironbark, but not the much more commonly occurring Grey Ironbark – *E. paniculata*) with interest as it is 'a species normally found in dry areas around Wisemans Ferry and further north'. He considered it to be a potential range extension for the species as the specimen recorded was 'evidently an old, original tree'.

Most of the species listed by Benson were recorded in the current study, with the exception of *Daviesia ulicifolia, Pultenaea villosa*, and *Scirpus* [now *Bolboschoenus*] *fluviatilis*.

## 2.1.5 Survey of Birds in Concord Summer 1982-83 - Concord Council

This survey was undertaken by Council's environmental officer from November 1982 to March 1983. The report documents 136 species with notes on preferred habitats but there are no dates or locations of observations. For example for the Grey Shrike-thrush the author notes "Forests and mangroves but rare here now"

Observed trends are noted-some of which have changed and some which have not:

- Trend1- Large numbers of esturine birds including waders
- Trend 2- low diversity of native "ground and shrub" birds such as "honeyeaters and wrens"
- Trend 3- high numbers of introduced birds- pigeons, Common Mynas and Starlings, Sparrows etc
- Trend 4- moderate presence of raptors including Whistling Kites, Black-shoulder Kites, Nankeen kestrels and White-bellied Sea-eagles.

The report notes that removal of shrub and ground layer vegetation has favoured introduced species to the detriment of small birds in particular and that

# 2.1.6 City Of Canada Bay Estuary Vegetation Management Plan - Maunsell/AECOM in 2008

The Estuary VMP was prepared by Maunsell/AECOM in 2008. The VMP had several objectives:

- Provide an inventory of estuarine vegetation, and report on the condition of each estuarine vegetation community, within the LGA;
- Summarise the various statutory requirements that are applicable to management of these communities;
- Identify existing and potential future threats to these communities;
- Provide overarching management strategies and site specific management actions that can be implemented regardless of the current status and knowledge base of remnant estuarine vegetation occurring within the LGA; and
- Develop draft internal guidelines that can be used by Council staff, contractors and volunteers, which guide how day to day maintenance / operations, less frequent activities, and development activities should be implemented within the vegetated estuarine environment

They found that mangroves were the most commonly occurring estuarine vegetation community, and were observed to be spreading into areas of saltmarsh and to open mudflats, affecting areas used by waders for foraging. They also noted the reduced opportunities for landward migration for Estuarine Saltmarsh and for Estuarine Swamp Oak Forest, and some potential conflicts for management of different parts of the ecosystem. Of note, they reported an occurrence of *Wilsonia backhousei* in saltmarsh in Brays Bay, occurring as a single patch <10m2. This patch was not relocated during the current study and council staff report not being able to locate it in previous surveys up to 10 years ago.

# 2.1.7 City of Canada Bay Flora Inventory - Roger Lembit Gingra Ecological Surveys 2009

This flora inventory was collated by Gingra Ecological Services in 2002 and is reported to have involved a literature review and field surveys of Council reserves, public land and golf courses across the LGA. The results are summarised as follows:

- A total of 159 plant species were located across the city area. One Vulnerable species, listed
  in Schedule 2 of the Threatened Species Conservation Act, Wilsonia backhousei, and another
  fourteen species of conservation significance are recorded from the City area. An additional
  two significant saltmarsh species, Halosarcia pergranulata and Lampranthus tegens, are
  recorded from the Badu Wetlands close to the City area boundary.
- Remnants of the Endangered Ecological Community, Sydney Turpentine-Ironbark Forest occur within the City area. This community is listed in Part 3 of Schedule 1 of the Threatened Species Conservation Act.
- The remnants of Sydney Turpentine-Ironbark Forest in best condition are those at Dame
  Eadith Walker Reserve and Queen Elizabeth Park. Other remnants of interest include the
  Grey Ironbark trees and associated understorey plants at Five Dock Park and the trees and
  associated understorey plants at North Strathfield Public School and Concord Golf Course.

The species list was not provided with the report so a comparison could be made with the results of the current study. Of note, *Lampranthus tegens* was recorded at Quarantine Reserve but is now considered to be an introduced species (<u>PlantNET - FloraOnline (nsw.gov.au</u>)).

Brief descriptions of some of the key reserves were provided, and the general indication when compared to the current survey is that uncommon and regionally significant understorey species are also being lost from the LGA under current management practices, with losses primarily from areas outside the control of Council, including primary schools, golf courses and properties managed by NSW Health.

### 2.1.8 Flora And Fauna Assessment, Yaralla Estate - Narla 2023

This report was prepared by Narla Environmental in 2023 for NSW Health who manages the estate. There was no consultation with any staff at Council during preparation of Narla's report, causing inaccuracies between external and internal vegetation mapping, especially Yaralla Estate East, but also Yaralla Estate West (also known as Dame Eadith Walker Reserve).

They recorded 144 species of flora within the wider estate, of which 63 species are native to the area and 81 species are introduced, including 7 priority control weeds. The surveys included areas outside those incorporated into the current study, making a comparison difficult. However, the reported diversity is generally consistent with that recorded in the current study.

# 2.1.9 Parramatta River Catchment Ecological Health Project - CT Environmental 2016

This report was prepared by CT Environmental in 2016 and primarily focused on the five iconic species adopted by PRCG to underpin the adoption of actions to improve ecological health within the catchment. These five species are all fauna, utilising different parts of the catchment:

- Powerful Owl terrestrial domain
- Southern Myotis riparian domain
- Eastern Long-necked Turtle freshwater domain
- Striped Marsh Frog freshwater domain
- Bar-tailed Godwit estuarine domain

The report briefly discusses some of the ecological values of the catchment and then works through the rationale for the selection of the five iconic species.

#### 2.1.10 Canada Bay Biodiversity Framework and Action Plan – EcoLogical Australia 2019

The Biodiversity Framework and Action Plan was developed by EcoLogical Australia in 2019, and forms the basis for the current management of biodiversity in the LGA.

The plan's vision is that "Canada Bay is a community that values, protects, conserves and enhances natural areas and biodiversity in an urban and river foreshore environment". This Biodiversity Plan is designed to act as an overarching framework that sits within the City of Canada Bay's Community Strategic Plan. It is designed to allow future action plans to be created and implemented and help inform Plans of Management for Parks and Reserves. The structure of the document will allow this flexibility and provides the capacity to measure improvement to better target spending need based on conservation priority and feasibility.

The plan is based upon six interconnected themes: native vegetation, urban waterways and foreshores, corridors and connectivity, public spaces, urban habitat and green infrastructure. The plan states that the City of Canada Bay manages 245 hectares of public open space in 169 parks and has 47 hectares zoned environmental conservation.

The actions provided in the plan are in line with current best practices for management of native vegetation in an urban environment.

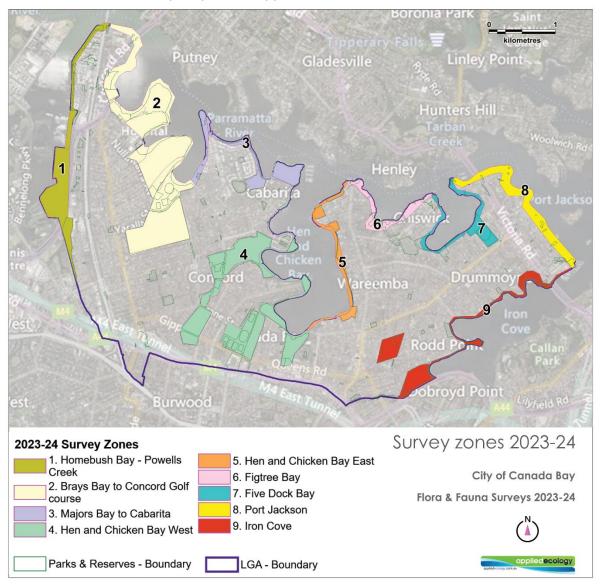
### 2.2 Review of Recommendations of Previous Studies

A review of recommendations in selected previous studies is provided in Appendix A Part B.

# 3 THE STUDY SITES

The named parks and reserves in the LGA were grouped into nine broad zones based on location, and these zones were further divided into 30 subzones for the purposes of some reporting results. The subzones were created to capture contiguous areas of vegetation that occur across reserve and/or tenure boundaries. It is useful to consider the reserves as part of a catchment where multiple reserves often form areas of linked open space, canopy

cover and revegetation areas. Differentiating between reserves, particularly smaller reserves, that form one area of bushland can be problematic on the ground and when undertaking a census of very mobile species, such as birds. Some valuable areas for flora and fauna occur outside named reserves, such as along continuous sections of foreshore, and it was important to capture these values.



Specific named reserves were deemed the most important to capture in the surveys and these are highlighted in bold in Table 5 along with other named reserves in each zone.

 $\textit{Table 5 Survey zones and named reserves and locations-with survey focus reserves in \textit{\textbf{bold}}$ 

Zone #	Zone name	Named reserve or location	
1	Homebush Bay - Powells Creek	Mill Park, Homebush Bay Corso, The Connection, Lewis Berger	
	Part A	Reserve	
	Part B	Powells Creek Reserve	
	Brays Bay to Concord Golf Course		
	Part A	Brays Bay Reserve, McIllwaine Park, Uhrs Point Reserve	
	Part B	Rhodes Park, Lovedale Place, Kokoda Track, Five Senses Park	
	Part C	"Rivendell"/Concord Hospital (Thomas Walker Estate)	
	Part D	Yaralla Bay south & bushland	
2	Part E	Yaralla House (Dame Eadith Walker Estate)	
	Part F	Arthur Walker Reserve, Yaralla House (east), Majors Bay Reserve (west)	
	Part G	Ron Routley Oval, Majors Bay Reserve, Majors Bay Reserve Synthetic Football Field, Sid Richards Park 1 & 2	
	Part H	Concord Golf Club	
	Majors Bay to Cabarita	Edwin Street Reserve, Northcote Street Reserve, Wangal Reserve,	
3	Part A	Younger Reserve, Waterfront Reserve, Northcote Street Park	
	Part B	Punt Park, Foreshore Walk, Breakfast Point, Waterfront Park	
	Part C	Cabarita Park, Kendall Bay	
	Hen and Chicken Bay West	Bayview Park, Durham Street Reserve, Prince Edward Park,	
	Part A	Roberts Road Garden	
	Part B	Massey Park Golf course, Edwards Park, Greenlees Park, Samuel Lee Place Garden, Sanders Reserve	
4	Part C	<b>Queen Elizabeth Park</b> , Goddard Park, Jesse Stewart Reserve, Rothwell Park	
	Part D	Cintra Park, St Luke's Park, Bowling Green, Cintra Hockey Complex at St Luke's, St Luke's North, St Luke's Oval, St Luke's 1, 2 & 3	
	Part E	Barnwell Park Golf Course, Charles Heath Reserve	
	Hen and Chicken Bay East		
E	Part A	Halliday Park, Friend Avenue Foreshore Reserve	
5	Part B	Wymston Parade Walkway	
	Part C	Henry Lawson Park, Quarantine Reserve, Battersea Park	
6	Fig Tree Bay	Fig Tree Bay Reserve, Wire Mill Park, Abbotsford Cove, Foreshore Park, Werrell Reserve, Armitage Reserve, Chiswick Steps, Marmion Lane Reserve, Abbotsford Cove Montrose Reserve	
_	Five Dock Poy	Blackwall Point Reserve, Chambers Reserve, Drummoyne Oval,	
7	Five Dock Bay	Drummoyne Park, Taplin Park, Howley Park, Lysaght Park, Raymond Avenue Reserve, The Esplanade Foreshore Reserve	
8	Port Jackson/Drummoyne East	Dunlop Reserve, Little Sisters of the Poor Reserve, Menzies Reserve, Pelican Reserve, Peppercorn Reserve, Queen Victoria Street Reserve, Red Cross Reserve, Utz Reserve, Wrights Point Reserve, Rea Reserve	
	Iron Cove		
9	Part A	<b>Bay Run</b> , Bridge Street Wharf Reserve, Cary Street Reserve	
		.,,,,,,,,,,,,,,	

Zone #	Zone name	Named reserve or location
	Part B	Brett Park
	Part C	Rodd Park
	Part D	Bay Run
	Part E	Timbrell Park
	Part F	Five Dock Park

# 3.1 Zone 1 Homebush Bay and Powells Creek

# 3.1.1 Mapped vegetation

One vegetation community is mapped as occurring in this zone and the adjacent estuarine environs. Lands below the mean high tide mark are managed by Transport for NSW, although by default these are often managed by Council where they adjoin Council owned and managed lands.

#### The community is:

 Estuarine Mangrove Forest – which is well established along the natural sections of Powells Creek.

Mapped vegetation communities for this zone are reviewed in Appendix A Section 10.1, noting that the extent and location of patches of mangroves is poorly mapped for this area and this report revises available mapping. Locations of reserves are provided at left.

### 3.1.2 Habitat overview

Habitat along Powells Creek acts as a buffer and supplementary habitat for wildlife that utilize better bush found in SOPA managed lands. The creek is a concrete trapezoidal drain upstream of a section of advanced regeneration and mature mangroves in Powells Creek Reserve. Traffic noise from Homebush Bay Drive degrades the value of this habitat where it crosses the creek. Plentiful weeds in the road corridor provide some habitat value for small birds. A small section of the channel, opposite Mason Park Wetland, has been 'naturalised' by Sydney Water in recent years. While marginal habitat, the channel provides supplementary habitat for birds that utilize Mason Park Wetland, including some that breed there, including Pied Stilts.



Figure 8 Zone 1 and reserves and parks



Image 3 Banks of Homebush bay are formalized at Rhodes with only marginal habitat values retained in the riparian zone- most of which occurs on reclaimed lands.



Image 4 Mature revegetation is a feature of Powells Creek Reserve and Lewis Berger Park (above).



Image 5 Banks of Powells Creek in the northern portion of Powells Creek Reserve are natural with a thick band of mangroves and advanced revegetation plantings at top of bank



Image 6 Large, mature mangroves line Powells Creek in the northern portion of Powells Creek Reserve



Image 7 Dense weeds proliferate along Homebush Bay Drive – but do provide habitat for small birds



Image 8 Upstream Powells Creek is concrete lined with native plantings (including saltmarsh) in sections of "naturalization"

# 3.2 Zone 2 Brays Bay to Concord Golf Couse

This zone includes a mix of Council managed reserves; large and important areas of open space and remnant bushland on the Rivendell and Yaralla peninsulas that are owned by NSW Health; and Concord Golf Club, a privately owned golf course. Most of these lands have frontage, or are connected to, Brays Bay, Yaralla Bay and Majors Bay in the suburbs of Rhodes and Concord West.

### 3.2.1 Mapped vegetation

Five vegetation communities are mapped as occurring in this zone and the adjacent estuarine environs. Lands below the mean high tide mark are managed by Transport for NSW, although by default these are often managed by Council where they adjoin Council owned and managed lands.

The communities are:

- Estuarine Mangrove Forest;
- Estuarine Swamp Oak Forest; and
- Estuarine Saltmarsh

which are restricted to foreshore areas and riparian zone and:

- Sydney Turpentine-Ironbark Forest; and
- Riverflat Paperbark Swamp Forest

found in disconnected patches in largely mown open space-largely on lands owned by NSW Health.

Mapped vegetation communities for this zone are reviewed in Appendix A Section 10.2, noting that the extent and location of patches of mangroves is poorly mapped for this area

and this report revises available mapping. Locations of reserves are provided below.

#### 3.2.2 Habitat overview

This zone contains the largest areas of remnant terrestrial vegetation and has the highest faunal diversity detected in this survey. Areas of mature weeds and exotic trees also provide resources for a range of fauna, including small birds associated with better bush, not observed elsewhere in the LGA.



Figure 9 Zone 2 – parks and reserves and other open space



Image 9 Constructed rock pools- foreshore McIllwaine Park, Rhodes.



Image 10 Mature Cabbage Palms line Kokoda Track Memorial Walkway



Image 11 Sydney Turpentine-Ironbark Forest patch at Rivendell with mown understorey



Image 12 Sydney Turpentine-Ironbark Forest patch at Yaralla Estate with more complex mid and understorey



Image 13 Majors Bay Reserve has fringing habitat, both estuarine and terrestrial. Some of the better habitat is very weedy at the boundary with Yaralla Estate



Image 14 Wetland/ freshwater habitat and advanced regen at Concord Golf Club.

# 3.3 Zone 3 Majors Bay to Cabarita

This zone includes a number of small reserves and estuarine communities on the eastern side of Majors Bay, the foreshore walk along the Parramatta River between Majors Bay and Kendall Bay, and Cabarita Park. Much of the area was formerly owned by Mortlake Gas Works of the Australian Gaslight Company (AGL). AGL began developing the site in 1883. The Mortlake Gasworks site offered river access for colliers to bring coal and virtually unlimited space for expansion<sup>2</sup>. The gas works remained in operation until the 1990s.

## 3.3.1 Mapped vegetation

Two vegetation communities are mapped as occurring in the zone:

- Estuarine Mangrove Forest; and
- Estuarine Saltmarsh

Located in small pockets at Kendall Bay, Cabarita Park and Majors Bay. Large areas of wetlands were infilled at Breakfast Point along the southern side of Kendall Bay, and the soils are highly altered through this suburb.

Mapped vegetation communities for this zone are reviewed in Appendix A Section 10.3, and this report revises available vegetation mapping. Locations of reserves are provided overleaf.

#### 3.3.2 Habitat overview

This zone provides excellent access to the foreshore for people with formalized walking paths, lighting at night and multiple access nodes and parks of varying sizes. The foreshore is largely formalized with seawalls and canopy plantings are scarce to maintain water views. This amenity and high levels of usage, along with past land uses, has greatly diminished the habitat value of the zone for flora and fauna. Mature (planted) trees in Cabarita Park have habitat value for some fauna species, but the understorey is mown throughout this reserve.

25

<sup>&</sup>lt;sup>2</sup> Broomham, R. 1986, Mortlake 1886-1986, AGL Pty. Ltd



Figure 10 Zone 3 – parks and reserves and other open space



Image 15 Wangal Park-a small park with mature revegetation and simplified understorey with good access to foreshore



Image 16 Looking west to Wangal Park from the Foreshore Walk- the beach and point are popular with dog walkers which reduces value for water birds.



Image 17 Foreshore Walk – looking east. Low mixed native planting provide unimpeded water views but have limited habitat value



Image 18 Kendall Bay – breakwall and beach provide roosting habitat for waterbirds away from dogs and walkers as there is no formal access to this beach



Image 19 Western Foreshore of Kendall Bay (at Cabarita Park) looking west across the Foreshore Walk to Breakfast Point



Image 20 Foreshore- Cabarita Park



Image 21 Mature trees with mown understorey – Cabarita Park

# 3.4 Zone 4 Hen and Chicken Bay west

This zone contains parks and reserves with frontage to the western shores of Hen and Chicken Bay and parks with connectively via open space to the south. These latter reserves occur along old drainage lines that have been piped in the upper reaches and formalized into concrete lined channels in lower reaches. They discharge to the larger bay via small named bays – Exile Bay at Massey Golf Club, via Cintra canal at Canada Bay, and through Barnwell Park Golf Course to Kings Bay.

# 3.4.1 Mapped vegetation

Five vegetation communities are mapped as occurring in this zone and the adjacent estuarine area. Lands below the mean high tide mark are managed by Transport for NSW, although by default these are often managed by Council where they adjoin Council owned and managed lands.

The communities are:

Seagrass Meadows

in France Bay and the southern shore of Exile Bay,

- Estuarine Mangrove Forest; and
- Estuarine Saltmarsh

in patches largely around Prince Edward Park, and

 Sydney Turpentine-Ironbark Forest;

found in Queen Elizabeth Park.

Mapped vegetation communities for this zone are reviewed in Appendix A Section 10.4, noting that the extent and location of patches of estuarine communities is poorly mapped for this area. This report revises available mapping. Locations of reserves are provided at right.



Figure 11 Zone 3 – parks and reserves and other open space

#### 3.4.2 Habitat overview

The foreshore has been modified with seawalls, however, some are well above the mean high tide mark, such as near Prince Edward Park where extensive sandy mud flats and rock are exposed during low tides. Advanced regeneration plantings occur on reclaimed wetlands at Massey Golf course, St

Lukes and Barnwell Park Golf Club. Queen Elizabeth Park contains remnant bushland in good condition with intact mid and understorey, however, the park is largely disconnected from other areas of bushland.



Image 22 Mature plantings and open space in Prince Edward Park provides habitat for a small suite of urban adapted birds that are resident most of the time



Image 23 Casuarinas line the foreshore walk with some saltmarsh species in the high intertidal zone at Prince Edward Park. The rocky foreshore gives way to mudflats that are utilized by waterbirds, particularly at low tides.



Image 24 Massey Golf Fairways are lined with mature revegetation plantings- canopy only. This provides habitat for a small suite of urban adapted birds that are resident most of the time

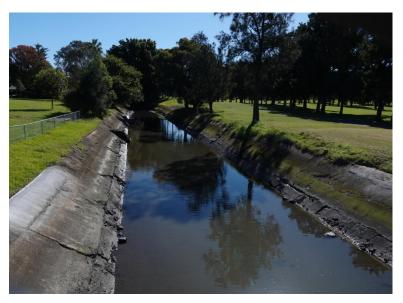


Image 25 Canal through Massey Golf Course- despite being formalize provides habitat for water birds, fish and the Australian Wood Ducks that frequent the course. The canal discharges to Exile Bay.



Image 26 Spotted gums lining the main path through Queen Elizabeth Park



Image 27 Structural complexity is a feature or the vegetation at Queen Elizabeth Park



 ${\it Image~28~Remnant~Sydney~Turpentines~are~a~highlight~of~the~vegetation~community~at~Queen~Elizabeth~Park}$ 



Image 29 Barnwell Park Golf Course fairways are lined with mature revegetation plantings- canopy only. This provides habitat for a small suite of urban adapted birds that are resident most of the time. The canal discharges to Kings Bay.



Image 30 Mature reveg planting-of Casuarinas, Melaleucas and Spotted gums line Cintra Channel-Cintra Park, Concord.



Image 31 Dense stands of Casuarina line Cintra Channel at St Lukes/Cintra Park. The canal discharges to Canada Bay.

# 3.5 Zone 5 Hen and Chicken Bay east

This zone contains parks and reserves, mudflats and foreshore areas of the western side of Hen and Chicken Bay.

# 3.5.1 Mapped vegetation

Three vegetation communities are mapped as occurring in this zone and the adjacent estuarine environs. Lands below the mean high tide mark are managed by RMS, although by default these are often managed by Council where they adjoin Council owned and managed lands. The communities are:

#### Seagrass Meadows

which occurs along much of the foreshore at Wymston Parade Walkway and Halliday Park, and also just north of Battersea Park,

# Estuarine Mangrove Forest

that occurs in good stands at Halliday Park and Quarantine Reserve with small patches near Henry Lawson park, and

Coastal Enriched Sandstone Dry Forest

Is mapped as occurring in a single patch in Henry Lawson Park.

Mapped vegetation communities for this zone are reviewed in Appendix A Section 10.5, noting that the extent and location of patches of mangroves and saltmarsh is poorly mapped for this area and this report revises available mapping. Locations of reserves are provided at right.



Figure 12 Zone 5 – parks and reserves and other open space

#### 3.5.2 Habitat overview

The most important habitat for fauna in this zone is the extensive mud flats that are exposed at low tides along the foreshore. These mudflats are important habitat for local shorebirds and waterbirds as well as migratory shorebirds. There is less fill (historic) on this side of the bay and pockets of good vegetation occur on largely natural soils in Henry Lawson Park and Quarantine Bay.



Image 32 Halliday Park is largely mown open space with a dense stand of mangroves lining the foreshore below the seawall. Mudflats here are contiguous with the mudflats that stretch to Henry Lawson Park in the north – all important wader and waterbird habitat



Image 33 Looking south and west from Wymston Parade foreshore to the mangroves at Halliday Park



Image 34 Looking north from near Halliday Park along the Wymston Parade foreshore mudflats- all important wader and waterbird habitat



Image 35 Wymston Parade Foreshore northern extent – note saltmarsh below low seawall



Image 36 Large trees and a dense midstorey at Henry Lawson Park provide deep shade for birds on hot days.



Image 37 The beach at Henry Lawson Park is utilized by a variety of waders and other water birds



Image 38 Quarantine Reserve Is a mix of treed grass open space and areas of more complex vegetation, rock outcrops and rocky and sand foreshore.



Image 39 Quarantine Reserve has a largely natural shoreline and is one of the few locations in the eastern part of the LGA that has woody debris along the shoreline – a favoured roosting spot for water birds.

## 3.6 Zone 6 Figtree Bay

This zone contains parks and reserves with frontage to Parramatta River and Figtree Bay from Abbotsford wharf to Chiswick wharf.

## 3.6.1 Mapped vegetation

No natural vegetation is mapped for this zone with advanced revegetation plantings in parks and reserves and some (potential) remnant vegetation. Vegetation in this is reviewed in Appendix A Section 10.6.

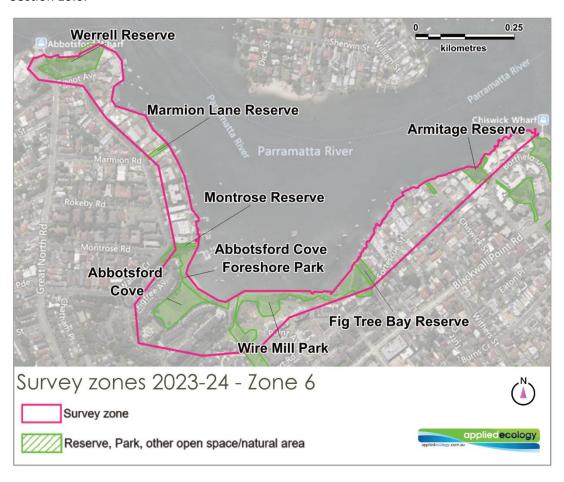


Figure 13 Zone 6 – parks and reserves and other open space

## 3.6.2 Habitat overview

The reserves and parks in this zone are located in elevated positions with steep frontages to the bay and river (eg Werrell Reserve) and/or on reclaimed lands below rocky bluffs with very steep areas of exposed rock between park upper and lower sections. These rocky areas provide good habitat for reptiles and areas of native vegetation persist. Mature street trees and private gardens in older dwellings provide good habitat in parts of this zone.



Image 40 Exposed rock outcrops at Figtree Bay Reserve



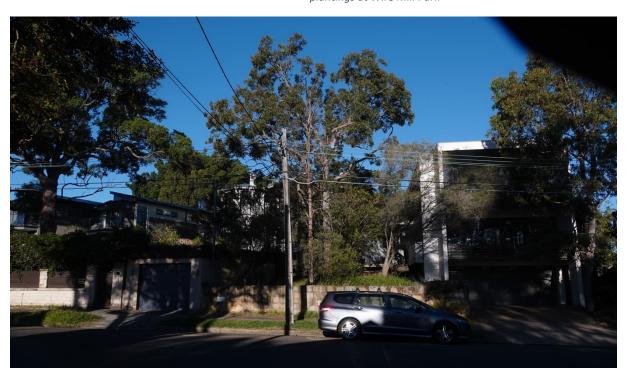
Image 41 Looking west from Figtree Bay Reserve to Wire Mill Park rocky foreshore



Image 42 Exposed rock outcrops at Wire Mill Park



Image 43 Exposed rock outcrops and advanced regeneration plantings at Wire Mill Park



 ${\it Image~44~Mature~eucalypts~on~private~property~opposite~Figtree~Bay~Reserve.}$ 

### 3.7 Zone 7 Five Dock Bay

This zone contains parks and reserves with frontage to Five Dock Bay from Chiswick Wharf to Howley Park.

### 3.7.1 Mapped vegetation

Two vegetation communities are mapped as occurring in this zone and the adjacent estuarine environs. Lands below the mean high tide mark are managed by RMS, although by default these are often managed by Council where they adjoin Council owned and managed lands. The communities are:

### Seagrass Meadows

Which occurs along in the bay from Raymond Avenue Reserve to Russell Park.

#### Estuarine Mangrove Forest

Which occurs in isolated patches on the foreshore off The Esplanade. Mapped vegetation communities for this zone are reviewed in Appendix A Section 10.7.



Figure 14 Zone 7– parks and reserves and other open space (right)

#### 3.7.2 Habitat overview

The reserves at the heads of the bay are elevated on rocky bluffs with very steep areas of exposed rock down to the river. Parks inside the bay are primarily sporting fields on reclaimed lands with few trees or other natural features. Drummoyne Park nearer Lyons Road is elevated and largely on natural soils with large mature trees and some areas of exposed rock. All parks are maintained without understorey. The foreshore is largely protected by seawalls with mangroves established on sediments below the seawall. Small areas of mud flats provide habitat for seabirds and waders.



Image 45 Planted natives (left) and baths and open space (right) – Chambers Reserve, Chiswick





Image 46 Mature trees on steep banks at Blackwall Point Reserve

Image 47 Mature trees and rock outcrop at Drummoyne Park



Image 48 Mudflats at Five Dock Bay are utilised by a variety of waders and seabirds

## 3.8 Zone 8 Drummoyne East

This zone was not included in detailed surveys. The zone contains the foreshore and a series of small parks and reserves with frontage to the river in the north and Port Jackson in the east.

The zone is wholly within the suburb of Drummoyne.

## 3.8.1 Mapped vegetation

One small patch of one vegetation community is mapped in this zone:

Seagrass Meadows

Which occurs just north of Drummoyne Sailing Club.

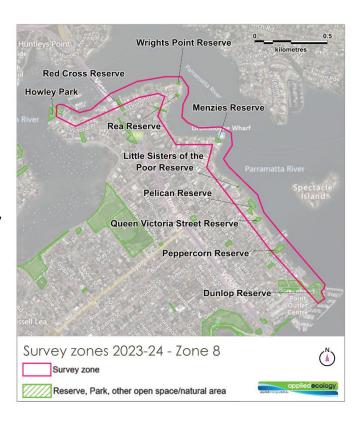


Figure 15 Zone 8– parks and reserves and other open space

#### 3.8.2 Habitat overview

Parks and reserves typically contain some reclaimed land along the foreshore - many with mature trees fringing mown open space. The parks are used for passive recreation with beach areas popular with dog walkers.



Image 49 Peppercorn Reserve includes reclaimed lands with seawall, mown open space, and user seating and picnic tables.



Image 50 Mature reveg planting and a small beach are a feature of Salton Reserve



Image 51 The foreshore to Port Jackson is highly developed and largely in private ownership in this zone - with a mix of seawalls and private jetties dominating the foreshore between Wrights Point and Birkenhead Point. Sandy beaches at Salton Reserve and Pelican/Queen Victoria Reserve are popular with dog walkers



Image 52 Mature reveg planting at Peppercorn Reserve are fairly isolated in the suburban matrix



Image 53 Mature reveg plantings at Saltram Reserve/Dunlop Reserve



Image 54 Reclaimed land forms an excellent viewing point across Port Jackson to Cockatoo, Snapper and Spectacle Islands – Peppercorn Reserve

#### 3.9 Zone 9 Iron Cove

This zone contains parks and reserves with frontage to Iron Cove, including the Bay Run, from Dunlop Park in Drummoyne to Timbrell Park, Five Dock.

## 3.9.1 Mapped vegetation

Four vegetation communities are mapped as occurring in this zone and the adjacent estuarine environs. Lands below the mean high tide mark are managed by RMS, although by default these are often managed by Council where they adjoin Council owned and managed lands. The communities are:

Seagrass Meadows

is mapped adjacent to, approximately, 50% of the foreshore,

• Estuarine Mangrove Forest

occurs in disjunct patches of varying sizes with good patches at Sisters Bay and Half Moon Bay,

• Estuarine Saltmarsh

That occurs in small narrow disjunct patches along the foreshore, and

Estuarine Swamp Oak Forest

is mapped as present upslope of Sisters Bay. Mapped vegetation communities for this zone are reviewed in Appendix A Section 10.8



Figure 16 Zone 9– parks and reserves and other open space

#### 3.9.2 Habitat overview

The Bay Run is a 7km circuit around Iron Cove that hugs the shoreline along Drummoyne and Five Dock before crossing over into the Inner West Council Local Government Area. This is a high use area with a wide shared path, lighting and multiple access nodes reducing the value. Natural foreshore areas occur at Sisters Bay, Half Moon Bay and Rodd Park- with sandy beached and rocky outcropping used by a variety of fauna. The foreshore is largely protected by seawalls with mangroves established on sediments below the seawall. Small areas of mud flats provide habitat for seabirds and waders. The larger parks, Five Dock Park, Brett Park, and Timbrell Park have mature revegetation rather than remnant vegetation and are mixed use destinations - organized sport and passive recreation.



Image 55 Litter trap (GPT) at Iron Cove Creek provides perching opportunities for water birds- natural snags are very rare in the eastern part of the LGA



Image 56 Sisters Bay has a wide band of large mature mangroves below steep rocky outcrops below Hemley Marine Drive.



Image 57 Rodd Point has a largely natural foreshore with sections of rock and sand. It is a very high use park which would otherwise be a very good high tide roost.



Image 58 Five Dock Park is predominantly treed open space. This provides habitat for a small suite of urban adapted birds that are resident most of the time.



Image 59 The Bay run at Rodd Point (looking south to Timbrell Park) is largely vegetated with grasses and small patches of trees above the seawall. Below the seawall Mangroves are well established in many spots with narrow mudflats beyond at low tide.



Image 60 Saltmarsh and mangroves below the seawall along the The Bay (looking north towards Half Moon Bay)



Image 61 The Bay Run with Sisters Bay on the left and Brett Park on the right- mature trees provide deep shade which is of increasing importance for fauna during periods of high temperatures



Image 62 Brett Park has a high diversity of native plants-including shrub and ground covers.

## 4 FAUNA METHODOLOGY

The methodology was devised by Council to be robust and repeatable. The following sections outline the techniques that were used in conjunction with ad hoc observations collected while traversing the study sites.

## 4.1 Camera trapping

Remote cameras were deployed in a subset of parks and reserves, often in a variety of locations. Areas of good habitat were targeted in an effort to maximise the species detected. Baiting stations were set up at most camera sites to attract animals into the field of view of the camera. Universal bait (peanut butter, honey & rolled oats) in a PVC canister were used. Baits were deployed up trees, on the ground, and (where Black Rats *Rattus rattus* were an issue) hung by a wire from an appropriate height. Many cameras were left in the same location for many weeks with cameras and bait cannisters serviced every two weeks.

Survey effort is summarised in Table 2; by zone in Table 3 below; and location in Figure 17 overleaf.

Table 6 Camera trapping survey effort

LOCATIONS	TARGET NIGHTS	TOTAL NIGHTS
14	160	790

Table 7 Camera trapping survey effort by location

Area		Days
#	Zone	deployed
	Homebush Bay - Powells	
1	Creek	77
	Brays Bay to Concord	
2	Golf Course	210
	Majors Bay (east) to	
3	Cabarita	0
	Hen and Chicken Bay	
4	West	193
	Hen and Chicken Bay	
5	East	68
6	Fig Tree Bay	57
7	Five Dock Bay	62
8	Port Jackson	0
9	Iron Cove	123
	Total camera days	790

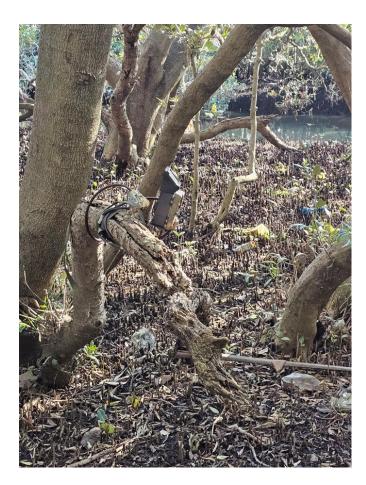


Image 63 Solar powered camera with battery backup at Powells Creek - one of several types of cameras used during the project. Target species here was Rakali.

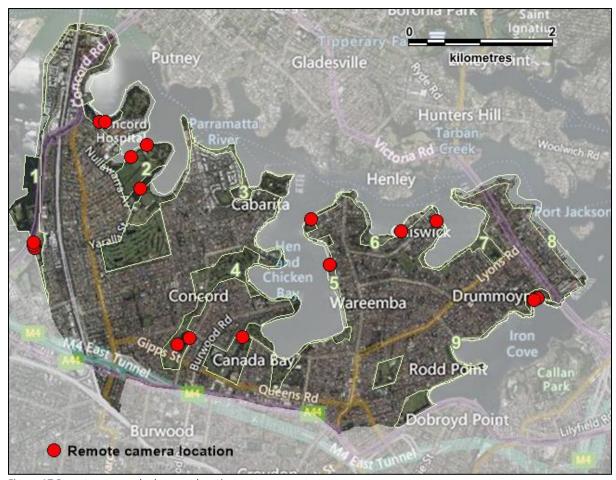


Figure 17 Remote camera deployment locations

## 4.2 Spotlighting Survey

Spotlighting was undertaken for all terrestrial and arboreal mammals, amphibians and nocturnal birds within the study area. Spotlighting was undertaken using 1000 lumen hand held spotlights which were used to sweep surrounding vegetation in search of eye-shine or animal movements. A Hikmicro thermal scope was used to sweep the foreshore for Rakali. Time was spent listening for calls at 10 minute intervals for 1 minute. All fauna species heard or observed during spotlighting meanders were recorded. The aim was to undertake spotlighting at least twice per key area. Time spent in each reserve/corridor spotlighting was dependent on habitat complexity and the likelihood of finding additional species once a core set of species was observed. Zone 8, for example, was not spotlighted due to small reserve size and proximity of housing. Care was taken not to spotlight foreshore areas where roosting waders or other water birds would be disturbed. Key dates for spotlighting are provided below in Table 8.

Table 8 Spotlighting effort and key dates

Named Reserve/area	Date			
Arthur Walker	12/12/2023	9/01/23	28/02/24	
Brett Park and Sisters Bay	7/12/2023			
Cabarita, Prince Edward, Foreshore walk	23/04/24	14/05/24		
Cintra Park, St Lukes	7/02/23	17/04/24		
Concord Oval	10/02/23			

Figtree Park, Wire Mill, Werrel Reserve	8/12/2023			
Five Dock Park	15/12/23			
Halliday Park	28/12/23			
Henry Lawson Park	28/12/23			
Kokoda Track/Lovedale Place	9/01/23	28/02/24		
Lewis Berger Park	14/05/24			
Majors Bay	12/12/2023	9/01/23	28/02/24	
McIllwaine Park	9/01/23	28/02/24		
Mortlake Point/Wangal - Shaw Reserve				
and foreshore	12/12/2023	14/05/24		
Powells Creek	28/02/24			
Quarantine Bay	28/12/23			
Queen Elizabeth Park	28/12/23	7/02/23	23/04/24	
Rhodes Park	28/02/24			
Rivendell	9/01/23	29/01/23	21/03/24	
Rodd Park/Bay run	15/12/23	7/02/23		
The Corso	28/02/24	14/05/24		
Timbrell Park	15/12/23	13/02/24		
Yaralla Estate	11/12/2023	9/01/23	29/01/23	21/03/24

### 4.3 Remote recording

Two types of recording devices were deployed to sample different classes of fauna. Birds hear ca. 50 Hz to ca. 12 kHz, max sensitivity 1-5 kHz, frogs <200 Hz to ca. 4 kHz, and bat echolocation in search mode ca. 10 –>160 kHz<sup>3</sup>. The latter were sampled with Anabat Express© units and the former with a Wildlife Acoustics Songmeters©.

### 4.3.1 Bat ultrasonic (Anabat) call recording

The method requires the recording and identification of high frequency, echolocation calls made by bats, which, except for one or two species, are ultrasonic, that is, inaudible to humans. The recording equipment consisted of Anabat Express® units. These were generally positioned in a fixed location for 5-10 nights. Location for deployment needed to be discrete to avoid tampering and theft, but also clear enough that units would not pick up interference from vegetation in and around the microphone. Units were often deployed in or near the intertidal area. All zones, except zone 8 (Port Jackson) were sampled several times in different locations (Figure 20).

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<sup>&</sup>lt;sup>3</sup> Allan Burbidge (2016) Use of sound recording devices in wildlife survey, Dept of Parks and Wildlife WA. www.eianz.org



Microbat call identification is a specialised process. Anabat recordings were transferred onto computer and sent to Margaret Turton (a specialist in this field) for analysis. Identifications are designated as either: definite, probable or possible, following the methodology of Parnaby (1992). Recordings are assessed visually and compared to reference libraries of calls taken in the Sydney basin (*Figure 19*)

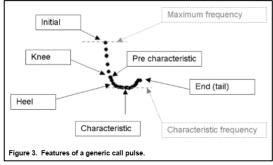


Figure 18 Characteristics of a call used to identify species (Pennay et al 2004).

Image 64 Express bat detector in mangroves off Lovedale Place (Brays Bay)

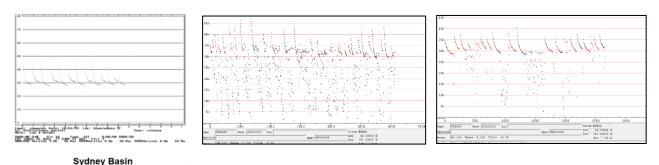


Figure 19 Reference call (left) for Gould's Wattled Bat and raw calls (centre and right) as downloaded from the anabat express units of the same species. Cascading "dots" in the raw calls are likely insect noise.

Calls that are considered not clear enough for ID are not identified - this includes very short calls that consist of just a few pulses. For this study, "possible" identifications were eliminated unless recorded nearby by this study, and the few "probable" identifications were treated as "confident" since, in most cases, the same species was recorded elsewhere in the zone or or in zone nearby.

Analysis was limited to identification of species present. The number of calls does not represent the number of bats present as a single bat may make numerous passes in front of the detector.

The number of calls may give an indication of the level of microbat activity in the area – more calls can indicate the location is used more frequently by microbats. During this survey, at some locations, the bat detectors deployed recorded no calls. Bat detectors and song meters were often deployed in the same locations. Locations, sessions and survey dates are provided in Table 10.

Table 9 Bat ultrasonic recording survey effort

LOCATIONS	TARGET NIGHTS	TOTAL NIGHTS
19	60	151

Table 10 Anabat express © locations and effort

Location	Date out	Date in	Date out	Date in	Nights
Arthur Walker/Yaralla Estate	11/12/2023	16/12/2023	15/05/2024	23/05/2024	13
Yaralla Estate (east)	29/01/2024	7/02/2024			9
Battersea Park	28/02/2024	2/03/2024			3
Blackwall Park	28/02/2024	2/03/2024			3
Cabarita Park	17/04/2024	23/04/2024			6
Chambers Reserve	24/01/2024	29/01/2024			5
Cintra Park/Canal	11/12/2023	16/12/2023			5
Figtree Bay	7/12/2023	11/12/2023	29/01/2024	7/02/2024	13
Kendall Bay	17/04/2024	23/04/2024			6
Lovedale Place & Brays Bay	2/01/2024	7/01/2024	21/03/2024	27/03/2024	11
Prince Edward Park	7/12/2023	11/12/2023			4
Quarantine Reserve	24/01/2024	29/01/2024			5
Queen Elizabeth Park	24/01/2024	29/01/2024	11/12/2023	16/12/2023	10
Rhodes/Lewis Berger	11/12/2023	16/12/2023	15/05/2024	23/05/2024	13
Powells Creek	28/02/2024	2/03/2024			3
Sisters Bay	2/01/2024	7/01/2024			5
Timbrell Park	16/12/2023	28/12/2023	10/04/2024	17/04/2024	19
Werrell Reserve	21/12/2023	28/12/2023			7
Wymston Parade foreshore	7/12/2023	11/12/2023	21/12/2023	28/12/2023	11



Figure 20 Bat detector/ultrasonic recording unit deployment locations

## 4.3.2 Acoustic recording

An acoustic recorder was deployed to record frog calls and nocturnal birds and incidentally mammals (Figure 21). Dawn chorus was also analysed and diurnal bird species added to the inventory if not already recorded. Wildlife Acoustics Song Meters© were set to sample 1 minute in every 5 minutes. The units began recording 30 minutes before dusk until 30 minutes after dawn. Recordings were visually analysed using Wildlife acoustics Kaleidoscope© software (Figure 22).

Summary of survey effort is provided in Table 11. Locations are provided in Figure 18 and timing and duration of surveys in named reserves/locations listed in Table 12.

Figure 21 (right) Song Meter at Lewis Berger Park (Zone 1)

Table 11 Acoustic recording survey effort





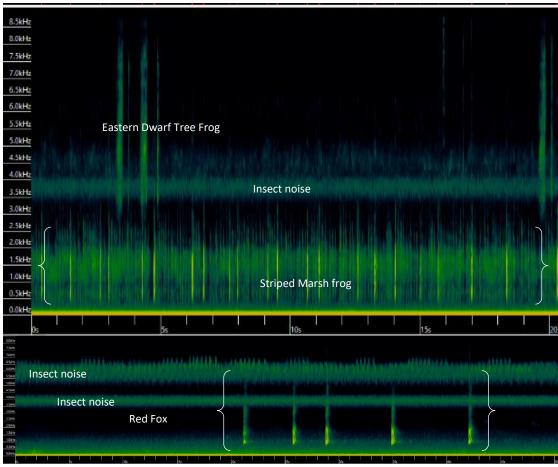


Figure 22 Frog calls from Concord Golf Course (top); and Red Fox at Yaralla (bottom) as viewed as a spectrogram

Table 12 Song meter© location and effort

Location	Date out	Date in	Date out	Date in	Nights
Arthur Walker/Yaralla Estate	11/12/2023	16/12/2023			5
Yaralla Estate (west)	29/01/2024	7/02/2024			9
Concord Golf Club (at fence line)	13/02/2024	27/02/2024			14
Blackwall Park	28/02/2024	2/03/2024			3
Chambers Reserve	24/01/2024	29/01/2024			5
Cintra Park/Canal	11/12/2023	16/12/2023			5
Figtree Bay	7/12/2023	11/12/2023			4
Kendall Bay	17/04/2024	23/04/2024			6
Lovedale Place/Brays Bay	2/01/2024	7/01/2024	21/03/2024	27/03/2024	11
Prince Edward	7/12/2023	11/12/2023			4
Quarantine Reserve	24/01/2024	29/01/2024			5
Queen Elizabeth	11/12/2023	16/12/2023	24/01/2024	29/01/2024	10
Rhodes/Lewis Berger	15/05/2024	23/05/2024			8
Rhodes run	11/12/2023	16/12/2023			5
Sisters Bay	7/12/2023	11/12/2023	21/12/2023	28/12/2023	11
Timbrell Park	16/12/2023	28/12/2023	10/04/2024	17/04/2024	19
Werrell Reserve	21/12/2023	28/12/2023			7
Wymston Parade foreshore	21/12/2023	28/12/2023			7

#### 4.4 Diurnal Bird Census

Bird surveys were both targeted and opportunistic. A total of 152 bird inventories were completed. Inventories consisted of 20 minute (+10 minute) or 2 ha surveys designed to capture peak activity (dawn chorus, morning, and late afternoon, low tides) were undertaken in core reserves/areas in each zone at least once per month and seasonally in parks where diversity was expected to be low due to lack of suitable habitat. All surveys were for a minimum of 20 minutes but were extended until there were no new species detected for 10 minutes (ie after the first 10 minutes of surveys). Thus, some surveys were completed in 20 minutes while other surveys took up to 60 minutes to complete. Location of birds (eg flying above or through, roosting etc) within the site, abundance (counts of individuals) and behaviours breeding were noted. In reality in large open space areas, such as Yaralla Estate, more than 2 ha contributes to each site. This occurs where the observer can see for some distance and when observers walk towards species sighted or heard to confirm identification and to count the number of individuals present. The inventory also includes species observed when walking

within a reserve to the survey site. For many of the reserves and parks the foreshore habitats contributes a good proportion of avian diversity and most surveys included surveying the foreshore and any mangroves as well as terrestrial vegetation and any open space. Individuals were counted exactly, or estimated to the nearest 5, 10, 20 or 50. For example, a social group of Superb Fairy-wrens can be hard to count so an estimate of numbers was rounded to the nearest 5. For some species in one location such as Noisy Miners a maximum of "20" was recorded for any given survey despite the likelihood of higher local abundance. Only species flying within the canopy, roosting or actively hawking/foraging were recorded (examples of active hawking includes raptors, martins etc). Any species observed during other survey activities and during general traverses of the site were also recorded. In many sites the species on the river could have been recorded for multiple reserves. For the purpose of this survey the species was recorded from the location of the observation. Location and survey dates are tabled in Section 12 APPENDIX C – Bird survey dates.



Image 65 A scope and or binoculars were used to survey around the edge of bays at low tide- here at Wymston Parade foreshore south to Halliday Park and Kings Bay

### 4.5 Reptile and Amphibian Searches

Reptiles and amphibians were surveyed within the study area by diurnal searches in key sites and opportunistic sightings were also recorded. Ad hoc reptile searches were undertaken in conjunction with bird surveys. Searches involved scanning tree trunks for arboreal skinks, turning logs and rocks and using a handheld torch to search crevices in sandstone.



Image 66 Eastern Water Skink Eulamprus quoyii – sheltering in a log at Yaralla Estate

## 4.6 Hair tubing

Hair-tubes are a remote sampling technique that can detect mammals by attracting them to an open cylinder containing a food bait held within a closed chamber. Fur from mammals that enter a hair-tube adheres to double-sided tape that is fixed to the inside of the device. Hair samples are then analysed in a laboratory to identify the species. For this project Georgeanna Story of Scatsabout laboratory undertook hair and scat analysis.





Image 67 Hair tube deployed in the seawall just south of Prince Edward Park, Cabarita (right), and hair sample (left).

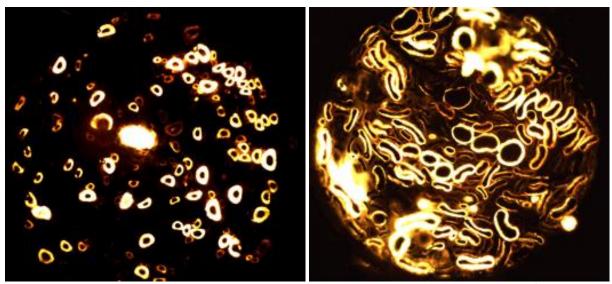


Figure 23 Cross section of hair samples showing different configuration of cells that are diagnostic for genus / species (Common Brushtail Possum and Bush Rat illustrated). Images supplied by Georgeanna Story.

Hair tubes were deployed in foreshore locations targeting Rakali. Locations are depicted in Figure 24 and effort detailed in Table 13.

Table 13 Hairtube sampling - survey effort

LOCATIONS	TARGET NIGHTS	TOTAL NIGHTS
11	200	219



Figure 24 Hairtube locations

### 4.7 Nocturnal Frog Searches

During the evening calling frogs were identified on the basis of their characteristic calls. Spotlighting traverses along drainage lines within the study zones were undertaken with the objective of detecting calling or active frogs. See section 4.2 for spotlighting survey effort across the reserves/zones.

#### 4.8 Searches for Evidence

Scats were collected when encountered during any of the survey activities. Systematic surveys for scats were not undertaken. Scats were placed in brown paper bags and stored in an airtight container prior to delivery to "Scatsabout" a company specialising in the field of hair and scat analysis. During these walks characteristic signs, tracks, and scats and other indirect evidence of fauna species from all fauna groups were recorded when observed.



Image 68 Fox scat- Arthur Walker Reserve 2024

### 4.9 Research Licensing

The survey and research of fauna during the 2019-2020 was undertaken under the following licences and approvals in accordance with the Animal Research Act (1991).

Principal: Anne Carey; Associates: Meredith Brainwood, Eloise Chambers, Caroline Forest

**DPIE Scientific Licence SL101080** 

Department of Primary Industries Animal Research Authority Trim 12/4893 (2)

Department of Primary Industries Director-General's Animal Care and Ethics Committee DG ACEC Trim 12/4893

## 5 FLORA METHODOLOGY

Flora surveys consisted of four key components:

- A general inventory of flora species using random meander searches in the manner of Cropper (1993)
- Quadrat meander surveys, used for allocating vegetation patches to PCTs
- BAM style plots, which rigorously quantify species present, cover and abundance of these, and floristic structure, along with other ecosystem features
- · Saltmarsh mapping along the accessible foreshore of the LGA

Surveys were undertaken in reserves based on initial advice from council, supplemented with other areas identified as having biodiversity potential during on-ground surveys. Many reserves have a mix of uses, including sports fields with perimeter vegetation. The purpose of surveys was to identify areas of biodiversity and document these, so the focus was on native flora and vegetation. Areas of mown open space were not included in surveys, and introduced species were only recorded if they were in areas of native flora.

Each of the survey methods used are described in more detail below.

#### 5.1 Random Meander Surveys

A general inventory of flora species present was collated using the random meander method described by Cropper (1993). The nominated reserves/parks/corridors were traversed and searched and all plant species recorded within areas with native flora species. Particular attention was given to areas with any signs of differences in vegetation, or potential differences, for example, through proximity to water, change in soil characteristics, disturbance, rocky outcrops, steep slopes, foreshore areas, etc. The aim was to record as many of the flora species present as possible, regardless of whether they were planted or naturally occurring.

Species inventories were collated for each reserve, or parts of the reserve where there was a clear difference in vegetation type and condition. The inventory comprised a list of species present along with plant form for native species and weed control priority where relevant for introduced species. The resulting species richness can be contrasted with any subsequent surveys, ideally at around 10 year intervals.

The City of Canada Bay LGA is part of the Greater Sydney Local Land Services. Priority weeds for the Greater Sydney region are listed in the Greater Sydney Regional Strategic Weed Management Plan 2023-2027, which is a strategic plan developed under the Local Land Services Act 2013 to implement the NSW Biosecurity Strategy 2013-2021 and NSW Invasive Species Plan in relation to weeds for the

Greater Sydney region. Regional Strategic Weed Management Plans play an important role in articulating the shared responsibility principle of the NSW Biosecurity Act 2015 (the Act) and communicating weed control obligations. As per s.15 of the Act, the Plan prioritises weeds that:

- out-compete other organisms for resources
- cause harm to other organisms through toxicity
- otherwise reduce the productivity of agricultural systems or the value of agricultural products
- damage infrastructure
- reduce the amenity or aesthetic value of premises
- harm or reduce biodiversity

This plan identifies the control priority for each weed species in the region, noting that this can be different to control priorities for the same weeds in other parts of the state. Specific information about each weed, including how to identify it and different control methods to be used, is available from NSW Dept Primary Industries website: NSW WeedWise

### 5.2 Quadrat Meander Surveys

Quadrat meanders are similar to random meanders but have a slightly different focus. This is a rapid technique derived from the survey methodology used by OEH (2016) in The Native Vegetation of the Sydney Metropolitan Area (version 3, volumes 1 and 2). Volume 2 includes description of each Map Unit/vegetation community in the metropolitan area with a set of diagnostic criteria that can be applied to a patch of native vegetation to more accurately determine whether it meets the description for a particular vegetation community. The quantified data used in this process is based on surveys of 0.04 hectares, or a 20m by 20m quadrat (or equivalent). Using a meander provides a rapid result for this. For some of the patches, the whole patch is not much larger. Many of the smaller patches have significant edge effects due to their small size and frequently a linear shape, and since the purpose of the survey is to identify the mostly likely vegetation community, all of the species recorded in the patch were used for the quadrat meander.

More information on ground truthing of vegetation mapping is provided later in this report.

### **5.3** Saltmarsh Surveys

Saltmarsh is a particular vegetation community that occurs in the intertidal zone in areas with irregular inundation. Areas that are regularly inundated (every high tide) favour the establishment of mangroves, and saltmarsh establishes in the narrow strip of land above this in areas that are typically inundated only at very high tides only. The altitudinal range of the community is therefore very limited.

Modification of foreshores through land reclamation and construction of seawalls have impacted the distribution of this community to the point that it has been listed as an endangered ecological community in NSW. The situation is further exacerbated by sea level rise, so that areas that were previously occupied by saltmarsh are now more regularly inundated, and mangroves are beginning to invade these areas. The normal response would be landward migration by saltmarsh, slowly moving inland as sea levels rise, however, in highly urbanised areas such as Sydney Harbour the opportunities for this are very limited.

Saltmarsh surveys were based on observations from walking all of the accessible foreshore in City of Canada Bay and documenting the distribution of vegetation patches that have one or more of the typical saltmarsh species present:

- Baumea juncea
- Ficinia nodosa
- Juncus kraussii subsp. australiensis
- Phragmites australis
- Samolus repens
- Sarcocornia quinqueflora subsp. quinqueflora
- Suaeda australis
- Tetragonia tetragonioides
- Triglochin striata

Warrigal Greens (*Tetragonia tetragonioides*) also occurs in more terrestrial areas with moderate levels of salinity, and was only recorded as saltmarsh when accompanied by another saltmarsh species.

#### 5.4 BAM Plots

The Biodiversity Assessment Method (BAM) is a standardised method for collection of floristic data in NSW (BCT, 2020). Several versions of the BAM exist and each have a specific focus. For this project we selected the Ecological Monitoring Module (EMM) which uses a full floristic assessment to provide information to support the evaluation of management effectiveness over time. The EMM was developed for use on stewardship sites established using the BAM and provides quantified results using a standardised replicable method. This is typically replicated at 5 or 10 year intervals, and each set of results compared to the previous one(s).

We established 50m by 20m plots in areas of better quality native vegetation using the layout provided below (Figure 25). The larger 50m by 20m vegetation survey plot was used to record floristic structure information based on the diameter at breast height (DBH) of all trees present. The smaller nested 20m by 20m quadrat was used to record floristic composition information based on the cover and abundance of each species within the quadrat, or overhanging the quadrat. The smaller litter plots record information about the functional integrity observed within the quadrat. Data is then recorded in a spreadsheet similar to the one shown in Figure 26, noting that the dung assessment was not completed for this project.

When the results of surveys are entered into the BAM calculator, all of this information is scored against reference values established for the relevant Plant Community Type (PCT) in the Sydney Basin. Once again, the stewardship site option was used for entering data into the calculator.

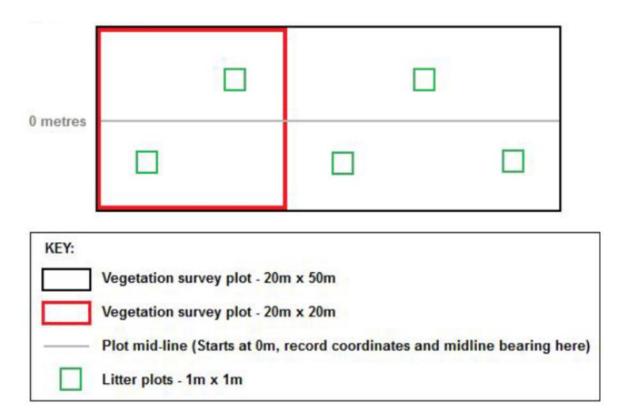


Figure 25 Standard plot layout to be used for site assessment (Biodiversity Assessment Method 2020, Figure 9, p.31)

## Full-floristic (BAM) plot

Start Time:	End Time:	MP ID	Agmt/Ctrl	Recorders			
Date	//						
Zone	Datum	Site Name		Plot dimensions			
Easting	Northing	IBRA region	In m	Plot bearing		Magnetic °	
Vegetation Clas	s / Condition State					Confidence:	

Growth Form	Genus and species name	N,E or HTW	Cover	Abund	Voucher
Code	1	OFFICE			
	2	1			
	3	1			
	4	1			
	5	1			
	6	1			
	7				
	8				
	9				
	10				
	11				
	12				
	13				
	14				
	15				
	16				
	17				
	18				
	19				
	20				

BAM Attribute (	1000 m² plot)
DBH	Present?
80 + cm	
50 – 79 cm	
30 – 49 cm	
20 – 29 cm	
10 – 19 cm	
5 – 9 cm	
< 5 cm	
Length of logs (m)	Tally space

Dung assessment										
1 x 1	1 x 1 m or 0.5 x 0.5 m (SSCA) plots								Count	
Species				С	ount	pelle	ts			cow pats (400 m <sup>2</sup> plot)

BAM Attribute (1 x 1 m plots)	L	Litter	COVE	er (%	(	Bare	grou	ınd c	over (	(%)	Cry	yptog	am c	over (	%)	Rock	cove	er (%)	
Subplot score (% in each)																			
Average of the 5 subplots																			

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Figure 26 Example of full floristic data collection sheet for the BAM on stewardship sites (note: dung assessment was not completed for this project)

## 5.5 Vegetation mapping used in this study

In 2016 Office of Environment and Heritage (OEH) released version 3 of the Native Vegetation of the Sydney Metropolitan Area. This provided updates to the previous version based on extensive ground truthing and feedback from practitioners, and included diagnostic criteria for each of the described vegetation communities, known as Map Units. A total of 7 mapped vegetation communities were identified in City of Canada Bay LGA in this mapping, which is commonly used to describe the composition of vegetation communities in the Sydney basin (Table 1).

Following the release of a raft of new legislation between 2016 and 2021 the NSW government has commenced the development of the State Vegetation Type Maps (SVTM) which provides consistency for the same vegetation communities in different parts of the state. This process also refined vegetation community descriptions from qualitative to quantitative values to produce a new set of map units called Plant Community Types (PCTs). The SVTM is designed to be routinely updated as new information becomes available. The distribution of PCTs is underpinned by further ground truthing and the data is available through BioNet Vegetation Classification. A new app has been developed by the NSW Government for use by practitioners in the field – called Trees Near Me (Trees Near Me NSW). All of this provides support for the ongoing development of greater accuracy of vegetation mapping in NSW.

What this means for City of Canada Bay is that there is now a new set of vegetation mapping (Table 14). This should more reliably reflect the current status of native vegetation within the LGA. These vegetation communities are described in the next section of this report.

Table 14 Approved Plant Community Types (DCCEEW, 2024) and their Map Unit &
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PCT#	PCT NAME	MAP UNIT	MAP UNIT NAME
3594	Sydney Coastal Sandstone	S_DSF06	Coastal Sandstone Foreshores Forest
	Foreshores Forest		
4028	Estuarine Swamp Oak Twig-rush	S_FoW08	Estuarine Swamp Oak Forest
	Forest		
4091	Grey Mangrove-River Mangrove	S_SW01	Estuarine Mangrove Forest
	Forest		
4097	Samphire Saltmarsh	S_SW02	Estuarine Saltmarsh
3262	Sydney Turpentine Ironbark Forest	S_WSF09	Sydney Turpentine Ironbark Forest
3448	Castlereagh Ironbark Forest	S_DSF01	Castlereagh Ironbark Forest
3176	Sydney Enriched Sandstone Moist	S_WSF02	Coastal Enriched Sandstone Moist
	Forest		Forest

A total of 7 PCTs have been mapped as occurring within the LGA, some of which are classed as threatened ecological communities (TECs) under the NSW Biodiversity Conservation Act 2016 and/or the Commonwealth Environmental Protection & Biodiversity Conservation Act 1999 (which is currently under extensive review). It is an offence to clear native vegetation without approval, except under limited and specific circumstances, but these TECs have a much higher level of protection than other PCTs due to their increased risk of extinction. Listing of native vegetation communities generally occurs because of a significant reduction in its distribution across regions or a decline in ecological function. These are described later in this report.

For this study, a combination of available mapping was used. To identify the vegetation community to test against using the data collected, the first option was any relevant PCTs in the current State

Vegetation Type Mapping. The OEH 2016 mapping was also checked and if the Map Unit and the PCT were the same, it was a relatively straightforward process to ground truth vegetation against the diagnostic criteria provided in The Native Vegetation of Sydney Metropolitan Area, V3 volume 2 for the equivalent Map Unit. For example, PCT 3594 Sydney Coastal Sandstone Foreshores Forest is considered to be equivalent to Map Unit S\_DSF06 Coastal Sandstone Foreshores Forest. The diagnostic criteria for each Map Unit details a series of diagnostic species, the number of these required and the total number of native flora species that should be present to undertake the test and get reliable results. Interestingly, PCT 3594/Map Unit S\_DSF06 was not mapped as present in the LGA in 2016.

In situations where there was no Map Unit or PCT provided in either set of mapping, reference was made to the pre-1750 vegetation mapping to find a likely PCT/Map Unit that may have been present. If the subsequent ground truthing test showed very little similarity to the pre-1750 PCT, another likely PCT was selected. In reality, the vegetation communities in City of Canada Bay are relatively simplistic, with three clearly stratified PCTs associated with estuarine environments and two of the other four mapped PCTs very sparsely distributed in the LGA. That left two other options, one of which is strongly associated with sandstone derived soils and the other with enriched, shale influenced soils.

PCTs provide a quantitative description of these vegetation communities, unlike the OEH 2016 descriptions which are predominantly qualitative. The advantage of using the qualitative testing process is that it relies on presence of species and does not require cover and abundance information for every vegetation patch. This level of data collection is more time consuming, and for the purposes of this study, the qualitative analysis was considered to be adequate.

PCT descriptions from DPIE's BioNet Vegetation Classification – BioNet Plant Community Type Data are provided in Appendix B.

## 6 SURVEY CONDITIONS & LIMITATIONS

Weather conditions were generally good for the surveys with some very wet and warm periods. High temperatures (Figure 28) and high rainfall (Figure 27) combined to make survey conditions challenging some of the time and may have impacted some results.

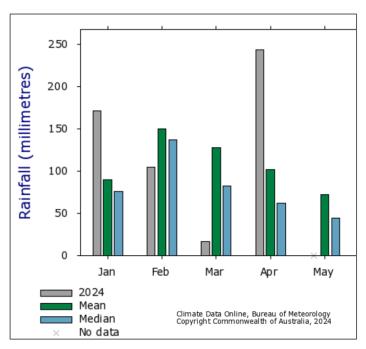


Figure 27 Rainfall data Concord (Brays Rd) http://www.bom.gov.au/jsp/ncc/cdio/weatherData/av?p\_nccObsCode=136&p\_display\_type=dailyDataFile&p\_startYear=2 020&p\_c=-871544385&p\_stn\_num=066011

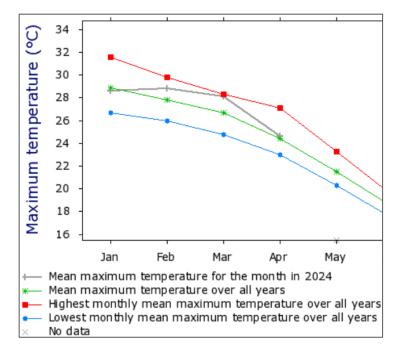


Figure 28 Maximum temperatures Sydney Olympic Park AWS (Archery Centre)

<a href="http://www.bom.gov.au/jsp/ncc/cdio/weatherData/av?p">http://www.bom.gov.au/jsp/ncc/cdio/weatherData/av?p</a> nccObsCode=122&p display type=dailyDataFile&p stn num=0
66212&p startYear=

Survey period commenced in December 2023, thus missing spring where migratory species may move through the LGA or be temporarily present during seasonal flowering events. Many species of birds would have fledged young by December, thus the opportunity to note breeding behaviours was largely lost. Some species of frogs may have called in spring and not through summer, so some species potentially present may not have been recorded, such as the Screaming Tree Frog. Similarly, many plants are best identified when flowering and flowering periods for some plants may not have occurred in the survey window.

## 7 RESULTS

## 7.1 Fauna survey results

A total of 111 terrestrial were recorded during the surveys. These are tabled by class below:

Table 15 Species recorded by class

CLASS	Provenance	# species
BIRDS	Native	78
	Introduced	6
MAMMALS	Native	11*
	Introduced	6
REPTILES	Native	7
AMPHIBIANS	Native	3
Tota	l species recorded	111

<sup>\*1</sup> probable (Rakali)

A summary of results by zone and sub zone (Figure 29) is provided in Table 9 overleaf.

Table 17 contains records from a variety of sources, including BioNet (the NSW Wildlife Atlas), ebird, Birdlife and the local community and bushcare. Community and bushcare records were collected via meetings with bushcare volunteers on their work days and via a community survey hosted on Council's website during this study.

Records from previous studies and the databases were examined in some detail - records from Bicentennial Park were separated out as the Billabong and surrounds are not managed by Council and contain a high diversity of species- some unlikely to be found in the rest of the LGA. Records that were incorrectly georeferenced, entirely out of range (such as Budgerigars – escaped pets), and birds flying over the LGA were not included, for example Hobcroft 2003 noted "Flock of eight birds seen in flight over Quarantine Bay Reserve on 26.1.03 was an unusual near coastal sighting of this mostly western species." This is followed by species profiles for threatened fauna detected during the Dec 2023-May 2024 survey period.

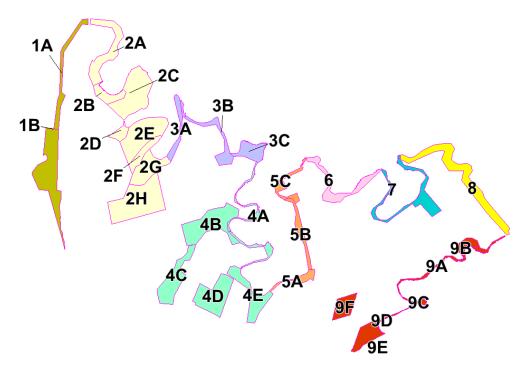


Figure 29 Zones and subzones/part 2023-24 surveys

Nomenclature used is consistent with that used in the Commonwealth Australian Faunal Directory<sup>4</sup> There are minor differences between this nomenclature and that used by the IOC at the time of development of this report.



Figure 30 Species richness model by subzone

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<sup>&</sup>lt;sup>4</sup> https://biodiversity.org.au/afd/home

**Abundance:** R= rare, UC=uncommon, MC=moderately common, C=common

Distribution: R= restricted, S=Sparse, L= Locally, MW= Moderately Widespread, W=Widespread

Examples: R=rare (1 sighting); RUC=Restricted to one zone and uncommon (1 or 2 birds seen on a visit);

RMC= Restricted to one zone and moderately common (potentially multiple birds seen on a visit);

SUC = Sparse and uncommon (restricted to 2 or 3 zones and 1 or 2 birds occasionally observed); RLC = restricted to one zone but species is locally common (multiple birds on most visits);

LMC = Locally moderately common (a few birds observed in a handful of subzones across 4 or more zones); MWMC= Moderately widespread and moderately common (observed in 4-6 zones in consistent, often small, numbers)

WC= Widespread and common (observed in most zones on most visits in good numbers for the species)

Threat listed

Threatened species – State and/or Federal listed

Introduced species

COMMON NAME	SCIENTIFIC NAME	Indicative abundance and distribution	Zone 1 A	Zone 1B	Zone 2 A	Zone 2 B	Zone 2 C	Zone 2 D	Zone 2 E	Zone 2 F	Zone 2 G	Zone 2 H	Zone 3 B	Zone 3 C	Zone 4 A	Zone 4 B	Zone 4 C	Zone 4 D	Zone 4 E	Zone 5 A	Zone 5 B	Zone 5 C	Zone 6	Zone 7	Zone 9 A	Zone 9 B	Zone 9 C	Zone 9 D	Zone 9 E	Zone 9 F	Sub zones present	% sub zones present	Zones present
Australasian Darter	Anhinga novaehollandiae	SUC																			Х	Х						Х			3	11%	2
Australasian Figbird	Sphecotheres vieilloti	LC					Х		Х									Х		Х	Х			Х							6	21%	4
Australasian Grebe	Tachybaptus novaehollandiae	RUC										Χ																			1	4%	1
Australian Brush-turkey	Alectura lathami	LMC	Χ	Х		Х	Х																		Х	Х		ļ			6	21%	3
Australian King-Parrot	Alisterus scapularis	SUC							Х									Х													2	7%	2
Australian Magpie	Cracticus tibicen	WC	Χ	Х	Х	Х	Х	Х	Х	Х	Х	Χ	Χ	Х	Х	Х	Х	Х		Χ		Χ	Х	Х	Х	Х	Х		Х	Х	25	89%	8
Australian Pelican	Pelecanus conspicillatus	LMC	Х				<u> </u>								Х				Х		Х							Х			5	18%	4
Australian Raven	Corvus coronoides	WC	Χ	Х	Х	Х	Х	Х	Х	Х	Х	Χ	Х	Х			Х	Х			Х	Х	Х			Х					18	64%	7
Australian White Ibis	Threskiornis molucca	WC		Х	Χ	Х	Х		Х		Х		Χ	Х	Х	Χ		Х	Х	Χ	Х	Χ		Х	Х				Х	Х	19	68%	7
Australian Wood Duck	Chenonetta jubata	WMC		Х		Х			Х			Χ	Х	Х		Х	Х	Х				Х									10	36%	5
Bar-tailed Godwit	Limosa lapponica	RLC																		Χ	Х	Χ									3	11%	1
Black-faced Cuckoo- shrike	Coracina novaehollandiae	RMC							Х	Х		Х																			3	11%	1
Black-fronted Dotteral	Elseyornis melanops	R		Х																											1	4%	1
Black Swan	Cygnus atratus	RUC										Χ																			1	4%	1
Brown Goshawk	Accipiter fasciatus	RUC							Х		Х																				2	7%	1
Brown Thornbill	Acanthiza pusilla	RUC							Х																						1	4%	1
Channel-billed Cuckoo	Scythrops novaehollandiae	LMC				х			х						х		Х				х	Х	х	Х	х						9	32%	5
Chestnut Teal	Anas castanea	LMC		Х	Χ		Х					Χ										Х			Х	ļ		Х			7	25%	3
Common Myna	Sturnus tristis	LC	Х	Х			Х	Х	Х	Х	Х									Х											8	29%	3
Common Starling	Sturnus vulgaris	LC					Х		Х					Х						Χ											4	14%	3
Crested Pigeon	Ocyphaps lophotes	LMC			Х			Х		Х	Х				Χ			Х		Х				Х						Χ	9	32%	3
Crested Tern	Thalasseus bergii	SUC											Х		Х						Х										3	11%	3

COMMON NAME	SCIENTIFIC NAME	Indicative abundance and distribution	Zone 1 A	Zone 1 B	Zone 2 A	Zone 2 B	Zone 2 C	Zone 2 D	Zone 2 E	Zone 2 F	Zone 2 G	Zone 2 H	Zone 3 B	Zone 3 C	Zone 4 A	Zone 4 B	Zone 4 C	Zone 4 D	Zone 4 E	Zone 5 A	Zone 5 B	Zone 5 C	Zone 6	Zone 7	Zone 9 A	Zone 9 B	Zone 9 C	Zone 9 D	Zone 9 E	Zone 9 F	Sub zones present	% sub zones present	Zones present
Dollar Bird	Eurystomus orientalis	R						ļ	Х																						1	4%	1
Dusky Moorhen	Gallinula tenebrosa	SUC		Х								Х																			2	7%	2
Eastern Koel	Eudynamys orientalis	MWMC		Х	Х	Х			Х		Х	Х		Х	Х		Χ				Х		Х		Х				Х		13	46%	7
Eastern Osprey	Pandion haliaetus	MWMC						ļ		Х	Х										Х			Χ	Х						5	18%	4
Eastern Rosella	Platycercus eximius	SUC						ļ		Х	Х							Χ													3	11%	2
Eastern Spinebill	Acanthorhynchus tenuirostris	R								Х																					1	4%	1
Eurasian Coot	Fulica atra	RMC										Х																			1	4%	1
Galah	Eolophus roseicapillus	LMC									Х	Х												Χ							3	11%	2
Golden Whistler	Pachycephala pectoralis	RMC						ļ	Х	Х																					2	7%	1
Great Cormorant	Phalacrocorax carbo	RUC											Х																		1	4%	1
Great Egret	Ardea alba	MWUC		Х															Х	Χ	Х	Х		Χ						Х	7	25%	5
Grey Butcherbird	Cracticus torquatus	WMC		Х		Х	Χ	Х	Х	Х				Х	Х	Х	Χ	Χ				Х	Х	Χ	Х	Х			Χ		17	61%	8
Grey Fantail	Rhipidura albiscapa	RMC						Х	Х	Х	Χ																				4	14%	1
Greylag Goose (domestic)	Anser anser	R																Х													1	4%	1
Hardhead	Aythya australis	R						ļ				Х														ļ					1	4%	1
Latham's Snipe	Gallinago hardwickii	RUC										Х																			1	4%	1
Laughing Kookaburra	Dacelo novaeguineae	WMC				Х	Χ	Х	Х	Х	Χ	Х	Х	Х			Χ	Χ			Х	Х	Х		Х	Х					16	57%	6
Little Black Cormorant	Phalacrocorax sulcirostris	SUC		Х	х				Х																			Х			4	14%	3
Little Corella	Cacatua sanguinea	LC				Х			Х			Х			Х	Х	Χ	Χ		Χ		Х					Х				10	36%	4
Little Egret	Egretta garzetta	RUC																			Х										1	4%	1
Little Pied Cormorant	Microcarbo melanoleucos	MWMC			Х		Х						Х	Х	Х					Х	х	Х	Х	Х				Х			11	39%	7
Little Wattlebird	Anthochaera chrysoptera	R																													1	4%	1
Long-billed Corella	Cacatua tenuirostris	RMC										Х																			1	4%	1
Magpie-lark	Grallina cyanoleuca	WMC	Χ		Х	Х		Х	Х	Х	Χ	Х		Х		Х				Χ	Χ				Х				Х		14	50%	6
Masked Lapwing	Vanellus miles	WC		Х	Х	Х		ļ	Х	Х	Χ	Х	Χ	Х	Х	Х		Χ	Х		Х	Х	Х	Χ	Х	ļ	Х		Х	Х	21	75%	8
Musk Lorikeet	Glossopsitta concinna	LC								Х		Х		Х							Χ										4	14%	3
Noisy Friarbird	Philemon corniculatus	R				Х																									1	4%	1
Noisy Miner	Manorina melanocephala	WC	Χ	Х	Х	Х	Χ	Х	Х	Х	Χ	Х	Χ	Х	Х	Х	Χ	Χ		Χ	Χ	Х	Х	Χ	Х	Х	Х		Х	Х	26	93%	8
Olive-backed Oriole	Oriolus sagittatus	RMC							Х	Х																					2	7%	1
Pacific Black Duck	Anas superciliosa	SUC				Х						Х									Х										3	11%	2
Pied Cormorant	Phalacrocorax varius	MWMC	Χ				Х		Х				Χ		Х						Х				Х						7	25%	6
Pied Currawong	Strepera graculina	wc		Х		Х		Х	Х	Х	Х		Χ	Х	Χ		Χ	Χ			Х	Х	Х		Х	Х					16	57%	7
Pied Oystercatcher (Australian)	Haematopus longirostris	SUC																			х			Х			Х				3	11%	3
Pied Stilt	Himantopus leucocephalus	LC	Χ												Х					Χ	Χ	Χ					Х				6	21%	4

COMMON NAME	SCIENTIFIC NAME	Indicative abundance and distribution	Zone 1 A	Zone 1 B	Zone 2 A	Zone 2 B	Zone 2 C	Zone 2 D	Zone 2 E	Zone 2 F	Zone 2 G	Zone 2 H	Zone 3 B	Zone 3 C	Zone 4 A	Zone 4 B	Zone 4 C	Zone 4 D	Zone 4 E	Zone 5 A	Zone 5 B	Zone 5 C	Zone 6	Zone 7	Zone 9 A	Zone 9 B	Zone 9 C	Zone 9 D	Zone 9 E	Zone 9 F	Sub zones present	% sub zones present	Zones present
Powerful Owl	Ninox strenua	R																											Х		1	4%	1
Rainbow Lorikeet	Triphaglangua haamatadua	wc	V	V		x			X		X		V	V	X	x	Х			V	V	x	X	X	X		X		X	X	26	93%	
Red Wattlebird	Trichoglossus haematodus  Anthochaera carunculata	R	Х	X	X		X	X	^	Х		X	Х	Х	^		^	X		Х	Х	^	^	^	^	X			^	^	26 1	4%	8
Red-browed Finch	Neochmia temporalis	RMC							Х																						1	4%	1
Red-whiskered Bulbul	Pycnonotus jocosus	RUC							Х																						1	4%	1
Rock Dove	Columba livia	WMC		Х				Х	Х			Х						Х			Х			Х				1	Х	Х	9	32%	6
Royal Spoonbill	Platalea regia	R		X														<u> </u>		Х	\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \										2	7%	2
Rufous Fantail	Rhipidura rufifrons	RUC							Х	Х																					2	7%	1
Sacred Kingfisher	Todiramphus sanctus	R	Х																												1	4%	1
Silver Gull	Larus novaehollandiae	wc	Х	Х	Х	Х	Х		Х	Х		Х	Х	Х	Х				Х	Х	Х	Х	Х	Х	Х		Х	Х	Х	Х	22	79%	8
Silvereye	Zosterops lateralis	RLC						Х	Х	Х																					3	11%	1
Southern Boobook	Ninox novaehollandiae	R							Х																						1	4%	1
Spotted Turtle-Dove	Streptopelia chinensis	LMC	Х	Х	Х			Х	Х	Х										Х	Х										8	29%	3
Striated Heron	Butorides striata	SUC		Х																Х	Х				Х						4	14%	3
Striated Pardalote	Pardalotus striatus	R						Х																							1	4%	1
Sulphur-crested Cockatoo	Cacatua galerita	MWMC		Х	Х	Х			Х				Х	Х		Х	Х						Х		Х	_					10	36%	6
Superb Fairy-wren	Malurus cyaneus	LC	Χ	Х	Χ	Х	Х	Х	Х	Х	Х																				9	32%	2
Tawny Frogmouth	Podargus strigoides	MWUC							Х		Х			Х			Х	Х			Х										6	21%	4
Topknot Pigeon	Lopholaimus antarcticus	RUC						Х																				1			1	4%	1
Tree Martin	Petrochelidon nigricans	SUC							Х	Х												Х	Х					1			4	14%	3
Welcome Swallow	Hirundo neoxena	wc		Х	Х	Х		Х	Х	Х	Х	Х	Х	Х		Х	Х	Х		Х	Х	Х		Χ	Х	Х	Х	1	Х	Х	22	79%	7
White-bellied Sea-eagle	Haliaeetus leucogaster	R									Х																	1			1	4%	1
		200							,,																							407	
White-browed Scrubwren	Sericornis frontalis	RMC	,,			\ , <sub>'</sub>			X	\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \						\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	,,	,,		.,	\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \			\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	+	\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	1			1	4%	1
White-faced Heron	Egretta novaehollandiae	WMC	Х			X			Х	Х					Х	Х	Х	Х		Х	Х	Х		Х	Х	-	X				14	50%	6
White-naped Honeyeater	Melithreptus lunatus	R							Х																						1	4%	1
Willie Wagtail	Rhipidura leucophrys	WMC			Х			Х	Х	Х	Х				Х				Х	Х	Х		Х	Х					Х		12	43%	6
Yellow Thornbill	Acanthiza nana	RLC						Х	Х	Х	Х																				4	14%	1
	Lichenostomus chrysops																																
Yellow-faced Honeyeater	chrysops	RLC							Х	Х																					2	7%	1
MAMMALS																															Bird sp	ecies	84
Black Rat	Rattus rattus	MWMC				Х	Х	Х	Х	Х							Х	Х				Х	Х	Х	Х		Х				12	43%	6
Brown Rat	Rattus norvegicus	RMC																									Х				1	4%	1
Cat	Felis catus	MWUC		Х				Х	Х				Х					Х					Х		Х				Х		8	29%	6
Common Brushtail Possum	Trichosurus vulpecula	WMC	Х			X	X	X	X			X		X	X		Х	X				X	х	Х	Х				X		15	54%	8

COMMON NAME	SCIENTIFIC NAME	Indicative abundance and distribution	Zone 1 A	Zone 1 B	Zone 2 A	Zone 2 B	Zone 2 C	Zone 2 D	Zone 2 E	Zone 2 F	Zone 2 G	Zone 2 H	Zone 3 B	Zone 3 C	Zone 4 A	Zone 4 B	Zone 4 C	Zone 4 D	Zone 4 E	Zone 5 A	Zone 5 B	Zone 5 C	Zone 6	Zone 7	Zone 9 A	¥ 6 0 10 7	Zone 9 B	Zone 9 C	Zone 9 D	Zone 9 E	Zone 9 F	Sub zones present	% sub zones present	Zones present
Common Ringtail Possum	Pseudocheirus peregrinus	WMC	Х			x	x			X		X	X	X	x		х					X	X					х		Х		13	46%	7
Eastern Bent-wing Bat	Miniopterus orianae																																	
_	oceanensis	SUC				Х	-	-																Х	Х					Χ		4	14%	3
European Hare	Lepus europaeus	RMC	Χ	Х																												2	7%	1
Gould's Wattled Bat	Chalinolobus gouldi	WMC		Х		Х		Х	Х	Х					Х		Х	Х			Х		Х	Χ	Х					Χ		13	46%	7
Grey-headed Flying Fox	Pteropus poliocephalus	wc	Χ	Х	Х	Χ	Х	Х	Х	Х		Х		Х			Х	Х		Х	Х	Х	Х	Х	Х		Χ			Χ	Х	21	75%	8
House Mouse	Mus musculus	RUC																					Х									1	4%	1
Large-footed Myotis	Myotis macropus	SUC																			Х				Х					Χ		3	11%	2
Large Forest Bat	Vespadelus darlingtoni	MWUC																Х			X		Х							Χ		4	14%	4
Little Bent-winged Bat	Miniopterus australis	RUC				Х																										1	4%	1
Rakali*	Hydromys chrysogaster	R																																
Red Fox	Vuples vulpes	LMC		Х				Х	Х	Х	Х				Х			Х														7	25%	3
Ride's Free-tailed Bat	Mormopterus ridei	RUC																			Х											1	4%	1
White-striped Free-tailed	Austronomus australis																																.,,	
Bat		RUC				Х																										1	4%	1
FROGS																																Mamm specie		17
Brown-striped Frog	Limnodynastes peronii	SLC				Х	Х					Х										Х										4	14%	2
Eastern Dwarf Tree Frog	Litoria fallax	RLC				^	^					Х										^										1	4%	1
Peron's Tree Frog	Litoria peronii	MWLC						Х	Х			Х			Х					Х	Х	Х	Х									8	29%	4
REPTILES	Enona peronn	111120						~	\ \			\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \								\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \										Frogs		3
Eastern Long-necked	Chelodonia longicollis	R										Х																				1	4%	1
Barred-sided Skink*	Concinnia tenuis	R										Х																				1	4%	1
Cream-striped Shinning- skink	Cryptoblepharus pulcher	SUC																					Х					Х				2	7%	2
Eastern Water Skink	Eulamprus quoyii	LMC	Χ			Х		Х	Х																Х							5	18%	3
Dark-flecked Garden																																		
Sunskink  Pole fleeked Corden	Lampropholis delicata	MWUC	Х	Х				Х	Х	Х							Χ							Х	Х							8	29%	5
Pale-flecked Garden Sunskink	Lampropholis guichenoti	MWMC	Х	X		Х		X	X	X			Х		Х		Х					Х	X	X	X							13	46%	8
Eastern Blue-tongue	Tiliqua scincoides	SUC		ļ				<u> </u>		Х			,									<u> </u>	X	,,								2	7%	2
	7																															Reptile		_
*Duckable Vesufinned by	Species richness		22	32	20	33	21	30	56	38	24	33	19	22	25	12	22	27	6	23	38	29	27	26	30	0	10	14	6	21	11	specie	s	7

<sup>\*</sup>Probable \*Confirmed by others

Table 17 Species records from multiple sources and notes

# B = Bicentennial Park only

	Applied Ecology 2024	Insight Ecology 2013	Hobcroft 2003	Narl Yaral Esta 202	la te Bi	oNet 2014 (excludir centennial	ng	Bico	Net2014- 2024 entennial Park	20	bird 014- 024	Birdlife 2014 2024 (ex Bicentennia Park)	Bushcare Volunteer
COMMON NAME	SCIEN	ITIFIC NAME		AE2024	IE2014	DH2003	N23	BN14- 24	BN14- 24	ebird	BL	CC24 <b></b>	Note
Birds										•			
Australasian (Purple) Swamphen	Fulica	porphyrio			•			•	В	•	•		
Australasian Bittern	Botau	rus poiciloptilu	s					•					BN14-24 WIRES record (1) Drummoyne- unclear if bird was found in Drummoyne or picked up from Drummoyne
Australasian Darter	Anhing	ga novaehollar	diae	•	•	•	•	•		•	•		
Australasian Figbird	Sphec	otheres vieillo	i	•	•	•	•			•	•		
Australasian Grebe		baptus hollandiae		•	•	•		•	В	•	•		
Australian Brush-turkey	Alectu	ra lathami		•				•		•	•	•	
Australian Hobby	Falco	longipennis				•							
Australian King-Parrot	Alister	rus scapularis		•	•					•	•		
Australian Magpie	Cracti	cus tibicen		•	•	•	•	•	В	•	•	•	
Australian Pelican	Peleca	anus conspicill	atus	•	•	•		•	В	•	•	•	
Australian Pied Oystercatcher	Haem	atopus longiro	stris	•						•	•	•	AE2024-Rodd Point, Wymston Parade, Five Dock Bay-all in autumn
Australian Raven	Corvu	s coronoides		•	•	•	•	•	В	•	•	•	

COMMON NAME	SCIENTIFIC NAME	AE2024	IE2014	DH2003	N23	BN14- 24	BN14- 24	ebird	BL	CC24	Note
Australian Reed-Warbler	Acrocephalus australis								В		
Australian White Ibis	Threskiornis molucca	•	•	•	•	•	В	•	•	•	
Australian Wood Duck	Chenonetta jubata	•	•	•	•	•		•	•	•	
Bar-tailed Godwit	Limosa lapponica	•	•	•				•	•		
Beautiful Firetail	Stagonopleura bella							•			ebird Yaralla east/Majors bay 1 record
Black Swan	Cygnus atratus	•	В				В	•	•		AE2024-Concord GC
Black-faced Cuckoo-shrike	Coracina novaehollandiae	•	•	•		•	В	•	•		
Black-faced Monarch	Monarcha melanopsis			•		•	В	•			DH 2003 notes very uncommon, BN14-24 WIRES record (2) Chiswick & Five Dock
Black-fronted Dotterel	Elseyornis melanops	•		•				•	•		AE2024 foraging in Powells Creek at low tide
Black-shouldered Kite	Elanus axillaris			•							
Black-winged (now Pied) Stilt	Himantopus leucocephalus	•	•	•			В	•	•		
Brown Cuckoo-Dove	Macropygia phasianella					•					BN14-24 WIRES record (1) Five Dock
Brown Gerygone	Gerygone mouki					•					BN14-24 WIRES record (1) Concord West
Brown Goshawk	Accipiter fasciatus	•		•				•	•		Ae2024- adult and juv at Yaralla on several occasions in autumn
Brown Quail	Synoicus ypsilophora					•					
Brown Thornbill	Acanthiza pusilla	•									
Brush Cuckoo	Cacomantis variolosus					•					
Buff-banded Rail	Gallirallus philippensis		•					•	•	•	Bushcare record 2024- Concord West

durhinus grallarius dydroprogne caspia dubulcus ibis dcythrops novaehollandiae	•				•					BN14-24 WIRES record (1) Concord
cythrops novaehollandiae	•	_								Colicola
cythrops novaehollandiae	•	_					•	•		
-	•	_				В	•	•		
naccastanaa		•	•	•	•	В	•	•		DH 2003 note uncommon in 2002
iids Castailea	•	•	•		•	В	•	•		
ccipiter cirrocephalus					•					BN14-24 WIRES record (1) Chiswick
urdus merula			•		•		•	•		
ringa nebularia			•							
turnus tristis	•	•	•	•	•		•	•	•	
turnus vulgaris	•	•	•			В	•	•		
terna hirundo			•							
Ocyphaps lophotes	•	•	•		•			•	•	
halasseus bergii	•	•	•					•		
Platycercus elegans					•		•	•		
Calidris ferruginea			•					•		DH 2003 Brays Bay & Halliday Park, Birdlife 1 record from the Corso Rhodes 2019
urystomus orientalis	•	•	•	•	•		•	•		
aenopygia bichenovii			•							DH 2003 Walker St, Rhodes (site now destroyed)
Sallinula tenebrosa	•	•	•			В	•	•		
iyto jayaniga					•					BN14-24 WIRES records (3) all from 2021- Five Dock, Canada Bay and Russell Lea
			_			P		_		Canada Day and Nussell Lea
iciting the state of the state	irdus merula inga nebularia urnus tristis urnus vulgaris erna hirundo cyphaps lophotes alasseus bergii atycercus elegans alidris ferruginea urystomus orientalis	ccipiter cirrocephalus ardus merula inga nebularia urnus tristis urnus vulgaris erna hirundo cyphaps lophotes alasseus bergii atycercus elegans alidris ferruginea urystomus orientalis eenopygia bichenovii allinula tenebrosa	ccipiter cirrocephalus ardus merula inga nebularia urnus tristis urnus vulgaris erna hirundo cyphaps lophotes alasseus bergii atycercus elegans alidris ferruginea urystomus orientalis eenopygia bichenovii allinula tenebrosa	ccipiter cirrocephalus ardus merula inga nebularia urnus tristis  urnus vulgaris erna hirundo cyphaps lophotes alasseus bergii atycercus elegans alidris ferruginea urystomus orientalis eenopygia bichenovii allinula tenebrosa  to javanica	ccipiter cirrocephalus ardus merula inga nebularia urnus tristis  urnus vulgaris erna hirundo cyphaps lophotes alasseus bergii atycercus elegans alidris ferruginea urystomus orientalis enenopygia bichenovii allinula tenebrosa  to javanica	ccipiter cirrocephalus ridus merula inga nebularia urnus tristis urnus vulgaris erna hirundo cyphaps lophotes alasseus bergii atycercus elegans alidris ferruginea urystomus orientalis enopygia bichenovii allinula tenebrosa  eto javanica	ccipiter cirrocephalus ardus merula inga nebularia urnus tristis  urnus vulgaris erna hirundo cyphaps lophotes alasseus bergii atycercus elegans alidris ferruginea urystomus orientalis enenopygia bichenovii allinula tenebrosa  B  ccipiter cirrocephalus	ccipiter cirrocephalus redus merula inga nebularia urnus tristis urnus vulgaris erna hirundo cyphaps lophotes alalasseus bergii atycercus elegans alidris ferruginea urystomus orientalis enenopygia bichenovii allinula tenebrosa	ccipiter cirrocephalus  ordus merula  inga nebularia  urnus tristis  urnus vulgaris  erna hirundo  cyphaps lophotes  nalasseus bergii  attycercus elegans  alidris ferruginea  orgustation and a series	ccipiter cirrocephalus iridus merula inga nebularia urnus tristis urnus vulgaris erna hirundo cyphaps lophotes alalasseus bergii atycercus elegans alidris ferruginea urystomus orientalis enopygia bichenovii altinula tenebrosa

COMMON NAME	SCIENTIFIC NAME	AE2024	IE2014	DH2003	N23	BN14- 24	BN14- 24	ebird	BL	CC24	Note
Eastern Osprey	Pandion haliaetus	•						•	•	•	
Eastern Rosella	Platycercus eximius	•	•	•		•		•	•		
Eastern Spinebill	Acanthorhynchus tenuirostris	•	•			•			•		AE2024- Yaralla, very low numbers across databases
Emerald Dove	Chalcophaps indica					•					BN14-24 WIRES records (1) Russell Lea
Eurasian Coot	Fulica atra	•	•	•			В	•	•		
European Goldfinch	Carduelis carduelis			•							DH 2003 Walker St Rhodes (site destroyed), Yaralla & Rodd point
Fairy Martin	Petrochelidon ariel							•	•		
Fan-tailed Cuckoo	Cacomantis flabelliformis					•			•		
Fork-tailed Swift	Apus pacificus				•	•		•			
Galah	Eolophus roseicapillus	•	•	•	•	•	В	•	•	•	
Golden Whistler	Pachycephala pectoralis	•	•					•	•		Consistently present at Yaralla in very low numbers
Golden-headed Cisticola	Cisticola exilis			•							DH 2003 Walker Street Rhodes only (site destroyed)
Great Cormorant	Phalacrocorax carbo	•	•	•				•	•		
Great Egret	Ardea alba	•	•	•			В	•	•		
Grey Butcherbird	Cracticus torquatus	•	•	•	•	•	В	•	•	•	
Grey Currawong	Strepera versicolor					•					BN14-24 WIRES records (4)
Grey Fantail	Rhipidura albiscapa	•	•	•				•	•		DH 2003 Yaralla-uncommon
Grey Shrike-thrush	Colluricincla harmonica							•	•		ebird/Birdlife 1 record 2015- near Henry Lawson Park
Grey Teal	Anas gracilis	В	В	•			В	•	•		
Greylag Goose (domestic)	Anser anser	•							•		

COMMON NAME	SCIENTIFIC NAME	AE2024	IE2014	DH2003	N23	BN14- 24	BN14- 24	ebird	BL	CC24	Note
Grey-tailed Tattler	Heteroscelus brevipes			•						•	DH 2003 Cabarita; CC2024 Iron Cove foreshore (ID confirmed)
Hardhead	Aythya australis	•		•				•	•		
Hoary-headed Grebe	Poliocephalus poliocephalus								В		
Horsfield's Bronze-Cuckoo	Chalcites basalis		В								
House Sparrow	Passer domesticus			•		•		•	•		DH 2003 moderately common
Intermediate Egret	Ardea intermedia/Ardea plumifera						В	•	•		
Jacky Winter	Microeca fascinans					•					BN14-24WIRES records (1) Five Dock
Latham's Snipe	Gallinago hardwickii	•		•							DH 2003-Rhodes wetland areas (site destroyed), AE2024 Concord GC
Laughing Kookaburra	Dacelo novaeguineae	•	•	•	•	•	В	•	•	•	
Leaden Flycatcher	Myiagra rubecula							•	•		ebird/BL 1 record 2021 Yaralla
Little Black Cormorant	Phalacrocorax sulcirostris	•	•	•		•	В	•	•	•	
Little Corella	Cacatua sanguinea	•	•	•		•		•	•	•	
Little Egret	Egretta garzetta	•	•				В	•	•		
Little Lorikeet	Glossopsitta pusilla					•		•	•		
Little Pied Cormorant	Microcarbo melanoleucos	•	•	•			В	•	•	•	
Little Wattlebird	Anthochaera chrysoptera	•	•	•				•	•		DH 2003 moderately common and widespread - breeding in Timbrell Park.
Long-billed Corella	Cacatua tenuirostris	•	•	•		•		•	•	•	
Magpie-lark	Grallina cyanoleuca	•	•	•	•	•	В	•	•		
Mangrove Gerygone	Gerygone levigaster		•								
Masked Lapwing	Vanellus miles	•	•	•	•	•	В	•	•	•	

COMMON NAME	SCIENTIFIC NAME	AE2024	IE2014	DH2003	N23	BN14- 24	BN14- 24	ebird	BL	CC24	Note
Mistletoebird	Dicaeum hirundinaceum		•			•	В		•		IE 2014 Yaralla
Musk Lorikeet	Glossopsitta concinna	•	•	•		•		•	•		
Nankeen Kestrel	Falco cenchroides		•				В	•	•		
Nankeen Night Heron	Nycticorax caledonicus			•					•		
New Holland Honeyeater	Phylidonyris novaehollandiae		•	•		•		•	•		IE 2014 Mill Park &Yaralla, DH2002 notes moderately common in 2002 but potentially declining
Noisy Friarbird	Philemon corniculatus	•	•						•		
Noisy Miner	Manorina melanocephala	•	•	•	•	•		•	•	•	
Noisy Pitta	Pitta versicolor					•					BN14-24 WIRES records (1) West Concord
Olive-backed Oriole	Oriolus sagittatus	•	•			•	В	•	•		
Pacific Baza	Aviceda subcristata								•		BL14-24 1 record Edwards Park
Pacific Black Duck	Anas superciliosa	•	•	•		•	В	•	•		
Pacific Golden Plover	Pluvialis fulva							•			ebird 1 record Wymston Parade 2018
Painted Button-quail	Turnix varius					•					BN14-24 WIRES records (1) Rodd Point & Concord
Peaceful Dove	Geopelia striata					•					BN14-24 WIRES records (1) Drummoyne
Peregrine Falcon	Falco peregrinus			•				•	•		
Pied Butcherbird	Cracticus nigrogularis							•	•		
Pied Cormorant	Phalacrocorax varius	•	•	•		•	В	•	•		
Pied Currawong	Strepera graculina	•	•	•	•	•	В	•	•	•	
Powerful Owl	Ninox strenua	•				•				•	AE2024 at Timbrell Park, Bushcare vols report seeing them occasionally

COMMON NAME	SCIENTIFIC NAME	AE2024	IE2014	DH2003	N23	BN14- 24	BN14- 24	ebird	BL	CC24	Note
											perched/hunting at night through suburban areas. Multiple pairs breed in the City of Ryde and Lane Cove LGAs nearby- City of Canada Bay would form part of home ranges of these birds.
Rainbow Lorikeet	Trichoglossus haematodus	•	•	•	•	•	В		•	•	
Red Knot	Calidris canutus							•	•		ebird- 3 records- all 2022 at Halliday park
Red Wattlebird	Anthochaera carunculata	•	•	•	•	•	В	•	•		DH 2002 widespread, IE 2014 widespread VUC in 2024 survey
Red-browed Finch	Neochmia temporalis	•	•	•		•		•	•		AE2024-small parties consistently present at Yaralla
Red-kneed Dotterel	Erythrogonys cinctus							•	•		ebird/birdlife 1 record on The Corso Rhodes 2019
Red-necked Avocet	Recurvirostra novaehollandiae							•	•		ebird/birdlife 2 record on The Corso Rhodes 2018
Red-rumped Parrot	Psephotus haematonotus		•	•		•		•	•		DH 2002 Moderately common in 2002; IE 2014 One sighting- Lukes Park
Red-whiskered Bulbul	Pycnonotus jocosus	•	•			•		•	•		
Rock Dove	Columba livia	•	•	•	•	•		•	•		
Royal Spoonbill	Platalea regia	•	•	•			В	•	•		
Rufous Fantail	Rhipidura rufifrons	•	•					•	•	•	Seasonal migrant-CC 24 Drummoyne, AE2024- Yaralla/ArthurWalker
Rufous Whistler	Pachycephala rufiventris					•	В	•	•		BN14-24WIRES records (1) Five Dock

COMMON NAME	SCIENTIFIC NAME	AE2024	IE2014	DH2003	N23	BN14- 24	BN14- 24	ebird	BL	CC24	Note
Sacred Kingfisher	Todiramphus sanctus	•	•	•		•	В	•	•		IE 2014 Yaralla/Rivendell and Timbrell Park
Scaly-breasted Lorikeet	Trichoglossus chlorolepidotus		•			•		•			
Sharp-tailed Sandpiper	Calidris acuminata			•				•	•		DH2003 noted at Halliday Park high tide roost
Shining Bronze-Cuckoo	Chalcites lucidus					•					BN14-24 WIRES records (1) Cabarita
Silver Gull	Larus novaehollandiae	•	•	•	•	•	В	•	•	•	
Silvereye	Zosterops lateralis	•	•	•	•	•	В	•	•		
Southern Boobook	Ninox novaehollandiae	•				•		•	•		
Spangled Drongo	Dicrurus bracteatus		•					•	•		IE 2014 Yarralla & B (2)
Spotted Pardalote	Pardalotus punctatus	В	•	•		•	В	•	•	•	
Spotted Turtle-Dove	Streptopelia chinensis	•	•	•		•		•	•		
Striated Heron	Butorides striata	•	•	•			В	•			
Striated Pardalote	Pardalotus striatus	•	•					•	•		
Sulphur-crested Cockatoo	Cacatua galerita	•	•	•	•	•		•	•	•	
Superb Fairy-wren	Malurus cyaneus	•	•	•	•	•	В	•	•		DH 2003 records all west of Brays Bay, some more easterly obs IE 2014
Swift Parrot	Lathamus discolor					•					BN14-24 Queen Elizabeth Park 2023
Tawny Frogmouth	Podargus strigoides	•	•	•		•	В	•	•		
Topknot Pigeon	Lopholaimus antarcticus	•		•		•		•	•		
Tree Martin	Petrochelidon nigricans	•						•	•		
Welcome Swallow	Hirundo neoxena	•	•	•		•	В	•	•		
Whistling Kite	Haliastur sphenurus								•		BL 1 record Yaralla 2015
White-bellied Sea-eagle	Haliaeetus leucogaster	•		•		•		•	•		

COMMON NAME	SCIENTIFIC NAME	AE2024	IE2014	DH2003	N23	BN14- 24	BN14- 24	ebird	BL	CC24	Note
White-browed Scrubwren	Sericornis frontalis	•	•	•			В	•	•		
White-cheeked Honeyeater	Phylidonyris niger		•	•			В		•		IE 2014 Rider Boulevarde Rhodes/Yaralla, DH2003 uncommon
White-faced Heron	Egretta novaehollandiae	•	•	•	•	•	В	•	•	•	
White-headed Pigeon	Columba leucomela					•					
White-naped Honeyeater	Melithreptus lunatus	•						•	•		AE2024-with autumn migration
White-necked Heron	Ardea pacifica							•	•		BL 2 records The Corso Rhodes 2019, Brays Bay 2014
White-plumed Honeyeater	Lichenostomus penicillatus		•	•				•	•		IE 2014 Widespread, breeding at Timbrell Park 13-14; note most ebird records from 2011-13 period, 2 records SOPA Lake Belvedere in 2024
White-throated Needletail	Hirundapus caudacutus			•	•	•		•	•		
White-throated Nightjar	Eurostopodus mystacalis					•					
Willie Wagtail	Rhipidura leucophrys	•	•	•	•	•	В	•	•		
Yellow Thornbill	Acanthiza nana	•	•	•			В	•	•		
Yellow-faced Honeyeater	Lichenostomus chrysops chrysops	•	•			•	В	•	•		AE2024- autumn migration- flocks 10-20 briefly stopping at Yaralla
Yellow-rumped Thornbill	Acanthiza chrysorrhoa			•							DH 2003 Yaralla
Yellow-tailed Black Cockatoo	Calyptorhynchus funereus			•		•		•	•	•	Bushcare-observed feeding in Brett Park -other records potentially all flying over (DH)
Mammals											
Bandicoot species unknown	Isoodon/Perameles sp.					•					BN14-24 WIRES record (1) Concord West
Black Rat	Rattus rattus	•		•		•	В			•	

COMMON NAME	SCIENTIFIC NAME	AE2024	IE2014	DH2003	N23	BN14- 24	BN14- 24	ebird	BL	CC24	Note
Brown Rat	Rattus norvegicus	•		•		•					
Cat	Felis catus	•	•	•		•	В				
Common Brushtail Possum	Trichosurus vulpecula	•	•	•		•				•	
Common Ringtail Possum	Pseudocheirus peregrinus	•	•			•				•	
Eastern Bent-wing Bat	Miniopterus orianae oceanensis	•					В				
Eastern Chestnut Mouse	Pseudomys gracilicaudatus					•					BN14-24 WIRES record (1) Drummoyne 2021- one of very few records for this species in Sydney.
European Hare	Lepus europaeus	•	•								
European Rabbit	Oryctolagus cuniculus		В			•					
Gould's Wattled Bat	Chalinolobus gouldi	•				•	В				
Grey-headed Flying Fox	Pteropus poliocephalus	•	•	•		•				•	
House Mouse	Mus musculus	•		•		•					
Large Forest Bat	Vespadelus darlingtoni	•				•					
Large-footed Myotis	Myotis macropus	•					В				
Lesser Long-eared Bat	Nyctophilus geoffroyi						В				
Little Bent-winged Bat	Miniopterus australis	•									
Rakali*	Hydromys chrysogaster	•				•					
Red Fox	Vuples vulpes	•	•	•		•	В			•	
Ride's Free-tailed Bat	Mormopterus ridei	•									
Short-beaked Echidna	Tachyglossus aculeatus					•					BN14-24 WIRES records (5) all from Cabarita over multiple years
Southern Forest Bat	Vespadelus regulus					•					BN14-24 Concord West Sewage Pumping Station

COMMON NAME	SCIENTIFIC NAME	AE2024	IE2014	DH2003	N23	BN14- 24	BN14- 24	ebird	BL	CC24	Note
White-striped Free-tailed Bat	Austronomus australis	•				•					
Frogs											
Brown-striped Frog (Striped Marsh Frog)	Limnodynastes peronii	•	•	•	•	•				•	DH2003-Walker Street Rhodes- 20 calling (site destroyed), 1 at Arthur Walker. AE2024 common on Concord GC only-elsewhere 1-2 calling
Cane Toad	Rhinella marina					•					Single record from Mortlake
Common Eastern Froglet	Crinia signifera		•	•		•				•	IE 2013 Rhodes Park and Yaralla, DH2002 Walker street Rhodes 2002 (100), BioNet-Concord Golf Club
Eastern Dwarf Tree Frog	Litoria fallax	•		•		•				•	
Green Tree Frog	Litoria caerulea					•					BN14-24 WIRES records (2) from Drummoyne and Wareemba
Peron's Tree Frog	Litoria peronii	•	•	•		•				•	Community identified breeding site (many tadpoles) 21 Gallipoli street Concord, AE2024-most often calling from private property adjacent to reserves
Screaming Tree Frog	Litoria quiritatus		•	В							IE 2014 Concord Golf Club
Reptiles											
Barred-sided Skink	Concinnia tenuis	•	•	•							Adjoining landholder confirmed continued presence in reserve and his lot (has images)

COMMON NAME	SCIENTIFIC NAME	AE2024	IE2014	DH2003	N23	BN14- 24	BN14- 24	ebird	BL	CC24	Note
											WIRES records (3) all from
						•					2021 Five Dock, Canada Bay
Bearded Dragon	Pogona barbata										and Russell Lea
Common Tree Snake	Dendrelaphis punctulatus					•					WIRES record (1) Drummoyne
Cream-striped Shinning- skink	Cryptoblepharus virgatus	•	•	•		•					
Dark-flecked Garden Sunskink	Lampropholis delicata	•	•	•		•	В				
Diamond Python	Morelia spilota					•					BN14-24 WIRES records, record from snake catcher- Abbotsford
Eastern Blue-tongue	Tiliqua scincoides	•	•	•		•	В			•	
Eastern Brown Snake	Pseudonaja textilis					•					BN14-24 WIRES records (2) Concord & Drummoyne
Eastern Long-necked Turtle	Chelodonia longicollis	•		•		•	В				
Eastern Water Dragon	Itellagama lesueurii		•		•	•					IE 2014 Rhodes Park & Bicentennial Park, Narla/BN14-24 24 Yaralla
Eastern Water-skink	Eulamprus quoyi	•	•	•		•					
Lace Monitor	Varanus varius					•					BN14-24 WIRES records (2) Concord West & Breakfast Point
Pale-flecked Garden Sunskink	Lampropholis guichenoti	•	•	•							
Red-bellied Black Snake	Pseudechis porphyriacus					•					BN14-24 WIRES records (8) widespread- including a removal from Concord Hospital
Weasel Skink	Saproscincus mustelinus						В				

### 7.2 Threatened Species profiles

### 7.2.1 Eastern Bent-winged Bat Miniopterus orianae oceanensis



Figure 31 Locations recorded vs locations not recorded in this study

#### Profile information from OEH profile<sup>5</sup>

Status:	BC Act 2016 Vulnerable
Distribution:	East coast of Australia, from Cape York Peninsula to Castlemaine, Victoria
City of Canada Bay	Sparsely distributed with calls recorded at Brays Bay also calls along Iron Cove Creek at Timbrell Park, and Sisters Bay
Distinguishing features:	Dark reddish brown to dark brown fur on its back, slightly paler on its belly. Muzzle is short, with a domed head. The bent-wing name comes from its unique anatomy - with on the third 'finger' of its wing the last bone is four times longer than the middle one, giving a bent appearance.
Habitat:	Rainforests, wet and dry schlerophyll forest, open woodland, and open grasslands.
Roosting:	Cave dwelling, but also use abandoned mines and culverts. Populations are centred on a maternity cave that is used annually. Each population disperses to other caves during the rest of the year. In the south, bats overwinter in hibernation caves, while in the north they remain active and forage nightly.

<sup>&</sup>lt;sup>5</sup> https://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10534

Foraging:	High flying species that forages from just above the canopy to many times canopy height. Also open areas where they forage just above the ground. Fast flying with swift shallow dives, foraging long distances from the roost site (up to 65km in one night).
Diet:	Moths, also flies, cockroaches, and beetles.
Reproduction:	Mating occurs May to June, conception occurs but implantation is delayed till August. Up to 100,000 females congregate in October into maternity colonies, and give birth December to January. Young are left in creches while the mothers forage. They can fly by 7 weeks, reach adult size and are weaned by 10 weeks. The mothers then disperse to their winter roost, followed by a mass exodus of juveniles, and the maternity colony is deserted by April.
Threats (NSW OEH)	<ul> <li>Disturbance by recreational cavers and general public accessing caves and adjacent areas particularly during winter or breeding.</li> <li>Loss of high productivity foraging habitat.</li> <li>Introduction of exotic pathogens, particularly white-nose fungus.</li> <li>Cave entrances being blocked for human health and safety reasons, or vegetation (particularly blackberries) encroaching on and blocking cave entrances.</li> <li>Hazard reduction and wildfire fires during the breeding season.</li> <li>Predation by feral cats.</li> </ul>
Activities to assist the species (NSW OEH)	<ul> <li>Control foxes and feral cats around roosting sites, particularly maternity caves.</li> <li>Retain native vegetation around roost sites, particularly within 300 m of maternity caves.</li> <li>Minimise the use of pesticides in foraging areas.</li> <li>Protect roosting sites from damage or disturbance.</li> </ul>

# 7.2.2 Little Bent-winged Bat Miniopterus australis



Figure 32 Locations recorded vs locations not recorded in this study

#### Profile information from OEH profile and All about Bats<sup>6</sup>

Status:	BC Act 2016 Vulnerable
Distribution:	East coast and ranges of Australia from Cape York in Queensland to Wollongong in NSW.
City of Canada Bay	Only recorded in one session in mangroves at Brays Bay
Distinguishing features:	Little Bentwing-bats are small dark chocolate brown insectivorous bats with a body length of about 45 mm. The tip of the wing is formed by a particularly long joint of the third finger, folded back and bent under the wing while the bat is at rest.
Habitat:	Moist eucalypt forest, rainforest, vine thicket, wet and dry sclerophyll forest, Melaleuca swamps, dense coastal forests and banksia scrub. Generally found in well-timbered areas.
Roosting:	Little Bentwing-bats roost in caves, tunnels, tree hollows, abandoned mines, stormwater drains, culverts, bridges and sometimes buildings during the day, and at night forage for small insects beneath the canopy of densely vegetated habitats

 $<sup>^6 \, \</sup>underline{\text{https://threatenedspecies.bionet.nsw.gov.au/profile?id=10533}} \, \& \, \text{https://www.allaboutbats.org.au/little-bentwing-bat/}$ 

Foraging:	Little bent-wing bats prefer well timbered areas where they feed primarily in the shrub and canopy layers.
Diet:	Their diet consists primarily of beetles, moths, flies and even spiders.
Reproduction:	In NSW the largest maternity colony is in close association with a large maternity colony of Eastern Bentwing-bats and appears to depend on the large colony to provide the high temperatures needed to rear its young.  Maternity colonies form in spring and birthing occurs in early summer. Males and juveniles disperse in summer.  Only five nursery sites /maternity colonies are known in Australia.
Selected Threats (NSW OEH)	<ul> <li>Changes to habitat, especially surrounding maternity/nursery caves and winter roosts.</li> <li>Pesticides on insects and in water consumed by bats bio accumulates, resulting in poisoning of individuals.</li> <li>Predation from foxes, particularly around maternity caves, winter roosts and roosts within culverts, tunnels and under bridges.</li> <li>Predation from feral cats, particularly around maternity caves, winter roosts and roosts within culverts, tunnels and under bridges</li> <li>Introduction of exotic pathogens such as the White-nosed fungus.</li> </ul>
Activities to assist the species (NSW OEH)	<ul> <li>Protect known roosting and nursery sites and surrounding forest from disturbance by restricting and/or monitoring access.</li> <li>Retain stands of native vegetation, particularly within 10km of roosts.</li> <li>Reduce use of pesticides within breeding and foraging habitat.</li> <li>Undertake non-chemical weed control to prevent obstruction of maternity cave and other roost entrances.</li> <li>Control foxes, feral cats and goats around maternity caves, winter roosts and other significant roost sites.</li> <li>Ensure adequate foraging habitat is retained when undertaking hazard reduction activities, particularly during the breeding/reproduction season.</li> </ul>

# 7.2.3 Large-footed Myotis Myotis Macropus



Figure 33 Locations recorded vs locations not recorded in this study

### Profile information from OEH profile<sup>7</sup>



Image 69 Myotis Macropus (photos: Applied Ecology)

<sup>&</sup>lt;sup>7</sup> https://threatenedspecies.bionet.nsw.gov.au/profile?id=10549

Status:	BC Act 2016 Vulnerable
Distribution:	Primarily coastal, from Kimberleys around northern and eastern Australia Cape York Peninsula to Victoria, and along the Murray River
City of Canada Bay	Uncommon-observed with thermal scope hunting off Halliday Park- recorded along Iron Cove Creek at Timbrell Park, patchy calls at Sisters Bay and near Henry Lawson Park.
Distinguishing features:	Distinguished by its disproportionally large feet, over 8mm long, greater than half the length of the tibia, giving rise to the common name for the species. Fur colour varies from dark grey to reddish brown.
Habitat:	Strong association with streams and permanent waterways, mostly in flat to undulating country, and usually vegetated rather than cleared, but will live anywhere as long as it is near water.
Roosting:	Near water in caves, tree hollows, among vegetation, bridges, old mines, tunnels, culverts, stormwater drains.
Foraging:	Usually forage in spaces between trees, active in riparian habitats.
Diet:	Bugs, flies and beetles, with some ants, moths and spiders.
Reproduction:	Young are born in November, usually single. Lactation occurs until mid to late January when young are free flying.
Selected Threats	Loss or disturbance of roosting sites.
(NSW OEH)	<ul> <li>Clearing adjacent to foraging areas.</li> </ul>
	<ul> <li>Application of pesticides in or adjacent to foraging areas.</li> </ul>
	Reduction in stream water quality affecting food resources
Activities to assist the species (NSW	<ul> <li>Retain native vegetation along streams and rivers and around other waterbodies.</li> </ul>
OEH)	<ul> <li>Minimise the use of pesticides adjacent to foraging areas.</li> </ul>
	<ul> <li>Protect roosts from damage or disturbance.</li> </ul>

# 7.2.4 Grey-headed Flying-fox Pteropus poliocephalus



Figure 34 Locations observed feeding during the study – also observed flying over throughout and in street trees in various locations- particularly fruiting Ficus species.



Image 70 Grey-headed Flying Fox in a Ficus at Yaralla Estate - December 23

# Profile information from OEH profile<sup>8</sup>

Status	BC Act 2016 Vulnerable, EPBC Act Vulnerable
Other Common Names	Fruit Bat
City of Canada Bay	Common throughout- most bats probably from the roost/camp at Hunters Hill.
	Observed regularly flying across the river early dusk.
Description	Largest Australian bat, with a head and body length of 23 - 29 cm. It has dark
	grey fur on the body, lighter grey fur on the head and a russet collar encircling
	the neck. The wing membranes are black and the wingspan can be up to 1 m. It
	can be distinguished from other flying-foxes by the leg fur, which extends to the
	ankle.
Habitat	Subtropical and temperate rainforests, tall sclerophyll forests and woodlands,
	heaths and swamps as well as urban gardens and cultivated fruit crops.
Diet	Nectar and pollen of native trees, in particular Eucalyptus, Melaleuca and
	Banksia, and fruits of rainforest trees and vines. Also gardens and crops. In the
	LGA Ficus species are a favourite when fruiting.
Biology/Breeding	Roosting camps are generally located within 20 km of a regular food source and
biology/ bi eeding	are commonly found in gullies, close to water, in vegetation with a dense canopy.
	Individual camps may have tens of thousands of animals and are used for mating,
	and for giving birth and rearing young. Annual mating commences in January
	and conception occurs in April or May; a single young is born in October or
	and dende the second in April of May, a single young is seen in october of

<sup>&</sup>lt;sup>8</sup> https://threatenedspecies.bionet.nsw.gov.au/profile?id=10697

Threats (NSW OEH)	November. Site fidelity to camps is high; some camps have been used for over a century. Can travel up to 50 km from the camp to forage; commuting distances are more often <20 km  • Loss of roosting and foraging sites. • Electrocution on powerlines, entanglement in netting and on barbedwire. • Heat stress. • Conflict with humans. • Incomplete knowledge of abundance and distribution across the species' range
Selected Activities to assist the species (NSW OEH)	<ul> <li>Illegal shooting</li> <li>Protect roost sites, particularly avoid disturbance September through November.</li> <li>Identify and protect key foraging areas.</li> <li>Identify powerline blackspots and implement measures to reduce deaths; implement measures to reduce deaths from entanglement in netting and on barbed-wire.</li> <li>Increase public awareness/understanding about flying-foxes, and their involvement in flying-fox conservation.</li> <li>Monitor the national population's status and distribution.</li> <li>Improve knowledge on demographics and population structure to better understand ecological requirements of the species.</li> </ul>



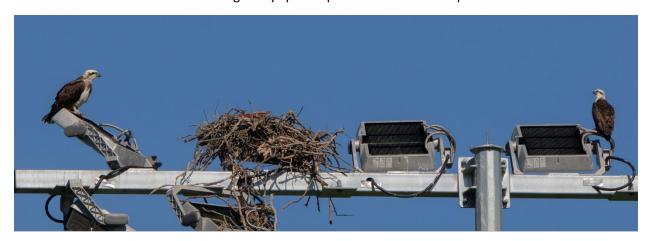
Image 71 Grey-headed Flying-fox above Quarantine Reserve- pre dusk - December 28, 2023.

### 7.2.5 Eastern Osprey Pandion cristatus



Figure 35 Eastern Osprey observation during this study

Profile information from DCCEEW migratory species profile and NSW OEH profile<sup>9</sup>



 $<sup>^9</sup>$  Commonwealth  $\underline{\text{https://www.dcceew.gov.au/environment/biodiversity/threatened/publications/epbc-act-referral-guidelines-migratory-birds} and <math>\underline{\text{https://threatened/publications/epbc-act-referral-guidelines-migratory-birds}}$ 

Image 72 Eastern Osprey pair with nest (in progress) May 2024.

Status	BC Act 2016 Vulnerable, EPBC Listed Migratory
Other Common Names	Osprey
City of Canada Bay	Breeding pair established 2023, currently in second breeding season—Majors Bar Reserve- lighting tower Ron Routley Oval. Observed fishing in Hen and Chicken Bay, Five Dock Bay and Iron Cove during this survey
Description	The Eastern Osprey is a large, water-dependent bird of prey, distinctive in flight and when perched. Despite its wing-span of up to 1.7 m, it is noticeably smaller than the White-bellied Sea-eagle. In flight it can be recognised by its distinctly bowed wings that are dark brown above, and barred underneath, and with white underwing coverts. Perched, the upperparts are dark brown and the underparts are white. The female has a dark streaky collar. The head is mainly white with a blackish stripe through the eye.
Habitat	Favoured habitats are coastal areas, especially the mouths of large rivers, lagoons and lakes but also along the larger coastal rivers.
Diet	The Osprey is a piscivore (fish eater), foraging over open, clear water.
Biology/Breeding	Breeding habitat for this species is in close proximity to water bodies. Large nests of sticks, driftwood and bark are constructed on a range of substrates, though most commonly nests are in the upper forks or broken trunks of dead trees, or in the dead canopy of a living tree. Nest sites are used traditionally, with pair returning regularly, if not annually, to the same nest site. Ospreys will also nest on artificial structures such as communications towers and, increasingly in recentimes, on purpose-built platforms or cradles atop towers.
	Clutches tend to be 2-3 eggs, with a 35-38 day incubation period. Most of the incubation is undertaken by the female, though males will take a turn during the day. After hatching the female takes on the role of brooding, whilst the male hunts and brings food to both the female and the chicks. Once chicks are larger (approx 1 month) the female will begin to hunt. Nestling period is 71-76 days. After fledging parents continue to provide food for 2-3 months. Nesting success rates vary with location and year, averaging 0.66 young per pair per year (0.92 young per active nest) in SA and 1.1 young per active nest in NSW.
Threats (NSW OEH)	<ul> <li>Disturbance to or removal of large trees near the coast that have been or could be used as nest sites.</li> <li>Disturbances to water quality, such as from the disposal of treated effluent or stormwater runoff, that increases turbidity in feeding areas.</li> <li>Ingestion of fish containing discarded fishing tackle.</li> <li>Potential electrocution of individuals using powerline poles for nesting.</li> <li>Disturbance to active nests potentially reducing reproductive success</li> </ul>
Activities to assist the species (NSW OEH)	<ul> <li>Provide information to recreational anglers about the threat posed by discarding fish with attached or ingested fishing tackle.</li> <li>Implement pollution control measures in estuarine and foreshore areas</li> <li>Protect coastal lakes, estuaries and their foreshore vegetation.</li> <li>Protect potential nest tree sites and provide artificial nesting sites where required.</li> </ul>

\*note that modification of existing lighting pole to include platform above lighting harness (in February after fledging and before next breeding season) will assist in breeding success and the continued use of the site for breeding.



Image 73 Returning from Yaralla with a stick for the nest –May 2024

# 7.2.6 Latham's Snipe Gallinago hardwicki



Figure 36 Latham's Snipe observation during this study



Image 74 Latham's snipe flush at a dam on Concord Gold Club - Jan 2024

# Profile information from the Commonwealth Conservation Advice<sup>10</sup>

Status	EPBC Act-Vulnerable. Latham's snipe is also a listed migratory species under the EPBC Act. The species is listed on the Japan-Australia Migratory Bird Agreement (JAMBA), China-Australia Migratory Bird Agreement (CAMBA) and the Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA).
Other Common Names	Japanese Snipe
City of Canada Bay	Flushed at a dam on Concord Golf Club Feb 2024
Description	Latham's snipes are 29–33 cm long, have a wingspan of 50–54 cm, and weigh 150–230 g. It is a medium sized wader with a long, straight bill; rather short, broad, pointed wings; a long tail, and short legs. The species shows no sexual dimorphism and only demonstrates slight seasonal variation in plumage. Juveniles appear slightly different to adults.
Habitat	Latham's snipe can roost singly and in aggregations. They shelter during the day in small wetlands including urban water bodies, saltmarshes, as well as creek edges, where there is adequate shallow flooded or inundated substrate. They also use crops and pasture. They mostly are found among dense cover comprising sedges, grasses, lignum, reeds, and rushes. The bird tends to disperse after dusk to forage over larger areas.
Diet	Latham's snipe feed in soft mudflats or shallow water typically at night, early morning, or evening (BirdLife Australia 2021).  The species is omnivorous and feeds on seeds and other plant material (mainly from species in families such as Cyperaceae, Poaceae, Juncaceae, Polygonaceae, Ranunculaceae and Fabaceae), and on invertebrates including insects (mainly flies and beetles), earthworms, spiders, and occasionally molluscs, isopods, and centipedes (Frith et al. 1977; Todd 2000). The species feeds by thrusting its long bill into mud with an up and down 'sewing machine' action.
Biology/Breeding	Latham's snipes breed in Hokkaido and highland areas of Honshu in Japan, and in Sakhalin and the nearby Kuril Islands of far eastern Russia. Breeding occurs in a variety of grassland habitats including meadowlands, croplands, dry reed and sedge fields, clearings and edges of woodland, and low-density urban fringes (Higgins & Davies 1996; Ura 2007; RDBSO 2016) Nests are constructed within shallow depressions, which are lined with grasses and leaves (BirdLife Australia 2021). Egg laying occurs between May to early June, with typical clutch sizes of 4 eggs (range 2–5; del Hoyo et al 1996). The female takes sole responsibility of incubation duties. Observational studies suggest that their incubation and nestling period is around 20 days (del Hoyo et al. 1996)
Migration	Latham's snipe is a migratory species. It breeds in Japan and in far eastern Russia during the boreal summer, and then migrates to Australia, where it remains for the duration of the boreal winter.  Southern passage: Latham's snipe depart their breeding grounds from July to November (Naarding 1985; Higgins & Davies 1996) and arrive in northern Australia from late July to early August onwards (Frith et al. 1977; Higgins & Davies 1996). Individuals then move southward, passing along the coastline (Frith et al. 1977; Storr 1984) and arriving in south-eastern Australia between August and November (Naarding 1982, 1983; Lane 1987; Higgins & Davies 1996). Most

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 $<sup>^{10}\</sup> https://www.environment.gov.au/biodiversity/threatened/species/pubs/863-conservation-advice-05012024.pdf$ 

individuals are found south of the Richmond River in New South Wales (Frith et al. 1977), and few (if any) remain in northern Australia over the southern summer (Lane 1987; Higgins & Davies 1996). Northern passage: Most Latham's snipes depart the non-breeding areas in south-eastern Australia by late February or early March (Frith et al. 1977; Naarding 1982, 1983). Individuals travel north along the coasts of New South Wales and Queensland (Storr 1984) from February to April. Most birds depart northern Queensland by mid-April (Bravery 1964; Gill 1970; Frith et al. 1977), arrive in Japan in April (Wolfe 1954; Naarding 1984, 1985), and in Russia in April and May (Higgins & Davies 1996).

The species has also been reported to persist in Australia during the southern winter (i.e., the breeding season); these records are probably of immature birds or birds that are incapable of

migrating because of being in a poor condition (Naarding 1981, 1982)

### 7.2.7 Australian Pied Oystercatcher Haematopus longirostris

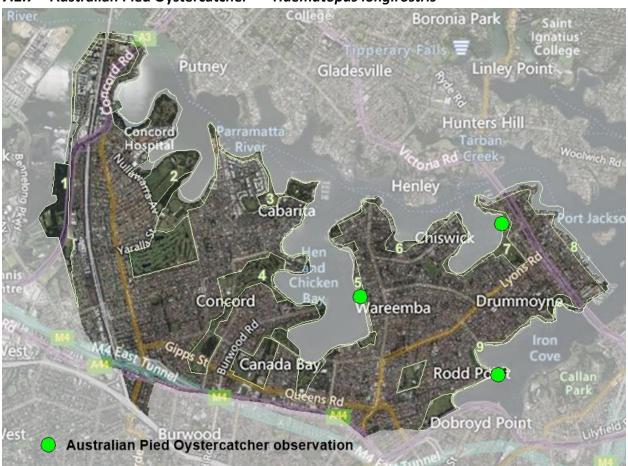


Figure 37 Australian Pied Oystercatcher observations during this study



Image 75 Australian Pied Oystercatcher – Rodd Point- April 2024

# Profile information from OEH profile $^{11}$

Status	BC Act 2016 Vulnerable
Distribution	The species is distributed around the entire Australian coastline, although it is most common in coastal Tasmania and parts of Victoria. In NSW the species is thinly scattered along the entire coast, with fewer than 200 breeding pairs estimated to occur in the State.
City of Canada Bay	A pair sighted at Rodd Point and Wynstrom Parade foreshore, also single bird at Five Dock Bay- autumn 2024
Description	The Pied Oystercatcher is an unmistakable, large, black and white wader, reaching 50 cm in length. The sexes are similar, yet may be separable when together with the female having a slightly longer, more slender bill.
Habitat	Favours intertidal flats of inlets and bays, open beaches and sandbanks.
Diet	Forages on exposed sand, mud and rock at low tide, for molluscs, worms, crabs and small fish. The chisel-like bill is used to pry open or break into shells of oysters and other shellfish.
Biology/Breeding	Nests mostly on coastal or estuarine beaches although occasionally they use saltmarsh or grassy areas. Nests are shallow scrapes in sand above the high tide mark, often amongst seaweed, shells and small stones.  Two to three eggs are laid between August and January. The female is the primary incubator and the young leave the nest within several days.
Threats (NSW OEH)	<ul> <li>Predation of eggs and chicks by foxes.</li> <li>Disturbance of nesting shorebirds and direct mortality of eggs and chicks by trampling or removal by humans.</li> <li>Disturbance of nesting shorebirds and direct predation of eggs and chicks by dogs.</li> <li>Inundation of nests by high tides, storms and other flooding.</li> </ul>

<sup>&</sup>lt;sup>11</sup> https://threatenedspecies.bionet.nsw.gov.au/profile?id=10386

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	<ul> <li>Predation of eggs and chicks by avian predators (mostly corvids and gulls).</li> <li>Loss or degradation of habitat (e.g. nesting areas and foraging areas) due to hydrological changes in estuaries.</li> <li>Degradation of habitat due to contamination of estuaries by urban and agricultural run-off, sediment re-suspension and oil-spills.</li> <li>Reduction of nesting area due to encroachment of vegetation.</li> <li>Entanglement in or ingestion of marine debris.</li> <li>Long-term declines of a key food source, the Pipi, as a result of overharvesting.</li> </ul>
Activities to assist the species (NSW OEH)	<ul> <li>Undertake fox, feral cat and Australian Raven control programs.</li> <li>Assess the appropriateness of dog and cat ownership in new subdivisions.</li> <li>Manage estuaries and the surrounding landscape to ensure the natural hydrological regimes are maintained.</li> <li>Install interpretive signs at major nesting sites.</li> <li>Protect and maintain known or potential habitat, including the implementation of protection zones around known habitat sites and sites of recent records.</li> </ul>

#### 7.2.8 Powerful Owl Ninox strenua



Figure 38 Powerful Owl observations during this study



Image 76 Powerful Owl adult male-Applied Ecology 2023

# Profile information from OEH profile and listing information 12

Status	BC Act 2016 Vulnerable
Distribution	The Powerful Owl is endemic to eastern and south-eastern Australia, mainly on the coastal side of the Great Dividing Range from Mackay to south-western Victoria.
City of Canada Bay	Present/hunting in Timbrell Park during spotlighting. Bushcare volunteers report seeing single birds occasionally at night – perched on street lights, in their backyards etc. High densities of Common Ringtail Possums and Common Brushtail Possums in some locations undoubtedly attract Powerful Owls to the LGA at night. No suitable breeding hollows for Powerful Owls were observed during this survey.
Description	The Powerful Owl is the largest owl in Australasia. It is a typical hawk-owl, with large yellow eyes and no facial-disc. Adults reach 60 cm in length, have a wingspan of up to 140 cm and weigh up to 1.45 kilograms. Males are larger than females. The upper parts of the Powerful Owl are dark, greyish-brown with indistinct off-white bars. The underparts are whitish with dark greyish-brown V-shaped markings.
Habitat	Mates for life (over 30 years in some cases) and pairs defend exclusive nesting territories within larger, defended home ranges of 400-4000 ha, depending on habitat quality and prey densities. Habitat modelling in the Sydney basin was undertaken by Bain et al. (2014) using data collected by the Birdlife Australia's "Powerful Owl Project" revealing pairs in high density breeding site areas (including the LGAs directly across the river from Canada Bay) is one site (one pair of owls) per 569 ha of modelled foraging habitat.
Diet	The Powerful Owl is a carnivore, eating mainly medium to large tree-dwelling mammals, particularly the Common Ringtail Possum and various gliders. It will also take roosting birds, flying-foxes and sometimes small ground-dwelling mammals. It forages mainly in trees, attacking silently, taking prey with its feet. Most of the prey biomass for the species is from mammals (Higgins 1999; Kavanagh 2002a).
Biology/Breeding	Powerful Owls nest in large hollows up to 1 m wide and 2 m deep in big old trees (usually alive but sometimes dead). The male prepares the nest. A clutch of usually two eggs is laid in autumn to winter, with a single attempt per year. The incubation period is 38 days. The female incubates the eggs and broods the young. The nestling period is two months, and the male provides the female and young with a constant supply of food during the early part of this nesting period with the female emerging later in the nesting period to hunt for food along with the male .  Young birds remain with the parents for several months after fledging and may stay within their parents' territory for over a year. Breeding productivity is 0.4-1.4 young per pair per year, depending on habitat quality (low in dry, fragmented inland forest, high in productive coastal forest).
Selected Threats (NSW OEH)	<ul> <li>Road kills.</li> <li>Secondary poisoning.</li> <li>Predation of fledglings by foxes, dogs and cats</li> </ul>

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<sup>&</sup>lt;sup>12</sup> https://threatenedspecies.bionet.nsw.gov.au/profile?id=10562

Activities to assist the species (NSW OEH)

- Retain large stands of native vegetation, especially those containing hollow-bearing trees.
- Protect riparian vegetation to preserve roosting areas.
- Protect hollow-bearing trees for nest sites. Younger recruitment trees should also be retained to replace older trees in the long-term.
- Retain at least a 200 metre buffer of native vegetation around known nesting sites.
- Assess the importance of the site to the species' survival. Include the linkages the site provides for the species between ecological resources across the broader landscape.

### 7.2.9 White-bellied Sea-eagle Haliaeetus leucogaster



Figure 39 White-bellied Sea-eagle observation during this study



Image 77 White-bellied Sea-eagle over Majors Bay Reserve -keenly watching the Eastern Ospreys nest-building efforts – May 2024.

# Profile information from OEH profile<sup>13</sup>

Status	BC Act 2016 Vulnerable
Distribution	The White-bellied Sea-eagle is distributed around the Australian coastline, including Tasmania, and well inland along rivers and wetlands of the Murray Darling Basin.
	In New South Wales it is widespread along the east coast, and along all major inland rivers and waterways.
City of Canada Bay	Observed over Majors Bay- known to take fish from the resident Eastern Osprey pair (pers comm- Birdlife volunteer)
Description	The White-bellied Sea-Eagle is a large eagle that has long broad wings and a short, wedge-shaped tail. It measures 75–85 cm in length, and has a wingspan of 180–220 cm. Adults are predominantly white and grey.
Habitat	Habitats are characterised by the presence of large areas of open water including larger rivers, swamps, lakes, and the sea.

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<sup>&</sup>lt;sup>13</sup> https://threatenedspecies.bionet.nsw.gov.au/profile?id=20322

Biology/Breeding  In subtropical eastern NSW White-bellied Sea-eagles nest at least 22 human settlements (mean 460 m, O'Donnell and Debus 2012). Spend Lynch (2005) report the White-bellied Sea-eagle avoids nesting near Nests may be abandoned if disturbed (Debus et al. 2014; DoE 2015). large stick nest, which is used for many seasons in succession. The new located in a tree up to 30m above the ground, but may also be place ground or on rocks, where there are no suitable trees. At the start of breeding season, the nest is lined with fresh green leaves and twigs.  Threats (NSW OEH)  In coastal areas potential threats to foraging resources includegradation or reclamation of saltmarsh, mangroves, sea grother riparian or shallow water vegetation resulting in loss of nursery habitats and food resources.  Increased mortality due to entanglement in discarded fishing entanglement in fish farm nets.  Increased mortality or reduced breeding success due to nor poisoning during vertebrate pest control, exposure to indust chemicals and pesticides used for agriculture (directly or incomposition of the protect known populations and areas of potential habitat for fragmentation or disturbance.  Protect known populations and areas of potential habitat for fragmentation or disturbance.  Establish 'buffer zones' around nest sites to limit disturbance or human activity. Where nests are located in extensive under the protect of the	es, but it takes ey up to the
degradation or reclamation of saltmarsh, mangroves, sea grother riparian or shallow water vegetation resulting in loss of nursery habitats and food resources.  Increased mortality due to entanglement in discarded fishing entanglement in fish farm nets.  Increased mortality or reduced breeding success due to nor poisoning during vertebrate pest control, exposure to indust chemicals and pesticides used for agriculture (directly or incomposed through prey), and deliberate poisoning.  Activities to assist the species (NSW OEH)  Protect known populations and areas of potential habitat from fragmentation or disturbance.  Establish 'buffer zones' around nest sites to limit disturbance.	encer and areas 5). The nest is a nest can be ced on the of the
species (NSW OEH) fragmentation or disturbance. • Establish 'buffer zones' around nest sites to limit disturbance	grass and sis of fish ning gear, and on-target ustrial
bushland a minimum buffer distance of 500m should be ma Where nests are located closer to existing developments a r buffer distance of 250m should be maintained, along with a undisturbed corridor at least 100m wide extending from the nearest foraging grounds.	nce by human Indisturbed maintained. a minimum n an

Image 78 White-bellied Sea-eagle over Majors Bay Reserve – May 2024.

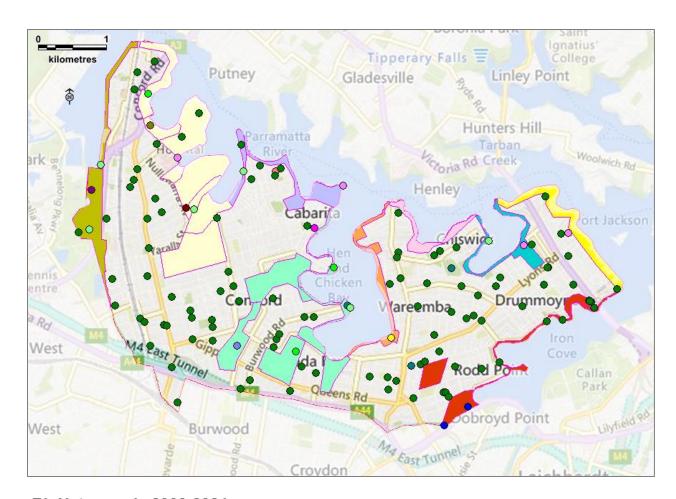
# 7.3 Threatened and listed migratory species records

The table below lists species, and the number of records, recorded in BioNet and the Atlas of Living Australia (ALA) from 01/01/2000 to 30/04/2024. ALA records include BioNet records and records from public databases such as ebird and inaturalist.

Table 18 Threatened and listed migratory species BioNet 2000-2024

Class			NSW	Comm	Count	Count
Name	Common Name	Scientific Name	Status	Status	BioNet	ALA
Aves	Fork-tailed Swift	Apus pacificus	Р	C,J,K	1	2
Aves	Australasian Bittern	Botaurus poiciloptilus	E1,P	E	1	1
Aves	Bush Stone-curlew	Burhinus grallarius	E1,P		3	9
Aves	Sharp-tailed Sandpiper	Calidris acuminata	Р	C,J,K		3
Aves	Red Knot	Calidris canutus	Р	V,C,J,K		3
Aves	Curlew Sandpiper	Calidris ferruginea	E1,P	CE,C,J,K	2	5
Aves	Speckled Warbler	Chthonicola sagittata	V,P			1
Aves	Little Lorikeet	Glossopsitta pusilla	V,P		5	
Aves	Pied Oystercatcher	Haematopus longirostris		E		6
Aves	White-bellied Sea-Eagle	Haliaeetus leucogaster	V,P		7	42
Aves	White-throated Needletail	Hirundapus caudacutus	V,P	V,C,J,K	1	8
Aves	Swift Parrot	Lathamus discolor	E1,P	CE	1	1
Aves	Bar-tailed Godwit	Limosa lapponica	Р	C,J,K	9	
Aves	Square-tailed Kite	Lophoictinia isura	V,P			2
Aves	Powerful Owl	Ninox strenua	V,P,3		1	
Aves	Eastern Osprey	Pandion cristatus	V,P			16
Aves	Pacific Golden Plover	Pluvialis fulva	Р	C,J,K		3
Aves	Crested Tern	Thalasseus bergii	Р	J	1	
Aves	Common Sandpiper		Р	C,J,K		1
		Miniopterus orianae				
Mammalia	Eastern Bent-winged Bat	oceanensis	V,P		1	1
Mammalia	Southern Myotis	Myotis macropus	V,P		6	5
	Long-nosed Bandicoot					
Mammalia	population in inner	Perameles nasuta	E2,P		2	4
	western Sydney		<u> </u>	E	3	4
Mammalia	Koala	Phascolarctos cinereus	E1,P	E	1	1
Mammalia	Eastern Chestnut Mouse	Pseudomys gracilicaudatus	V,P	.,	1	1
Mammalia	Grey-headed Flying-fox	Pteropus poliocephalus	V,P	V	214	212

The distribution of BioNet records is provided in Figure 40 overleaf.



# BioNet records 2000-2024 Threatened and Listed Migratory species



Figure 40 Threatened and listed migratory species BioNet 2000-2024

The very low numbers of most threatened and migratory species recorded makes it difficult to determine if there are observable trends in presence/absence over time. Reporting numbers for 5-year intervals are tabled overleaf-with Grey-headed Flying-foxes constituting 83% of BioNet records and 65% of ALA records, with the White-bellied Sea-eagle contributing a further 13% of ALA records. Most of the threatened species (81%), and all of the migratory species, are capable of flight so their sporadic presence in the LGA may continue. Eastern Osprey and White-bellied Sea-eagles breed in and near the LGA respectively, so reporting rates via eBird and Birdlife should remain around the same while breeding pair presence continues. The proximity of the Hunters Hill Flying-fox colony, with individuals

flying into the Canada Bay LGA to feed in the parks and reserves and in street trees, should maintain the current high reporting rates (often through WIRES records when the animals require assistance).

Table 19 Records by five year intervals 2000-2024 BioNet and Atlas of Living Australia record.

Period	BioNet # of records	ALA # records
2000-2005	4	5
2006-2010	7	25
2011-2015	75	82
2016-2020	138	149
2021-2024	34	69
Total	258	330

ALA records were used to create graphs of observation frequency by year by species. These are presented in Figure 41-Figure 61.

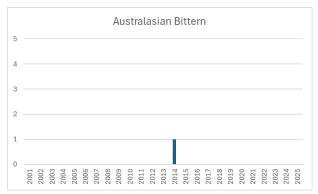


Figure 41 Australasian Bittern records ALA 2000-2024

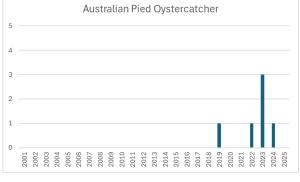


Figure 42 Australian Pied Oystercatcher records ALA 2000-2024

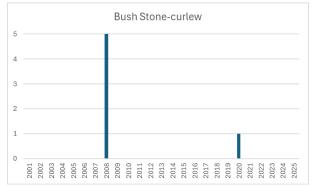


Figure 43 Bush Stone-curlew records ALA 2000-2024

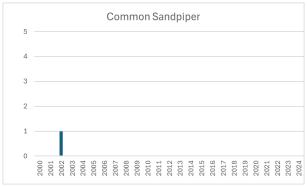


Figure 44 Common Sandpiper records ALA 2000-2024

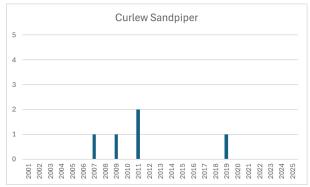


Figure 45 Curlew Sandpiper records ALA 2000-2024

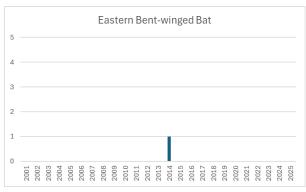


Figure 46 Eastern Bent-winged Bat records ALA 2000-2024

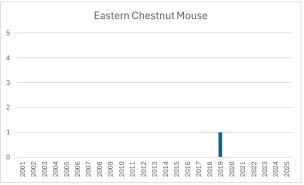


Figure 47 Eastern Chestnut Mouse records ALA 2000-2024

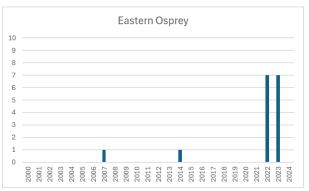


Figure 48 Eastern Osprey records ALA 2000-2024

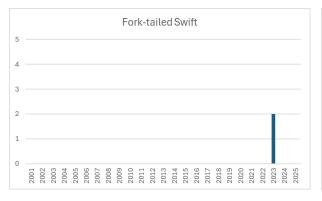


Figure 49 Fork-tailed Swift records ALA 2000-2024

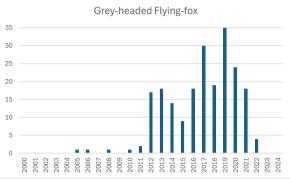
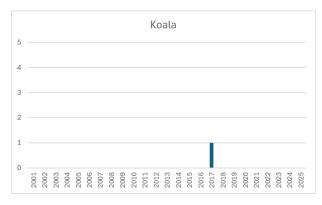


Figure 50 Grey-headed Flying-fox records ALA 2000-2024



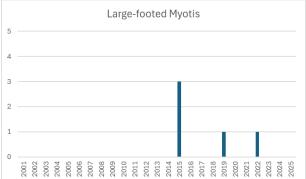
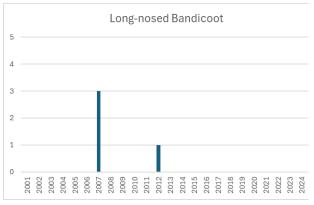


Figure 51 Koala records ALA 2000-2024

Figure 52 Large-footed Myotis records ALA 2000-2024



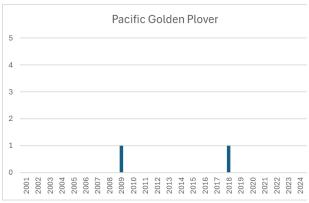
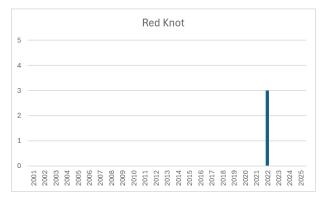


Figure 53 Long-nosed Bandicoot ALA 2000-2024

Figure 54 Pacific Golden Plover records ALA 2000-2024



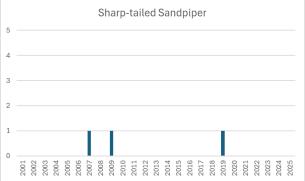
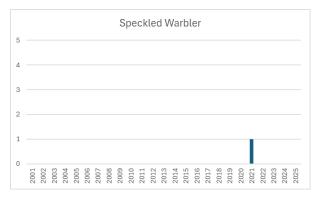


Figure 55 Red Knot records ALA 2000-2024

Figure 56 Sharp-tailed Sandpiper records ALA 2000-2024



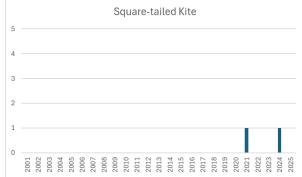
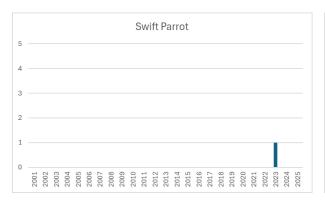


Figure 57 Speckled Warbler records ALA 2000-2024

Figure 58 Square-tailed Kite records ALA 2000-2024



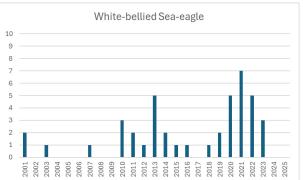


Figure 59 Swift Parrot records ALA 2000-2024

Figure 60 White-bellied Sea-eagle records ALA 2000-2024

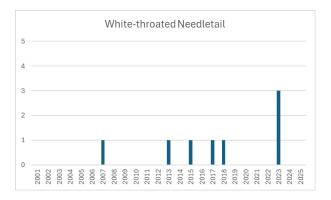


Figure 61 White-throated Needletail records ALA 2000-2024

# 7.4 Other fauna survey results

#### 7.4.1 Scat Collection

A total of 15 fox scats were collected during the project. Red Foxes were detected on remote cameras, but scats were hard to find initially. Red Foxes often use scats as markers in their territories, so scats are often in prominent places – along tracks and animal pads and the 'edges" where one habitat type meets another. More likely is that Red Foxes were using the intertidal area to move around the foreshore reserves. Scats were analyzed by Georgeanna Story from "Scatsabout", an expert in this field.

Most of the fox scats had a mix of food types – Common Ringtail Possums were the most common vertebrate fauna detected (one third of scats) mixed with the occasional bird, invertebrates (particularly beetles) and vegetable matter. Surprisingly Black Rat was only present in one scat.



Image 79 Red Fox at Majors Bay Reserve – January 2024



Image 80 Fox diggings (for invertebrates) in the mown grass Majors Bay Reserve-left; Fox scats collected at Yaralla Estate and Eadith Walker Estate — centre and right.

### 7.4.2 Hair Analysis

Very few hairtubes collected hair samples- noting that all were set in the intertidal zone or seawalls in an effort to detect Rakali. Two samples were sent for analysis – and both were Red Fox.

## **7.5** Flora survey results

Surveys were broadly divided into two categories:

- Species inventory for reserves and ground truthing of extant vegetation
- Foreshore surveys for saltmarsh

A total of 51 'reserves' were surveyed, including two golf courses and 5 schools. Many of the reserves included areas of playing fields or other mown open space, and several are on land owned by NSW Health. These reserves are described in detail in Appendix A.

#### 7.5.1 Ground truthing of vegetation

Results of species inventories are provided in Table 20. Descriptions of the vegetation in each reserve is provided in a separate section of this report.

Greatest floristic diversity was observed in Brett Park, largely as a result of extensive revegetation planting. Queen Elizabeth Park had a similar level of diversity but started with more natural vegetation and this was supplemented with species appropriate for the extant vegetation community. Both these reserves have extensive ongoing management. The diversity was very high in a number of reserves with minimal management in areas of vegetation, including all the land currently managed by NSW Health. Species richness recorded in reserves was primarily influenced by several factors: size of the vegetated area, area and health of remnant vegetation, extent and appropriateness of revegetation planting. Foreshore areas have inherently lower levels of species richness because of the nature of the vegetation communities found in this area.

Table 20 Summary of species richness for reserves surveyed in City of Canada Bay, 2023/4

CORRIDOR	RESERVE	NATIVE	THREATENED	INTRODUCED	PRIORITY CONTROL
#2	Brett Park	89	0	35	1
#5	Queen Elizabeth Park	87	0	31	2
#6	Rivendell Park	73	0	37	7
#1	Arthur Walker Reserve	64	0	24	3
#9	Yaralla East	64	0	31	7
#9	Yaralla West	57	0	30	5
#4	Powells Creek parks	54	0	41	4
#5	Quarantine Reserve	54	0	32	2
#3	Kokoda Track	52	1	18	1
#9	Wangal Reserve	45	0	11	1
#6	Rothwell Park	44	0	23	0
#9	St Lukes Park	44	0	34	0
#2	Cabarita Park	43	0	28	4
#2	Concord High School	43	0	29	1
#2	Figtree Bay Reserve	41	0	16	1
#2	Henry Lawson Park	39	0	30	2
#6	Rhodes Park	37	1	16	3
#9	Timbrell Park	34	0	32	1
#2	Concord Golf Course	30	1	20	2
#2	Half Moon Bay	30	0	28	3
#6	Rodd Park	29	0	8	0
#9	Wiremill Reserve	29	0	24	1
#3	Lovedale Place	26	0	19	0
#5	Prince Edward Park	26	0	14	0
#3	Lewis Berger Park	25	0	17	2
#4	McIllwaine Park	25	0	17	1
#1	Bayview Park	23	0	20	0
#7	Sisters Bay	23	0	18	3
#9	Werrell Reserve	23	0	22	2
#9	Yaralla Point	23	0	34	6
#4	Montrose St Reserve	20	0	22	3
#1	Bay Run (below Brett Park)	18	0	12	0
#2	Cintra Park	18	0	19	0
#2	Drummoyne Park	18	0	18	1
#5	Powells Creek Reserve	18	0	10	1
#9	Strathfield North Public School	18	0	8	1
#2	Bicentennial Park	17	0	12	2
#2	Brays Bay Park	17	0	11	0
#4	Mortlake Public School	16	0	16	1
#2	Iron Cove Bay Run north	14	0	10	1

CORRIDOR	RESERVE	NATIVE	THREATENED	INTRODUCED	PRIORITY
					CONTROL
#6	Russell Lea Primary School	14	0	6	0
#4	Majors Bay Rd park	12	0	8	0
#4	Majors Bay Reserve	12	0	10	1
#4	Mayne Lane foreshore	12	0	24	5
#2	Five Dock Park	10	0	5	0
#2	Halliday Park/Wymston Pde	9	0	11	2
#2	Iron Cove Bay Run south	9	0	14	1
#9	Waterfront Park	6	0	12	3
#3	Majors Bay eastern foreshore	5	0	6	0
#4	Massey Park Golf Course	4	0	4	0
#1	Abbotsford Public School	1	0	12	0

Species richness for native flora species was then compared to the diagnostic criteria for each mapped PCT/Map Unit (Table 21). When there was no PCT or Map Unit indicated in the vegetation mapping, reference was made to the pre 1750 vegetation mapping. Many of the reserves had more than one PCT mapped and/or present, and some had multiple patches of several PCTs. Where appropriate these were also tested against diagnostic criteria. Vegetation patches with extensive planting did not always comply with the diagnostic criteria for the relevant PCT. Care should be taken not to over-interpret a positive diagnostic test result if this is based solely or primarily on revegetation plantings – these are not considered part of a PCT but should be considered as important supplementary buffer components. The PCT also includes other components of the ecosystem, including soil biota and terrestrial invertebrates that are important in fertilization, spread of plant propagules and nutrient cycling.

Table 21 Results of comparison with diagnostic criteria for each mapped PCT in each surveyed reserve

RESERVE	PRE	MAPPED	PCT to	MAP	DIAG	DIAG	TOTAL	TOTAL	COMPLIES?
	1750	PCT	test	UNIT	REQD?	COUNT	REQD	COUNT	
Abbotsford PS	3262	3262	3262	S_DSF06	20		35		no
Arthur Walker Reserve	3262		3262	S_WSF09	20	33	35	64	yes
Arthur Walker Reserve	3594		3594	S_DSF06	14	12	28	64	no, mostly planted
Bayview Park	3594	N/A	3594	S_DSF06	14	2	28	23	no, planted
Bayview Park	4091	4091	4091	S_SW01	N/A	1	N/A	1	yes
Bicentennial Park	4091	4091	4091	S_SW01	N/A	1	N/A	1	yes
Bicentennial Park	N/A	N/A	4097	S_SW02	1	3	1	4	yes
Brays Bay Reserve	3594	3594	3594	S_DSF06	14	2	28	17	no, planted
Brett Park	3594	3594	3594	S_DSF06	14	21	28	88	yes
Brett Park	4028	4028	4028	S_FoW08	1	4	5	23	yes
Cabarita Park	3594	N/A	3594	S_DSF06	14	12	28	43	no, mostly planted
Cabarita Park	3594	N/A	3594	S_DSF06	14	12	28	43	no, mostly planted
Cabarita Park	3594	N/A	3594	S_DSF06	14	12	28	43	no, mostly planted
Cabarita Park	4097	4097	4097	S_SW02	1	5	1	5	yes
Cintra Park	3262	N/A	3262	S_WSF09	20	3	35	18	planted
Cintra Park	4091	N/A	N/A	N/A					landfill
Concord Golf Course	3594	3594	3594	S_DSF06	14	6	28	30	relict, planted
Concord Golf Course	3262	3262	3262	S_WSF09	20	6	35	30	relict, planted
Concord Golf Course	4097	N/A	4097	S_SW02	1	4	1	5	yes
Concord Golf Course			4028	S_FoW08	1	3	1	4	yes
Concord High School	3262	N/A	3262	S_WSF09	20	13	35	44	relict
Drummoyne Park	3594	N/A	3594	S_DSF06	14	9	28	18	relict
Drummoyne Park	3594			S_DSF06					no
Figtree Bay Reserve	3594	N/A	3594	S_DSF06	14	11	28	41	relict, planted
Five Dock Bay	3594	N/A	4091	S_SW01	N/A		N/A		no
Five Dock Park	3262	N/A	3262	S_WSF09	20	2	35	10	planted
Half Moon Bay Foreshore	3594	3594	3594	S_DSF06	14	11	28	30	relict
Half Moon Bay Foreshore	4097	4097	4097	S_SW02	1	6	1	7	yes
Half Moon Bay Foreshore	4091	4091	4091	S_SW01	N/A	1	N/A	1	yes

RESERVE	PRE	MAPPED	PCT to	MAP	DIAG	DIAG	TOTAL	TOTAL	COMPLIES?
	1750	PCT	test	UNIT	REQD?	COUNT	REQD	COUNT	
Henry Lawson Park	3594	3594	3594	S_DSF06	14	14	28	40	yes
Henry Lawson Park	3594	3594	3594	S_DSF06	14	14	28	40	yes
Iron Cove north (1)	4091	4091	4091	S_SW01	N/A	1	N/A	1	yes
Iron Cove north (1)		4097	4097	S_SW02	1	5	3	7	yes
Iron Cove south (1)	4091	4091	4091	S_SW01	N/A	1	N/A	1	yes
Iron Cove south (2)	4097	4097	4097	S_SW02	1	4	3	9	yes
Kokoda Track	4091	4091	4091	S_SW01	N/A	1	N/A	1	yes
Kokoda Track	4097	4097	4097	S_SW02	1	6	1	8	yes
Kokoda Track	4028	4028	4028	S_FoW08	1	5	5	7	yes
Kokoda Track	3594	3594	3594	S_DSF06	14	11	28	52	marginal
Kokoda Track	3448	3448	3448	S_DSF01	20	5	35	52	planted
Lewis Berger Park	4091	4091	4091	S_SW01	N/A	1	N/A	1	yes
Lewis Berger Park		4097	4097	S_SW02	1	6	3	25	yes
Lewis Berger Park		N/A	3594	S_DSF06	14	8	28	20	planted
Lewis Berger Park		N/A	3262	S_WSF09	20	9	35	20	planted
Lovedale Place	3448	N/A	N/A	N/A				8	planted
Lovedale Place	4028	4028	4028	S_FoW08	1	5	1	7	
Majors Bay Foreshore	N/A	3594	3594	S_DSF06	14	2	28	12	landfill
Majors Bay Foreshore	N/A	3594	3594	S_DSF06	14	3	28	12	landfill
Majors Bay Foreshore	4091	4091	4091	S_SW01	N/A	1	N/A	1	yes
Majors Bay Foreshore	4097	4097	4097	S_SW02	1	4	3	9	yes
Majors Bay Reserve			3594	S_DSF06	14	5	28	12	planted
Majors Bay Reserve	4091	4091	4091	S_SW00	N/A	0	N/A	0	landfill
Majors Bay Reserve	4091	4091	4091	S_SW01	N/A	1	N/A	1	yes
Massey Park GC	4091	N/A	N/A	N/A					landfill
Mayne Lane Reserve	3594	N/A	N/A	N/A					cleared
Mayne Lane Reserve	4091	4091	4091	S_SW01	N/A	1	N/A	1	yes
Mayne Lane Reserve		4097	4097	S_SW02	1	5	3	12	yes
McIlwaine Park	3594	3594	3594	S_DSF06	14	5	28	25	planted
Montrose Rd Reserve	3594	N/A	3594	S_DSF06	14	7	28	20	planted
Mortlake PS	3262	N/A	3262	S_WSF09	20	5	35	16	relict

RESERVE	PRE	MAPPED	PCT to	MAP	DIAG	DIAG	TOTAL	TOTAL	COMPLIES?
	1750	PCT	test	UNIT	REQD?	COUNT	REQD	COUNT	
Northcote Rd Reserve	4091	4091	4091	S_SW01	N/A	1	N/A	1	yes
Powells Creek parks	3262	N/A	3262	S_WSF09	20	12	35	53	planted
Powells Creek parks	4097	N/A	4097	S_SW02	1	6	1	10	yes
Powells Creek parks	N/A	N/A	4028	S_FoW08	1	3	1	10	yes
Powells Creek Reserve	4091	4091	4091	S_SW01	N/A	1	N/A	1	yes
Powells Creek Reserve	N/A	N/A	4028	S_FoW08	1	2	1	3	yes
Powells Creek Reserve	N/A	N/A	4097	S_SW02	1	4	1	5	yes
Prince Edward Park	4097	4097	4097	S_SW02	1	6	1	6	yes
Prince Edward Park	3594	3594	3594	S_DSF06	14	3	28	26	planted
Quarantine Reserve	3594	3594	3594	S_DSF06	14	14	28	52	yes
Quarantine Reserve	3594	3594	3594	S_DSF06	14	14	28	52	yes
Quarantine Reserve		N/A	4028	S_FoW08	1	3	5	10	yes
Quarantine Reserve		N/A	4028	S_FoW08	1	3	5	10	yes
Quarantine Reserve		N/A	4091	S_SW01	N/A	1	N/A	2	yes
Quarantine Reserve		N/A	4091	S_SW01	N/A	1	N/A	2	yes
Quarantine Reserve		N/A	4097	S_SW02	1	4	3	4	yes
Queen Elizabeth Park	3262	3262	3262	S_WSF09	20	32	35	79	yes
Rhodes Park	3594	3594	3594	S_DSF06	14	6	28	37	planted
Rhodes Park	3448	3448	3448	S_DSF01	20	3	35	37	planted
Rivendell Point	4091	4091	4091	S_SW01	N/A	1	N/A	1	yes
Rivendell Point P1	3262	3262	3262	S_WSF09	20	12	35	38	yes
Rivendell Point P2	3594	3594	3594	S_DSF06	14	10	28	30	marginal
Rivendell Point P3	3262	3262	3262	S_WSF09	20	19	35	28	marginal
Rivendell Point west	4028	4028	4028	S_FoW08	1	5	5	10	yes
Rodd Point Park	3594	3594	3594	S_DSF06	14	6	28	29	planted
Rodd Point Park	3594	3594	3594	S_DSF06	14	6	28	29	planted
Rodd Point Park	3594	3594	3594	S_DSF06	14	6	28	29	planted
Rothwell Park	3262	N/A	3262	S_WSF09	20	22	35	44	yes
Russell Lea PS	3262	N/A	3262	S_WSF09					no
Sisters Bay Foreshore	3594	3594	3594	S_DSF06	14	8	28	23	relict
Sisters Bay Foreshore	4028	4028	4028	S_FoW08	1	4	5	23	yes

RESERVE	PRE	MAPPED	PCT to	MAP	DIAG	DIAG	TOTAL	TOTAL	COMPLIES?
	1750	PCT	test	UNIT	REQD?	COUNT	REQD	COUNT	
Sisters Bay Foreshore	4091	4091	4091	S_SW01	N/A	1	N/A	1	yes
Sisters Bay Run	3594	3594	3594	S_DSF06	14	6	28	18	relict
St Lukes Park	3262	N/A	3262	S_WSF09	20	15	35	44	mostly planted
Strathfield North PS	3262	N/A	3262	S_WSF09	20	8	35	18	relict
Timbrell Park	4091	N/A	N/A	N/A					landfill
Timbrell Park	4097	N/A	N/A	N/A					landfill
Timbrell Park	3594	N/A	3594	S_DSF06	14	8	28	34	planted
Wangal Reserve	3594	3594	3594	S_DSF06	14	10	28	44	planted
Werrell Park	3594	N/A	3594	S_DSF06	14	8	28	23	planted
Wiremill Reserve	3594	3594	3594	S_DSF06	14	10	28	29	planted
Yaralla East	3594	3594	3594	S_DSF06	14	14	28	46	yes
Yaralla East	3594	3594	3594	S_DSF06	14	14	28	46	yes
Yaralla East	3262	3262	3262	S_WSF09	20	37	35	64	yes
Yaralla Estate	3594	N/A	3594	S_DSF06	14	3	28	23	planted
Yaralla Estate	3594	N/A	3594	S_DSF06	14	3	28	23	planted
Yaralla Estate	3594	N/A	3594	S_DSF06	14	3	28	23	planted
Yaralla Estate	3262	N/A	3262	S_WSF09	20	6	35	23	planted
Yaralla Estate	4028	4028	4028	S_FoW08	1	4	5	23	yes
Yaralla Estate	4028	4028	4028	S_FoW08	1	4	5	23	yes
Yaralla Estate	4028	4028	4028	S_FoW08	1	4	5	23	yes
Yaralla Estate	4028	4028	4028	S_FoW08	1	4	5	23	yes
Yaralla Estate	4028	4028	4028	S_FoW08	1	4	5	23	yes
Yaralla Estate	4028	4028	4028	S_FoW08	1	4	5	23	yes
Yaralla Estate	4097	4097	4097	S_SW02	1	5	3	23	yes
Yaralla West	3262	3262	3262	S_WSF09	20	26	35	37	Yes

# 7.6 Threatened Flora Species

Threatened flora species appear to be poorly recorded for City of Canada Bay. A review of records held by BioNet (NSW Wildlife Atlas) show three species recorded in the LGA (Table 22, Figure 62), with another 86 species 'known' or 'predicted' to be present. In reality, it is highly unlikely that any of these species would be present. However, it is also possible that some species occurrence records have not been transferred to BioNet since there has been an observation of *Wilsonia backhousei* on Brays Bay foreshore (Lovedale Place) in 2008 recorded by Maunsell/AECOM. *Wilsonia backhousei* is a species with potential to occur on foreshore areas of City of Canada Bay.

Table 22 NSW Wildlife Atlas (BioNet) threatened flora species records for City of Canada Bay LGA (all records for all years)

COMMON NAME	SPECIES NAME	NSW	FED	RECORD	RECORD
COMMON NAME	SPECIES INAIVIE	STATUS	STATUS	COUNT	YEAR
Narrow-leafed Wilsonia	Wilsonia backhousei	V		4	2002,
					1965
Black-eyed Susan	Tetratheca juncea	V	V	2	1884
	Pimelea curviflora var. curviflora	V	V	1	1907

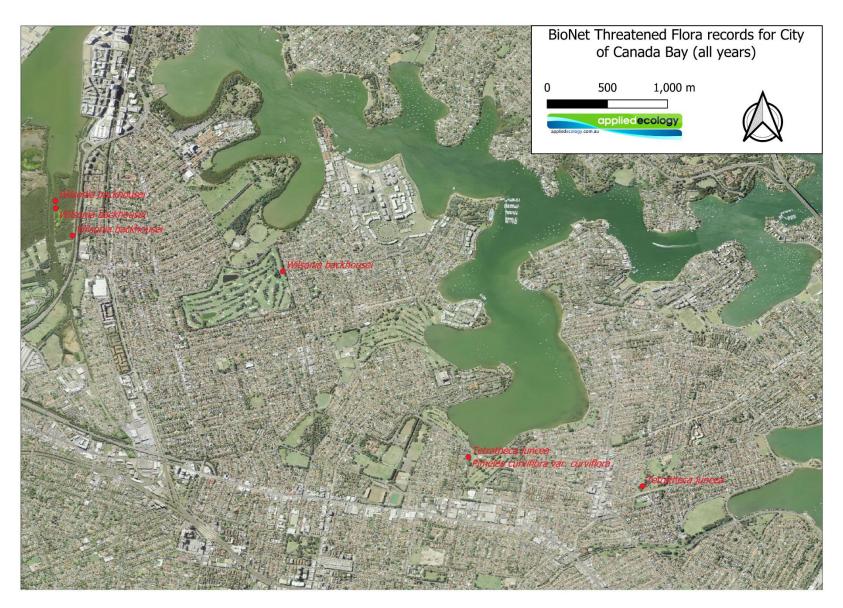


Figure 62 NSW Wildlife Atlas (BioNet) threatened flora species records for City of Canada Bay LGA (all records for all years)

## 8 DISCUSSION

### 8.1 Discussion of fauna results

### 8.1.1 Species richness

Observed species richness in any fauna survey is directly linked to survey effort and length of survey. This survey included 5 months (December 2023-April 2024) of on-ground surveys with some remote equipment also deployed in May along with ad hoc observations in that month. Unique species were detected in each of the 5 months of on-ground surveys. Species accumulation had slowed but not plateaued with species accumulation very likely to continue with any increase in the length of the survey, particularly including spring months.

Typically, larger and more heterogeneous reserves have higher species richness and this generally held true for this survey (Figure 30), with areas of contiguous mangroves and remnant or mature vegetation patches -Brays Bay through to Majors Bay Reserve – collectively having the highest species diversity. If the LGA is divided into western and eastern sections, of the 111 species recorded in this survey, 100 are present in the western section of the LGA and 66 in the eastern section of the LGA (Figure 63) with 56 shared species.

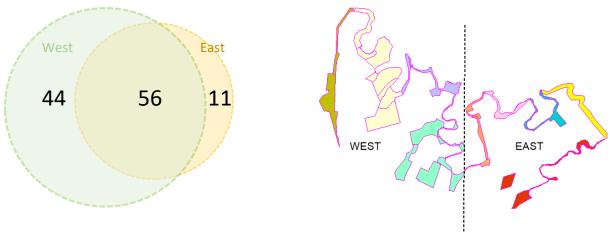


Figure 63 Unique and shared species- western and eastern sections of the LGA

A unique habitat in the LGA are freshwater ponds and wetlands. These are now restricted to the privately owned Concord Golf Club. Several species, such as Australasian Grebes, Black Swans, Latham's Snipe and Eastern Dwarf Tree Frogs were only observed at the golf course (Image 81). In the 2002-03 surveys (Dion Hobcroft) freshwater habitats were present on the western side of Homebush Bay Drive at Rhodes (now fully developed) – in that survey these areas were also species rich with a variety of unique species.



Image 81 Black Swans, Eurasian Coots, Dusky Moorhens and Australian Wood Ducks at one of the ponds on Concord gold Course.

Mudflats that stretch from Halliday Park to Henry Lawson Park on the eastern side of Hen and Chicken Bay are also species rich with a variety of waterbirds and waders often present (Image 82). Fauna using terrestrial vegetation along Wymston Parade and in Halliday Park and Henry Lawson Park contribute to species diversity in this area.



Image 82 Bar-tailed Godwit, Australian White Ibis, White-faced heron and Magpie Lark at Halliday Park.

Lower species richness is found in the isolated, small or more highly modified reserves such as Quarantine Reserve and Brett Park, despite good habitat being present. In these locations species that are not reliant on the size or quality of bushland remnants account for the bulk of species richness, often a mix of larger carnivorous water/seabirds and/or urban adapted species.



Image 83 Pied Currawong feeding Channel-billed Cuckoo chick at Quarantine Reserve



Image 84 Australian Brush-turkey crossing the Bay Run and Henley Marine Drive to Brett Park (active mound in Sisters Bay)

Around a quarter of the species observed were widespread during this survey, occurring in 75% or greater of the zones surveyed (Table 23). Flocking and/or social species were both abundant and widespread while solitary species were widespread but naturally in lower numbers (Image 85-Image 93).

Table 23 Widespread species during the 2024 survey

COMMON NAME	SCIENTIFIC NAME	ZONES OBSERVED
Australian Magpie	Cracticus tibicen	100%
Common Brushtail Possum	Trichosurus vulpecula	100%
Grey Butcherbird	Cracticus torquatus	100%
Grey-headed Flying Fox	Pteropus poliocephalus	100%
Masked Lapwing	Vanellus miles	100%
Noisy Miner	Manorina melanocephala	100%
Pale-flecked Garden Sunskink	Lampropholis guichenoti	100%
Rainbow Lorikeet	Trichoglossus haematodus	100%
Silver Gull	Larus novaehollandiae	100%
Australian Raven	Corvus coronoides	88%
Australian White Ibis	Threskiornis molucca	88%
Channel-billed Cuckoo	Scythrops novaehollandiae	88%
Common Ringtail Possum	Pseudocheirus peregrinus	88%
Eastern Koel	Eudynamys orientalis	88%
Gould's Wattled Bat	Chalinolobus gouldi	88%
Little Pied Cormorant	Microcarbo melanoleucos	88%
Pied Currawong	Strepera graculina	88%
Welcome Swallow	Hirundo neoxena	88%
Black Rat	Rattus rattus	75%
Cat	Felis catus	75%
Laughing Kookaburra	Dacelo novaeguineae	75%
Magpie-lark	Grallina cyanoleuca	75%
Pied Cormorant	Phalacrocorax varius	75%
Rock Dove	Columba livia	75%
Sulphur-crested Cockatoo	Cacatua galerita	75%
White-faced Heron	Egretta novaehollandiae	75%
Willie Wagtail	Rhipidura leucophrys	75%



Image 85 Noisy Miners were the most abundant and widespread species during this survey – here feeding on a planted native at Lewis Berger Park.



Image 86 Rainbow Lorikeets were widespread and abundant – here feeding on planted flowering natives at the Cintra Park Tennis Courts



Image 87 Pale-flecked Garden Sunskinks were the most common and widespread reptile during this survey – here at Edith Walker Estate



Image 88 Common Brushtail Possums were the most widespread and abundant native mammal observed during this survey – here at Kokoda memorial track



Image 89 A moderate size feeding flock of Australian White Ibis at Yaralla Estate. This size flock was unusual during this survey, with small groups of 3-10 birds more typically observed foraging around mudflats and in parks. They do not appear to be over abundant in the LGA.



Image 90 Sulphur-crested Cockatoos, like Australian White Ibis, are widespread but not over abundant in the LGA. They roost in trees along Majors Bay Road, along with Little Corellas causing some fouling on the road. Here at Queen Elizabeth Park near a hollow it was inspecting.



Image 91 Channel-billed Cuckoos were present in all zonesmore often heard than observed despite their large size- here at Yaralla Estate. Host species were widespread in the LGA-Australian Magpies, Pied Currawongs and Australian Ravenswhich in part explains the prevalence of this species.



Image 92 Common Ringtail Possums were observed during most spotlighting sessions – here using electricity cables to move along the street between Henry Lawson Park and Quarantine Reserve



Image 93 Little Pied Cormorant at Rivendell – nowhere common but widespread.

#### 8.1.2 A closer look at Classes

Birds contribute most species to overall richness in all corridors followed by mammals, reptiles and frogs (Figure 64). Birds are mobile enabling them to move through the urban matrix and beyond from one patch to another, either on seasonal migratory routes, dispersing from natal grounds, or in response to local resource availability (both local movements from mainly sedentary species and true nomads). Migratory honeyeaters were observed flying west along the foreshore reserves from Majors Bay in autumn and other seasonal migrants, such as Rufous Fantails were observed, foraging in Yaralla Estate and Majors Bay Reserve as they made their way northward. Species that are non-volant including reptiles, frogs and some mammals are largely unable to, without high mortality, move between one patch of habitat and another.



Figure 64 Species richness by class

A small number of urban adapted species such as Common Brushtail Possums and Eastern Blue-tongue Lizards can negotiate the suburban environment with some success (Koenig et al. 2001) provided some refugia is available in backyards and nature strips and verge gardens. High smooth, no gap, fencing increases the barriers to successful movement in many newer developments. Many other species, such as Eastern Long-necked Turtles, are restricted to a small area of suitable habitat. If predation, extreme weather or similar stressors reduces local populations of many non-volant species to such a degree where recovery is unlikely without recruitment from migration, then many of these isolated populations will disappear. In the case of reptiles, it can be difficult to locate uncommon and rare species despite considerable effort (Cogger 2010) and a handful of additional species are still likely to be present in the LGA. See Section 7.1 of this report, where results from this survey are tabled with other fauna observations from the study sites, for a comprehensive fauna inventory (Table 17).

Urban tolerant species were, unsurprisingly, the most commonly observed species overall. The reasons why some species are rare, or observed only once, are more complex. These species can be cryptic, only present in the area for a short time as part of migration, in very low densities either naturally or not, or vagrant, or a particular area may be surveyed infrequently. The sixteen species that were observed only once are tabled below.

Table 24 Species with the lowest rates of observation

COMMON NAME	SCIENTIFIC NAME
Black-fronted Dotterel	Elseyornis melanops
Dollar Bird	Eurystomus orientalis
Eastern Spinebill	Acanthorhynchus tenuirostris
Greylag Goose (domestic)	Anser anser
Hardhead	Aythya australis
Little Wattlebird	Anthochaera chrysoptera
Noisy Friarbird	Philemon corniculatus
Powerful Owl	Ninox strenua
Red Wattlebird	Anthochaera carunculata
Sacred Kingfisher	Todiramphus sanctus
Southern Boobook	Ninox novaehollandiae
Striated Pardalote	Pardalotus striatus
White-bellied Sea-eagle	Haliaeetus leucogaster
White-naped Honeyeater	Melithreptus lunatus
Rakali	Hydromys chrysogaster
Barred-sided Skink	Concinnia tenuis

#### 8.1.2.1 Aves

A total of 84 bird species were detected during the survey including 6 introduced species. Four NSW threatened bird species were recorded and one Commonwealth listed species. Of these five threatened species, three are listed Migratory species (Listed Marine/Listed Migratory) under the EPBC Act -the Eastern Osprey is listed migratory (Bonn Convention) and the Latham's Snipe is listed under the Japan-Australia Migratory Bird Agreement (JAMBA), China-Australia Migratory Bird Agreement (CAMBA) and the Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA). The Bar-tailed Godwit is Listed marine, Listed migratory- Bonn, CAMBA, JAMBA, ROKAMBA. The Rufous Fantail is Listed migratory – Bonn.

Introduced species were widely, but patchily, distributed in the reserves surveyed. Rock Doves, Common Mynas and Common Starlings were observed in greater numbers in smaller suburban parks and shopping strips not included in this survey. Occasional small flocks were observed in the reserves and much lower numbers around foreshore areas and mudflats (Image 94, Image 95).





Image 94 Common Mynas at Majors Bay Reserve

Image 95 Rock Doves at Yaralla Estate

To better understand the bird assemblages in the zones all native bird species recorded during the survey were allocated to one feeding guild and results tabled against location (Figure 65).

Many species could be allocated to more than one guild because they consume incidental amounts of other types of food; more commonly have a different diet when young and developing rapidly; in response to seasonal triggers or resource availability. A good example is the Red-browed Finch, found at Yaralla estate (Image 96), that feeds on small seeds of grasses and weeds but also takes seeds of fruit and berries and occasionally small insects. Nestling diet is initially insects, and older nestlings are fed with small dehusked grass seeds. This species also feeds on ground and in low vegetation and takes seeds from the ground or from stems. Insects are also taken in flight (Payne, 2020).

Examples of species included in each guild include:

- Carnivores Laughing Kookaburra, cormorant species, Australian Raven;
- Insectivores Welcome Swallows, Superb Fairy-wrens, Australian Magpie, Dollarbird and Grey Fantail;
- Omnivore Pied Currawong, Dusky Moorhen, and Australian Brush-turkey;
- Nectarivore Musk Lorikeet and Noisy Miner;
- Frugivore Channel-billed Cuckoo and Topknot Pigeon;
- Granivore Little Corella, Crested Pigeon, Red-browed Finch, and Australian King-Parrot; and
- Herbivore grazing duck species such as Australian Wood Duck, Pacific Black Duck.



Image 96 Red-browed Finch at Yaralla Estate – February 2024

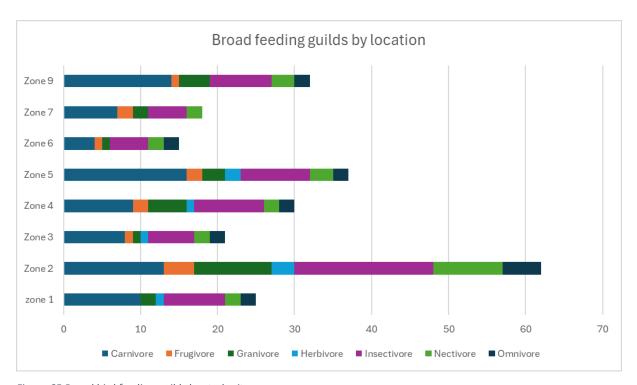


Figure 65 Broad bird feeding guilds by study site

Carnivores are the most common guild recorded during this survey. This is partly due to the long frontage to the Parramatta River where the base numbers of widely distributed carnivores (Australian Raven and Laughing Kookaburra) in reserves are supplemented by the presence of large fishing species including Eastern Ospreys, Little Pied Cormorants and Australasian Darters. For these latter species the treed parks and reserves along the river are important complementary habitat to the open water habitat where they hunt. Remnant bushland, mangroves and stags near hunting areas provide places where raptors and other large species can rest and feed (Image 97). This is especially important for species that would preferentially perch on woody debris in, or over the water- but such debris that is washed into the river and bays appears to be cleaned up quickly by RMS or boat owners.





Image 97 Australasian Darter roosting on woody debris over water at Quarantine Reserve (left) as opposed to roosting on an abandoned crab pot in Kings Bay where there are no roosting habitats.



Image 98 Australasian Darter successfully fishing off Breakfast Point

Insectivores are better described as invertebrativores as this guild includes species that feed predominantly on invertebrates. In good bush this is often the most common guild observed. This guild is less prevalent in areas with modified or smaller areas of vegetation, including many of the parks and reserves in the eastern section of the LGA. In these locations common, and widely distributed, insectivores such as Australian Magpies, Masked Lapwings and Welcome Swallows were present but species requiring vegetation complexity with all three stratums intact, such as White-browed Scrubwrens, Spotted Pardalotes, and Superb Fairywrens were absent.



Image 99 Superb Fairywren at Majors Bay Reserve- this small insectivore was only found in the western section of the LGA-a similar result to Hobcroft 2003.

The smallish number of species allocated to the omnivore guild included species that had restricted distributions but were likely locally common including Dusky Moorhens and Eurasian Coots. Other omnivores were fairly ubiquitous such as Pied Currawongs and Australian Brush-turkeys. The latter species was not detected in earlier surveys (Hobcroft 2003) but has become well established in the interim.



Image 100 Australian Brush-turkeys at Powells Creek

Frugivores are fruit eating species and like omnivorous species were both widespread (Channel-billed Cuckoos) or associated with specific restricted habitat features. Australasian Figbird, for example, were strongly associated with the presence of fruiting fig trees and Camphor Laurels (Image 101).



Image 101 Male Australasian Figbird in fruiting Camphor Laurel- Yaralla Estate April 2024

The majority of granivores observed were parrots and included species that typically feed on the ground, such as Sulphur-crested Cockatoos and Galahs, and arboreal feeders such as Eastern Rosellas. Galahs and Little and Long-billed Corellas were observed on mown open space - including on the three golf courses in the LGA (Image 102). Some of the parrot species present are the result of escapes/releases from captivity, or have increased in number due to improved resource availability, including feeding by residents and habitat modification (Bergin and Saunders 2007). These species include Galahs, Little Corellas, Rainbow Lorikeeets and Eastern Rosellas. Parrots are not typically harassed by Noisy Miners that limit many larger species' ability to forage and roost in such locations (Piper and Catterall, 2003) thus compete very successfully for hollow resources within the bushland reserves.



Image 102 Long-billed Corellas foraging on a green at Concord Golf Club.

The most common herbivorous species was the Australian Wood Duck that was present in most suitable habitats. The three local golf courses, again, were important habitat for this species (Image 103).





Image 103 Australian Wood Duck at Concord Gold Club (left) and at Massey Golf Course (right)

Species were grouped in broad size classes, large, medium and small, for the study areas (Figure 66). Many of the carnivorous species were also large species (86%) and this is reflected in the higher number of large species in reserves where areas of open water areas were also surveyed. Medium sized birds, which includes species such as Eastern Rosellas, Noisy Miners, and Magpie-larks, were the most commonly observed across all reserves. Almost 25% were granivores. Small species, often insectivores, that include many of the "bush birds" associated with good bush were restricted to the western section of the LGA, particularly where there is connectivity to natural areas outside the LGA (such as the Sydney Olympic Park), and within the LGA around NSW Health Lands at Yaralla Estate.

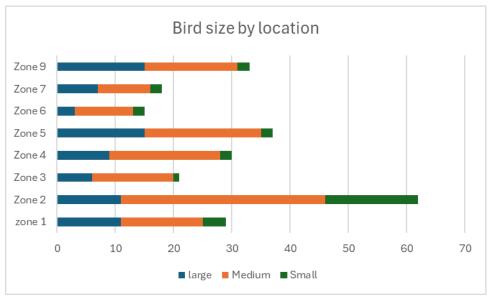


Figure 66 Bird size by zone

Sedentary species dominate the birds recorded during the survey (approximately two thirds) highlighting the importance of maintaining or improving the condition of local reserves. Most sedentary species will undertake at least some local movements in response to resource availability, however, many species fidelity to a particular location is very high. Some examples from banding studies include:

Yellow Thornbill *Acanthiza nana*<sup>i</sup>: Primarily resident; some local movements reported, with autumn-winter post-breeding occurrences at some sites, moving into wider range of habitats. Of 389 recoveries of 278 individuals, all were less than 10 km from ringing site.

Willie-wagtail *Rhipidura leucophrysii* Resident throughout range. Some small-scale seasonal movements, e.g. post-breeding descent from higher altitudes to lower elevations and some South-North shift, although extent not known. Of 360 recoveries of ringed individuals, 358 (99·4%) captured less than 10 km from site where first ringed.

Red-browed Finch *Neochmia temporalis*<sup>iii</sup> Mainly resident. Some seasonal differences at some localities, with local movement outside breeding season; longest distance of ringing recovery 42 km.

Laughing Kookaburra *Dacelo novaeguineae* <sup>iv</sup>Sedentary, with occasional temporary movements to exploit abundant prey; prior to breeding, auxiliaries may disperse into vacant breeding sites; 90% of ringing recoveries less than 10 km from ringing site.

Seasonal breeding north/south migrants, including species such as the Rufous Fantail, Sacred Kingfisher and Dollarbirds were not abundant in number but had reasonable diversity. Nomadic species includes species that search for particular food resources, sometimes over large distances, or move in response to weather events such as Great Cormorants, several duck species and species that follow flowering events such as Musk Lorikeets.



Figure 67 Musk Lorikeet feeding- Concord Golf Club January 2024

#### 8.1.2.2 Mammals

A total of 17 mammal species were detected during the survey including 4 threatened species. The total includes 6 introduced species. Of the remaining 11 native species 7 were microbats.

Although bat diversity was reasonably good some species were only detected from a single location on a single or very few nights and the number of calls was lower than in nearby LGAs with networks of bushland reserves (for example, Lane Cove or the City of Ryde).

Jung & Threlfall (2016) reviewed studies on microbats in urban environments from Europe, North America and Australia. Most of these studies report relatively high bat activity and species richness in areas with remaining vegetation such as older residential areas, riverine habitats or parklands. Certain bat species appear to thrive in these urban environments, and success has been linked to species-specific traits (Duchamp and Swihart 2008). In particular, microbat species with high wing loadings and aspect ratios, so presumed to forage in open areas (Norberg and Rayner 1987), which also roost primarily in human structures appeared to adjust to urban environments, provided that there is sufficient tree cover (Dixon 2012).

It is typically members of the Molossidae (in this study Ride's Free-tailed bat and the White-striped Free-tailed Bat), which are known to forage in the open spaces above the tree canopy that seem to tolerate and potentially profit from highly urbanised areas (Jung and Kalko, 2011). In addition, many buildings in cities provide potential roost sites that resemble natural crevices and are known to be readily occupied by molossid bats (Scales and Wilkins, 2007).

Some studies report a reduced richness and greater dominance of a few species in highly urbanised areas (Jung and Kalko 2011), but in other cases there is greater species richness in urban parks and residential areas (Hourigan et al. 2010; Threlfall et al. 2012). In general, though, there tends to be a positive relationship with native remnant vegetation. Vegetation cover provides roost sites and predicts, along with soil fertility, forage availability (invertebrate biomass) which are positively correlated with the presence of microbat species in urban environments (Threlfall 2013). The availability of resources is also impacted by past and present land-use practices, such as patterns of urban development, with ensuing decreases in the complexity and biodiversity in developed areas by, for example, removing vegetation from suburban backyards to create medium density housing. Basham et al. (2011) in a study of the "leafy" northern suburbs of Sydney found that species richness was strongly correlated to low density residential areas with large areas of remnant bushland in steep gullies and large gardens (often > 0.1 ha) with tall trees. High density housing with areas of remnant bushland has lower species diversity (Hourigan et al. 2010). Other considerations for microbats include competition for roost sites, especially tree hollows (Threlfall et al. 2013).

Threlfall et al. (2011,2012) found that there are, at a minimum 17 species of microbat, extant within 60kms of the Sydney CBD from a study where data collected was collected from 113 sites over 226 anabat nights (2 nights sampling at each site). Only 5 species were detected at more than 25% of sites. These were Gould's Wattled Bat Chalinolobus gouldii, White-striped Free-tailed Bat Austronomus australis [Tadarida australis], Ride's Free-tailed Bat Ozimops ridei [Mormopterus sp. 2], Large [Eastern] Bent-winged Bat Miniopterus orianae oceanensis [Miniopterus schreibersii oceanensis], and Little Forest Bat Vespadelus vulturnus. The first four are considered to be urban tolerant species (Gonsalves & Law 2017, Threlfall 2011, 2012) and were present in the LGA during the current study. However, only Goulds Wattled Bat could be considered widespread and relatively common. Gould's Wattled Bat appears very tolerant to the

effects of urbanisation with a widespread distribution throughout parks and reserves in urban areas (Threlfall et al 2012a). It is a hollow-using species that favours large flyways and low level of forest clutter i.e. an open understorey (Lloyd et al. 2006) and therefore is highly adaptable to foraging in cities, making them one of the most common city microbats in Australia (Richards et al. 2012).

The Large or Eastern Bent-winged Bat was also detected in 3 zones. There are known roost sites in North Sydney and Ashfield that may play a role in the presence of this threatened species in the LGA. Eastern Bent-winged Bats are believed to be relatively tolerant to urbanised landscapes, mainly because they will utilise man-made structures for roosting sites, including stormwater drains, tunnels and culverts, and buildings. This species is threatened because of its breeding biology. It is reliant on a small number of caves with very specific and narrow abiotic factors (eg temperature and humidity) for giving birth and raising young. Up to 150,000 individuals can gather at a single cave system. Loss of any of these caves through stochastic events or changing conditions within caves through climate change could be catastrophic for this species.

The White-striped Free-tailed Bat was only detected at Brays Bay. This large species has been found to make extensive use of the urban matrix where it has been recorded more frequently foraging above cleared and grassy flood-plains (Threlfall et al 2012) but was very uncommon during this survey.

Ride's Free-tailed Bat is the last of the urban tolerant species detected and was only detected south of Henry Lawson Park. It is an open-space bat that uses low-clutter environments and edges (McConville et al. 2014, Thredall et al. 2011).

The remaining 3 species are considered nonurban adapted species. Of these, 2 are threatened species" the Little Bent-wing Bat which was only detected once, and Large-footed Myotis which was more widespread in frequencies higher than some urban adapted species. The Large Forest Bat was recorded in several locations around the foreshores of the eastern section of the LGA. Forest bat species are dependent on tree hollows for roosting and breeding, often dead or mature trees with multiple hollows, thus, their presence in the LGA is somewhat surprising. Gonsalves and Law (2018) did not detect any of the Forest Bats in North Sydney during an extensive 12 month study in 2013-2015. In that study 7 species were detected in total including the four urban adapted species and the Yellow-bellied Sheathtail Bat at 1 site (n=17), Large-footed Myotis at 2 sites and Little Bent-wing Bat at 1 site.

Many microbats are migratory or undertake seasonal movements. Female Large Bent-wing Bats leave Sydney in late spring and fly to one of the three known maternity caves in NSW returning in autumn (Gonsalves and Law, 2018), and these seasonal movements are reflected in detection rates. Some of the urban tolerant species likely enter periods of torpor in colder months when invertebrate numbers diminish (Dixon, 1983; Turbill, 2008; Churchill 2009).

Common Ringtail Possums, Common Brushtail Possums and the threatened Grey-headed Flying-fox were present in all months of the survey and were widespread and relatively common in relation to homerange size and resource availability. Grey-headed Flying foxes were most common in areas with observed flowering events. However, interestingly, in areas where they were heard foraging at night where there was no observed flowering or fruiting events, they may have been actively hunting cicadas (Smith *et al.* 2020). Rakali are present in the estuary and remote cameras and hairtubes were deployed to target this species. A poor image was captured along Powells Creek in the mangroves which had many of the distinguishing features – large body size, russet and black fur and small rounded ears.

There was evidence that Red Foxes and Black Rats are widespread and abundant, with foxes most often observed in the western part of the LGA. Surprisingly, foxes were not detected by cameras deployed in Queen Elizabeth Park, Figtree Bay or Sisters Bay. It is important to note that failure to detect is not equivalent to absence. Brown Rats were observed at Rodd Point – the same location noted in previous studies (Image 104-Image 109). Cats were also widely detected on remote cameras although it is unclear whether these are roaming pets or street/feral cats. Most of the cats did not have collars and some appeared to be muscular tomcats (Image 110 - Image 112).



Image 104 Red Fox at St Lukes



Image 105 Red Fox at Arthur Walker Reserve



Image 106 Red Fox with young Common Brushtail Possum? Yaralla Estate



Image 107 Brown Rat burrow at Rodd Point



Image 108 Black Rats in Rhodes Park



Image 109 Black Rat Quarantine Reserve



Image 110 This muscular tomcat was a regular visitor to the camera at Figtree Bay.



Image 111 One of several cats that regularly patrol the canal at Cintra Park



Image 112 A cat roaming the remnant bushland adjoining the Yaralla foreshore.

Domestic dogs were also widespread, commonly observed off leash and also captured on remote cameras. Most owners appeared to have their dogs under control, even when off leash, however, even when on leash, when dogs are allowed to approach sensitive areas or species, they are very likely a limiting factor for native fauna in some areas (Image 113). All dogs captured by remote cameras appeared to be owned- with collars or harnesses and well fed and groomed, thus dogs were not included in survey results. However, they do present a management issue for native fauna when allowed to roam freely in the small areas that should be considered refugia or breeding habitat for native animals (Image 114).



Image 113 Dogs on long leash at Wymston Parade Foreshore approaching Bar-tailed Godwits and other water birds-December 2023.







Image 114 Dog off leash in Cintra Park at night (left), Kelpie in the Yaralla Estate intertidal zone (centre), and one of many dogs off leash near the eastern "dog" beach at Quarantine Reserve (right) despite the reserve being an on-leash only reserve.

### 8.1.2.3 Reptiles

Most reptiles observed were small skinks. Larger reptiles including dragons, monitors, pythons and some venomous snakes are often the first species to disappear from developed areas. There has been a considerable loss of reptile diversity in all areas of the urbanised Sydney basin due to habitat destruction, ensuing loss of refugia and prey species, poor water quality and changed hydrological regimes and predation by introduced species. Collection, disturbance and direct killing (not so common now) by people also plays a role in the extirpation of reptiles when species are already under considerable stress (White and Burgin 2010).

Shea (2010) examined reptile records for the largely developed areas of the Sydney basin and plotted the loss of diversity over time (Figure 187). In that paper the current study area falls within the author's inner west suburb grouping and Shea records 34 species of reptile as having occurred there. The current study recorded 20% of Shea's (2010) regional reptile fauna within the Canada Bay LGA.

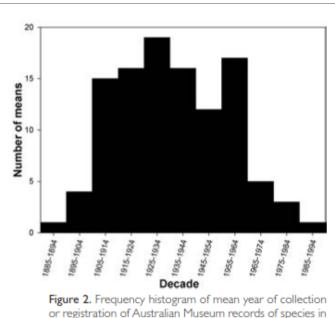


Figure 2. Frequency histogram of mean year of collection or registration of Australian Museum records of species in the five core areas, for species with three or more records in an area.

Figure 68 (right) Loss of reptile diversity over time in the developed areas of Sydney (Shea 2010).

Constant disturbance of reptiles by park and reserve users (and their dogs), either directly or indirectly, impacts diurnal reptiles ability to forage and hunt and also to bask which is essential to maintain active body temperatures, particularly for larger species (White and Bergin 2010). As noted previously, in the case of reptiles, it can be difficult to locate uncommon and rare species despite considerable effort (Cogger, 2010) and a handful of additional species are still likely to be present in the LGA. WIRES records /snake catcher records indicate that Red-bellied Black Snakes and Common Tree Snakes are present, at least on the rare occasion, when dispersing from bushland areas nearby. Remnant bush around the Yaralla Estate is the most likely habitat to contain additional reptile species.

#### 8.1.2.4 Frogs

Frog diversity was poor with 3 species detected during the survey. One species of ground frog and two species of tree frog were recorded.

All frog species were in low numbers based on number of individuals calling during spotlighting and recorded on song meters with one exception. Good choruses of all three species were recorded on Concord Golf Course, which contains the only freshwater wetlands and pond habitats in the LGA. One or

two Striped Marsh Frogs were heard calling below stormwater headwalls that discharge freshwater through the intertidal zone around Brays Bay. Survivorship of tadpoles in these hostile environments would be low. Frogs were more often heard calling from private property where there were either frog friendly gardens or construction work that had pooling water or sediment ponds.

### 8.1.3 The problem with urban remnants

The key issue affecting the long term sustainability of fauna in the LGA (and the Sydney Basin more generally) is lack of connectivity between reserves. This is exacerbated by ongoing pro-development pressures to increase housing supply through increased density that reduces the number of bushy garden blocks, and in the Sydney basin the lack of long-term strategic planning at appropriate scales coupled with community perceptions of what "nature" looks like. An understanding that urban bushland remnants are not self-sustaining must be foremost in dealing with their management issues and that they require a proactive mix of planning, science and on ground works to conserve or increase existing biodiversity values and maintain some ecological function.

Urban reserves cannot simply be managed in isolation as community support for management actions and strategies is often critical to the success of conservation efforts. Corridors or biolinks are necessary because without functional connectivity the long-term viability of species confined to isolated remnants is questionable (Parker et al 2008). Many remnants rapidly lose species richness and abundance when certain patch size thresholds are reached (Drinnan 2005). Determining what these thresholds are and the different minimum spatial habitat requirements for various species often produces disparate results (Taylor, 2008). And in the urban landscape such as Canada Bay the question is often moot as there simply aren't the resources to buy private lands, or lands with conservation value, to form comprehensive and adequate corridors. In an urban area in southern Sydney, Drinnan (2010) found that bird and frog species richness rapidly declined in remnants under 4 hectares in area and plant and fungal species richness declined rapidly in remnants under 2 hectares in area, whilst 50 hectares was another significant threshold for "forest interior" species vulnerable to edge effects.

Without functional connectivity the opportunity for migration between remnants is limited to only the most mobile species. Even within highly mobile groups, such as birds, movement can be hindered by aggressive introduced species such as the Common Myna (*Acridotheres tristis*) or native species such as the Noisy Miner (*Manorina melanocephala*). Control of Common Mynas is highly desirable and has had strong community support in many areas as they are a "strongly disliked" species amongst residents who have witnessed harassment of native species, particularly nesting species (Tidemann 2005)- a sentiment also reflected in the community survey conducted by Council as part of this project. However, the magnitude of their impact on native species in urban environments may be overestimated (Lowe *et al.* 2011).

Control of unnaturally abundant native species in urban areas is more problematic. For example, Pied Currawongs (*Strepera graculina*) can have a major impact on the breeding success of other species through nest predation (Major 1996) and through mobbing and aggressive behaviour. Red Wattlebird numbers are much decreased locally compared to previous studies likely due, in part, to the abundance of Pied Currawongs.

Nest predation is natural for Pied Currawongs, but it becomes an issue when any predatory species has unnaturally increased in abundance. This may be because of a trophic cascade in urban areas where the largest predators that typically controlled these mid-sized predators are no longer extant in urban areas

(Ford *et al.* 2001). Ford et al. (2001) considered the presence of Noisy Miners as one of the most significant determinants of avifauna diversity and abundance in fragmented habitats. Noisy Miners play a significant role in suppressing other species, particularly small specialist species of birds. In Sydney (and elsewhere within their range) the Noisy Miner is ubiquitous in fragmented habitats. They are large, sedentary, highly social honeyeaters that prefer open forest and woodlands with a low grassy or sparse understorey - a simplified version of this is created in many suburban backyards, along road reserves and in urban open spaces used for passive recreation, including golf courses and parklands.

While the Noisy Miner has increased in abundance in urbanised areas, many other species have significantly declined in abundance or simply disappeared. The aggressive behaviour of Noisy Miners includes harassment, mobbing and bullying of other species. These behaviours are well documented and play a large part in limiting the variety and abundance of other bird species, particularly small species, by

# A note on mobbing behaviour

Mobbing is an antipredator behaviour designed to make the predator move on. Interactions between species like this are designed to be, and are, very stressful to the predator. Continuous areas of bushland play an important role in providing the space required for raptors to avoid continual mobbing by other species. In this study it was noted that many of the species involved in mobbing and harassing behaviours of other species are common and abundant and have benefited from bushland modification and includes Noisy Miners, Australian Ravens, and Rainbow Lorikeets.

threshold that has been commonly reported in association with area-standardised avian diversity reductions (Piper & Catterall, 2003).

effectively excluding them from available habitat (Grey et al. 1997; Catterall et al. 2002; Piper & Catterall 2003). With an edge effect 200 m deep, a remnant 10 ha in size is likely to become entirely occupied by Noisy Miners. This is a size

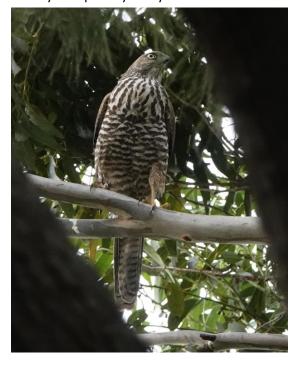


Image 115 Young Brown Goshawk at Yaralla was relentlessly harassed by Noisy Miners -April 2024

Exclusion of small insectivorous species can allow proliferation of insects that are implicated in native vegetation dieback and generalised poor tree health (Clarke *et al.* 1995). Studies have demonstrated that with increasing understorey density and complexity, including long grasses, the abundance of Noisy

Miners decreases (Piper & Catterall 2003, Grey & Clark 2011). One option is trapping and humane destruction of these over-abundant native species, but another is to manage the landscape to minimise their preferred habitat features, and to moderate residential community behaviours, such as feeding birds, and planting heavy flowering or fruiting non local natives which favour this and other overabundant species.

Vascular plant richness along with remnant size are often the best predictors for overall species richness and abundance within a remnant (Margules and Pressey 2000, Brauniger et al. 2010), with proximity and connectivity to other patches also playing an important role (Drinnan 2005). At a local scale, habitat characteristics, such as for example fallen logs, exfoliated rock, soft soils, and proportion of exotic plant species, may be more important than floristic diversity as a predictor of survivorship for some species (Garden *et al.* 2010, Jellinek *et al.* 2004).

Cultural perceptions of what "nature" should look like can become an issue for land managers in urban areas when this perception of "nature" is confused with ecological function. Any management strategy that involves increasing the structural complexity of a remnant, or restoring parklands to a more natural state, or restoration of parts of the matrix between remnants, will involve making the landscape more "messy" and efforts to do so will inevitably lead to public criticism by some parts of the community (McDonnell 2007). This is despite evidence that simple measures such as leaving drainage easements unmown can improve functional connectivity between remnants (FitzGibbon *et al.* 2007). Management of urban bushland, therefore, needs to balance the needs of "nature" against fear of threats such as snakes and rats for example.

Many of the reserves with remnant vegetation or mature revegetation, such as Queen Elizabeth Park and Timbrell Park also adjoin mown open space used for formal sport resulting in light spill into natural areas. Light spillage alone has the potential to reduce available habitat and induce behavioural changes in nocturnal species. Light spill may alter fauna behaviour, affecting their roosting sites, feeding and breeding behaviours and patterns (Baker & Richardson 2006, Miller 2006, Kempenaers 2010). Under moonlight, for mammals, there may be fewer but more successful prey encounters. In contrast, some species show a noticeable response to artificial light in the wild, while others show no response at all (Beier, 2006). Predatory diurnal birds such as Laughing Kookaburras and Pied Currawongs can exploit the twilight conditions created by light spill to hunt nocturnal and crepuscular species while some species, such as the Rainbow Lorikeet, roost near lighting as a strategy to assist in detecting nocturnal predators such as the Powerful Owl (Debus, 2015).

Light spill into bushland reserves affects both vertebrates and invertebrate and how animals interact with the environment and each other. Impacts on bats and their prey depend on the light spectra produced by lights. Ultraviolet (UV) wavelengths attract more insects and consequently some species of insectivorous bats (Rowse et al, 2016). Relationships between bat species and artificial illumination may be very complex and reflect differences in, for example, the type of light source (e.g. mercury vapour vs. sodium vapour lights), bat ecology and landscape context. While certain light sources attract insects and subsequently foraging bats, artificial illumination can disrupt bat foraging behaviour and flight paths such as forest-dwelling bat species that emerge from their roosts relatively late in the evening, presumably to minimise predation risk from diurnal birds of prey and so may be 'hard-wired' to be light-averse.

Ambient noise influences the availability and use of acoustic information by animals in many ways – it can impact predator/prey interactions, foraging and reproductive strategies and success. For example, calling frogs may need to change the pitch of their calls to be heard over ambient noise which may impact reproductive success (Parris *et al.* 2009). Several studies on birds, in particular, show that as the noise levels increase in an area, abundance and species richness significantly decreased (Newport *et al.* 2014). Gleaning microbat species are an especially vulnerable group as they rely on listening for prey rustling sounds to find food.

In the LGA the most abundant introduced vertebrate pest species include the Red Fox (*Vulpes vulpes*), the Black Rat (*Rattus rattus*) and to a lesser extent the domestic cat (*Felis catus*). These animals interact with native species in a variety of ways, including predation and competition for resources (May and Norton 1996). Many native prey species also react negatively to the scent of these predators, causing them to actively avoid the area these species use. This has implications for the function of corridors in urban areas (Little *et al.* 2002).

Cats and foxes are blamed for catastrophic declines and numerous extinctions of small to medium sized mammals following the arrival of Europeans in Australia. Ongoing and current levels of impact from these species are complicated by habitat destruction, fragmentation and changed fire regimes (May and Norton 1996). The true extent of their ongoing impacts on native fauna is largely anecdotal and difficult to quantify (Saunders & McLeod 2007). There is no dispute is that Red Fox numbers in urban areas can be extremely high (Saunders and McLeod 2007) and both feral and owned cats actively hunt native species (Robertson 1998).

Council also needs to consider that any suppression of foxes may inadvertently increase the abundance of cats (both feral and domestic) hunting in bushland areas. Foxes may suppress or hamper hunting by cats by directly reducing numbers through predation and by interfering with and harassing cats within their territories (Triggs et al. 1984, Read & Bowen 2001). Similarly, removal of these introduced predators may lead to increases in black rat abundance as they comprise an important part of the diets of foxes in urban remnants (Cox et al. 2000); an observation that held only partly true for this current study although the sample size was small (n=15). Black rats have been implicated in the decline of bird species through nest predation, and for native *Rattus*, *Antechinus* and *Melomys* species through direct competition (Cox et al. 2000). When attempting to conserve any of these species, control of black rats may be necessary.

Along with weed invasion and suppression, altered fire regimes have the greatest potential to change vegetation community composition through the alteration of natural disturbance regimes that trigger recruitment (Crosti et al. 2007) or support underlying ecological processes such as nitrogen cycling and stimulation of soil seed banks (Prober et al. 2005). Too frequent fires are listed as a key threatening process, but exclusion of fire from fire-adapted communities conserved in urban remnants is equally problematic. This process can contribute to the ongoing extinction debt since older fragments typically have fewer species than more recently burnt fragments (Ross et al. 2002). If small scale burns are undertaken, and they need to be very small due to the small size of remnant vegetation patches, the ecological benefits should be documented to assist in the development of future burn plans. Strategic use of small burns may assist with weed suppression in some areas, noting that weeds may be important habitat for some species and any burn will reduce available resources in the short to medium term.

Any revegetation works (or development) near wader habitat needs to consider lines of sight for these birds. Waders were formerly found in good numbers at Rodd Point and the western side of Hen and Chicken Bay (see Hobcroft 2003 or Survey of Birds in Concord 1982-83). A variety of factors have resulted in reduced wader numbers arriving in the Parramatta River estuary - most significant is the drastic reduction in numbers elsewhere in their ranges through habitat destruction and disturbance. Within the LGA increased disturbance by watercraft, dogs and people, changes to patterns of deposition and accretion in the mudflat zones, impacts on the number and types of benthic organisms available as prey, and the extent of mudflats undoubtedly play a role. The maturation of planted vegetation in foreshore parks and recruitment of mangroves in some areas, together with nearby development may also impact how waders utilize habitats.



 $Image\ 116\ Changes\ to\ vegetation\ and\ mudflats-Rodd\ Point\ and\ Prince\ Edward\ park\ 1986-2021\ aerial\ imagery^{14}$ 

<sup>&</sup>lt;sup>14</sup> City of Canada Bay Public Mapping Service (https://canadabay.spatial.t1cloud.com/spatial/intramaps/?configld=c02b4c5d-ca5a-45ec-b15a-658c63f074d6&project=3a881e0a-268d-4f23-bf29-cee4e9727665)



Image 117 Plantings on the edge of the beach/mud flats at Rodd Point may further disrupt sight lines.

Exotic plant species displace native species and can reduce the occurrence of important habitat plants for some fauna species. The Sydney Metropolitan region contains the greatest diversity of weed species in NSW (SMCMA 2007). Over 65 weed species in the region form a direct threat for 20 ecological communities, 39 vascular plants, 9 fungi species and 12 fauna species now listed under the NSW Biodiversity Conservation Act 2016 and NSW Fisheries Management Act 1994 (Coults-Smith & Downey 2006).

#### 8.2 Discussion of flora results

#### 8.2.1 Comparison with other surveys and databases

The current study appears to be the first comprehensive survey of native flora species in council reserves in City of Canada Bay, other than the one completed by Gingra Ecological Services in 2002. Unfortunately the inventory collated during that survey was not available for comparison.

The Atlas of Living Australia (ALA) compiles species records from several sources, including specific surveys, iNaturalist and others. This data was extracted for the LGA and compared with that collected in the current study. Many of these records are located outside the set of reserves included in this study (Figure 69).

Table 25 Data sources included in Atlas of Living Australia records

SOURCE	YEAR(S)
ACA Vegetation Survey	2014
David Thomas Miscellaneous Flora Surveys	2021
DPIE Data from Scientific Licences dataset	2001-2023
iNaturalist observations	2014-2024
iNaturalist research-grade observations	2017-2024
METROCMA2 Vegetation Survey	2008
Royal Botanic Gardens Herbarium Specimen Register	2001,2,4,6

Data was also extracted from BioNET and included 909 records of 293 species for records since 1770. This was culled to include records since 2000 to provide a reasonable comparison, given the extent to which the LGA has been modified. Many of these records are also outside the current study area (Figure 70) but were included because they give a potentially more holistic overview of native flora in the LGA. This included 738 records of 213 species. This was further cleaned to remove duplicated species based

on nomenclature, species native to NSW but not the Sydney Basin, and species not identified beyond genus, leaving 178 species.

When the three databases were combined, this gave a total of 361 native flora species that have been recorded in the LGA since 2000, of which 270 were recorded during the current study, 245 were recorded on ALA, and 178 were recorded on BioNET. Clearly, none of these databases have a complete list of native flora species records. A total of 128 species were recorded on all three databases, 76 on two of these, and 157 on only one database.

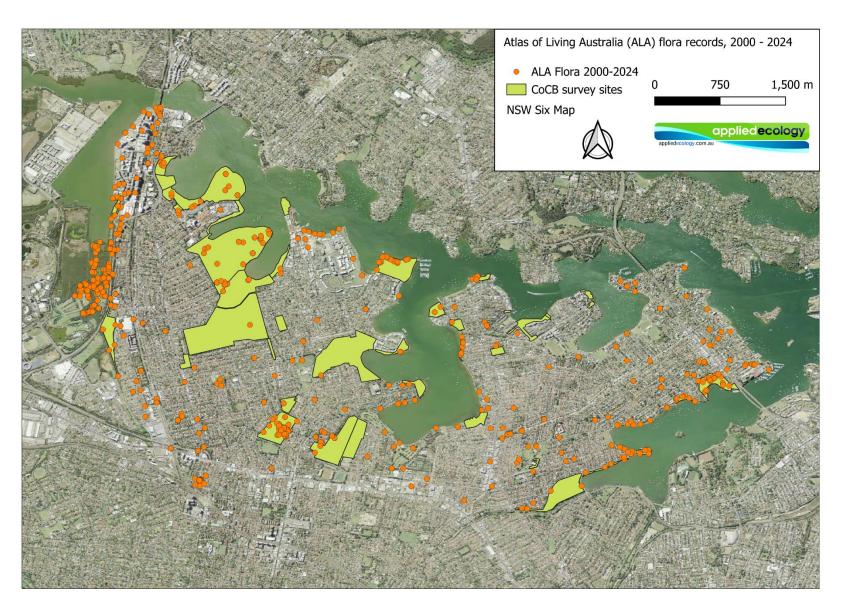


Figure 69 Locations of ALA flora species records in City of Canada Bay, 2000-2024

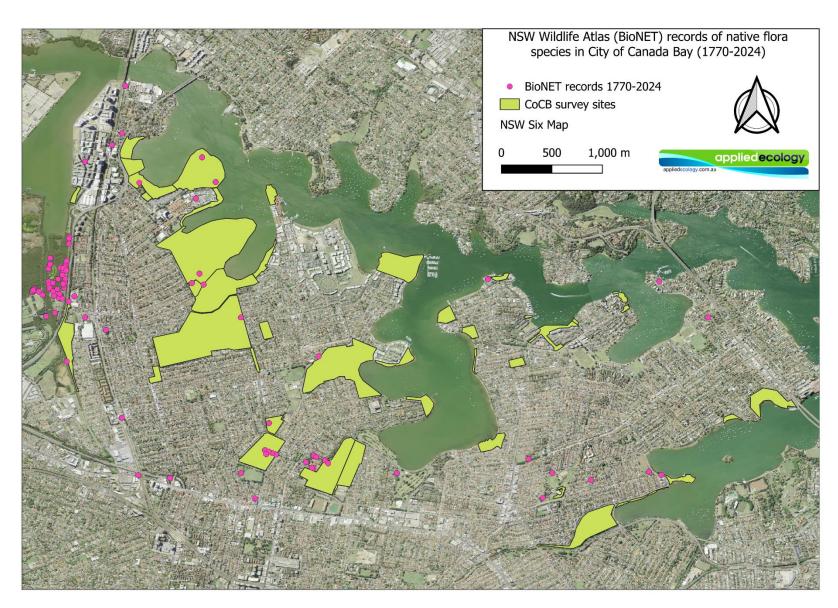


Figure 70 Locations of BioNET flora species records in City of Canada Bay, 1770-2024

Table 26 Compilation of species records from Applied Ecology's survey 2023/4, ALA 2000-24, and BioNET 2000-24

SPECIES NAME	AE 2023/4	ALA 2000-24	BioNET 2000-24	DATABASES
Acacia binervata	у			1
Acacia binervia	У	У	у	3
Acacia decurrens	У			1
Acacia falcata	у	у	у	3
Acacia falciformis		у	у	2
Acacia fimbriata	у	У		2
Acacia floribunda	у	у	у	3
Acacia implexa	у	у	у	3
Acacia linifolia	у			1
Acacia longifolia	у	У	у	3
Acacia longifolia sophorae		У		1
Acacia longifolia subsp. longifolia		у	у	2
Acacia longissima	у			1
Acacia mearnsii		У	у	2
Acacia melanoxylon	У			1
Acacia myrtifolia	у			1
Acacia parramattensis	у	у	у	3
Acacia suaveolens	у	у		2
Acacia terminalis	у			1
Acmena smithii	у	у	у	3
Actinotus helianthi		У		1
Adiantum aethiopicum	у	у	у	3
Aegiceras corniculatum	у			1
Alectryon subcinereus		у	у	2
Alisma plantago-aquatica		у	у	2
Allocasuarina littoralis	У	У	у	3
Allocasuarina verticillata	У			1
Alocasia brisbanensis	У			1
Alternanthera denticulata	У			1
Angophora bakeri	у			1
Angophora costata	у	у	у	3
Angophora floribunda	у	у	у	3
Angophora hispida	у			1
Anthosachne scabra		У	у	2
Archontophoenix cunninghamiana	У	У		2
Aristida ramosa		У		1
Aristida vagans	У	У	у	3
Asplenium australasicum	У	У	у	3
Atriplex australasica		У	у	2
Atriplex semibaccata		У	У	2
Austrostipa ramosissima	У	У	у	3
Austrostipa rudis		У	у	2
Austrostipa sp.	у			1
Austrostipa verticillata	У	У	У	3

SPECIES NAME	AE 2023/4	ALA 2000-24	BioNET 2000-24	DATABASES
Avicennia marina subsp. australasica	У	у	У	3
Azolla filiculoides		У	у	2
Azolla pinnata		У		1
Backhousia myrtifolia	у	у		2
Baeckea spp.		у	у	2
Banksia ericifolia	У	У	у	3
Banksia integrifolia	У	У	у	3
Banksia marginata		у		1
Banksia oblongifolia	у			1
Banksia robur	у			1
Banksia serrata	У			1
Banksia spinulosa	У	У	у	3
Billardiera scandens	у			1
Blechnum ambiguum	У			1
Blechnum cartilagineum	У		у	2
Bolboschoenus caldwellii		у	у	2
Bothriochloa macra	у	у	У	3
Brachychiton acerifolius	у	у	У	3
Brachychiton populneus		у	У	2
Brachyscome sp.	у			1
Breynia oblongifolia	у	у	У	3
Bursaria spinosa subsp. spinosa	у	у	У	3
Callistemon citrinus	у	у	у	3
Callistemon linearis	у			1
Callistemon salignus	у	у	у	3
Callistemon viminalis		У	у	2
Callitris spp.			у	1
Calochlaena dubia	У			1
Calystegia marginata	У			1
Calystegia sepium		у		1
Carex appressa	У			1
Carpobrotus glaucescens	У	у		2
Cassinia aculeata	у			1
Cassinia arcuata R.Br.		у		1
Cassinia longifolia	У			1
Cassinia sifton		у	У	2
Cassytha glabella	У			1
Casuarina cunninghamiana	У	у	У	3
Casuarina glauca	у	у	У	3
Cayratia clematidea	у	у	У	3
Cenchrus purpurascens	у	у	У	3
Centella asiatica	У	у	У	3
Ceratopetalum apetalum	у			1
Ceratopetalum gummiferum	у	у	У	3
Cheilanthes sieberi	У	У		2

SPECIES NAME	AE 2023/4	ALA 2000-24	BioNET 2000-24	DATABASES
Chloris truncata	у			1
Christella dentata	у			1
Cissus antarctica	у			1
Clematis aristata		у	у	2
Clematis glycinoides	у			1
Clerodendrum tomentosum	у	у	У	3
Comesperma ericinum		у		1
Commelina cyanea	у	у	у	3
Convolvulus angustissimus	у			1
Cordyline petiolaris	у			1
Cordyline stricta	У			1
Correa alba	У	У	у	3
Correa reflexa	у			1
Corymbia eximia		У	у	2
Corymbia gummifera	У	У		2
Corymbia maculata	у	у	у	3
Cotula australis		у	у	2
Cryptostylis subulata		у		1
Cupaniopsis anacardioides	у	у	у	3
Cyathea australis	у			1
Cymbopogon refractus	у			1
Cyperus gracilis		у	у	2
Cyperus imbecillis	У			1
Cyperus sanguinolentis	У			1
Dendrobium linguiforme		У		1
Dendrobium speciosum speciosum		у		1
Dendrophthoe vitellina		у		1
Denhamia silvestris	у	у	У	3
Dianella caerulea	у	у	У	3
Dianella caerulea var. producta	у	у	У	3
Dianella longifolia	у	у	У	3
Dianella revoluta		у	У	2
Dichanthium sericeum	у			1
Dichelachne micrantha	у			1
Dichondra repens	у		У	2
Digitaria didactyla	у	у	У	3
Digitaria parviflora	у	у	У	3
Dillwynia spp.		у	У	2
Diploglottis campbellii *	у			1
Dipodium variegatum		у		1
Diuris aurea		у		1
Dodonaea triquetra	у	у	У	3
Doodia aspera	у	у	У	3
Doryanthes excelsa	у	у	У	3
Dysphania carinata	у			1

SPECIES NAME	AE 2023/4	ALA 2000-24	BioNET 2000-24	DATABASES
Echinopogon caespitosus	у	У	у	3
Echinopogon ovatus	У	У	у	3
Einadia hastata	У	У	у	3
Einadia nutans	у	У	у	3
Einadia polygonoides	у			1
Einadia trigonos		У	у	2
Elaeocarpus reticulatus	У	у	У	3
Entolasia marginata	у	У	у	3
Entolasia stricta	у	У	у	3
Epacris pulchella		У		1
Eragrostis brownii	У	У	у	3
Eragrostis leptostachya	у	У	у	3
Eremophila debilis	у			1
Erodium crinitum	у			1
Eucalyptus acmenoides	У	у	У	3
Eucalyptus agglomerata	у			1
Eucalyptus amplifolia	у			1
Eucalyptus beyeriana		у	у	2
Eucalyptus bosistoana F.Muell.		у		1
Eucalyptus botryoides	у			1
Eucalyptus crebra	у			1
Eucalyptus elata		у	у	2
Eucalyptus eugenioides	У			1
Eucalyptus fibrosa	У	У	у	3
Eucalyptus globoidea	У	у		2
Eucalyptus grandis		у	У	2
Eucalyptus longifolia	у	у	У	3
Eucalyptus macrorhyncha	у			1
Eucalyptus microcarpa		у	У	2
Eucalyptus microcorys	у	у	У	3
Eucalyptus moluccana	у			1
Eucalyptus nicholii		у		1
Eucalyptus paniculata	у	у	У	3
Eucalyptus pilularis	у	у	У	3
Eucalyptus punctata	у	у	У	3
Eucalyptus racemosa	у			1
Eucalyptus resinifera subsp. resinifera	у	у	У	3
Eucalyptus robusta	у	у	У	3
Eucalyptus saligna	у	у	У	3
Eucalyptus scias	у			1
Eucalyptus scoparia		у		1
Eucalyptus siderophloia	у			1
Eucalyptus sideroxylon	у	у		2
Eucalyptus tereticornis	у	у	у	3
Euchiton sphaericus		у	У	2

SPECIES NAME	AE 2023/4	ALA 2000-24	BioNET 2000-24	DATABASES
Eustrephus latifolius	у	у	У	3
Ficinia nodosa	у			1
Ficus coronata	у			1
Ficus macrophylla		У	У	2
Ficus obliqua		у	У	2
Ficus rubiginosa	у	У	У	3
Ficus virens		У		1
Gahnia aspera	у	У		2
Gahnia aspera		у		1
Gahnia clarkei	у			1
Gahnia sieberiana	у			1
Gaudium trinervium	у			1
Geranium homeanum	у			1
Geranium molle subsp. molle		У		1
Geranium solanderi	у			1
Geranium spp.			у	1
Gleichenia dicarpa	у			1
Glochidion ferdinandi	у	у	у	3
Glycine clandestina	у	У	у	3
Glycine microphylla	у	у	у	3
Glycine tabacina	у	У	у	3
Goodenia ovata	У	У	у	3
Grevillea buxifolia	у			1
Grevillea diffusa	у			1
Grevillea juniperina		у		1
Grevillea linearifolia	у	у		2
Grevillea longifolia		у	у	2
Grevillea sericea	у	у	у	3
Grevillea speciosa	У	у		2
Grona varians	у			1
Hakea dactyloides	у			1
Hakea salicifolia	у	у	у	3
Hakea sericea	у	у		2
Hardenbergia violacea	у	у	у	3
Hibbertia scandens	у	у	у	3
Hibiscus heterophyllus	у			1
Histiopteris incisa	у	у		2
Homalanthus populifolius	у	у	у	3
Hydrocotyle acutiloba	-	у	-	1
Hydrocotyle sibthorpioides	У	у		2
Hypolepis muelleri	У	у		2
Imperata cylindrica	У			1
Indigofera australis	У	у		2
Ipomoea indica		у		1
Jacksonia scoparia		у		1

SPECIES NAME	AE 2023/4	ALA 2000-24	BioNET 2000-24	DATABASES
Juncus bufonius		У		1
Juncus kraussii subsp. australiensis	у	у	У	3
Juncus usitatus	у	У	у	3
Kennedia prostrata	у			1
Kennedia rubicunda	у			1
Kunzea ambigua	У	у	у	3
Lagenophora gracilis	-	У	У	2
Lepidium spp.		-	У	1
Lepidosperma gunnii	у		-	1
Lepidosperma laterale	У	у		2
Lepidosperma laterale	,	у	У	2
Leptospermum laevigatum		у	У	2
Leptospermum petersonii	у	у	У	3
Leptospermum polygalifolium	у	,	,	1
Leucopogon juniperinum	У			1
Livistona australis	у	у		2
Lobelia purpurascens	У	,		1
Lomandra filiformis subsp. filiformis	у	у	у	3
Lomandra longifolia	У	у	У	3
Lomandra multiflora	у	у	у	3
Macadamia integrifolia *	У	,	,	1
Macadamia tetraphylla	,	у		1
Machaerina juncea	у	,		1
Macrozamia communis	У	у		2
Macrozamia spiralis	,	у	у	2
Marsdenia suaveolens	у	,	,	1
Melaleuca decora	у	у	у	3
Melaleuca ericifolia	у	у	у	3
Melaleuca hypericifolia	у	,	,	1
Melaleuca linariifolia	У			1
Melaleuca linearis	,	у		1
Melaleuca nodosa	у	у	У	3
Melaleuca quinquenervia	У	у	У	3
Melaleuca squamea	у			1
Melaleuca stypheliodes	у	у	У	3
Melaleuca thymifolia	у	у	У	3
Melia azedarach	у	у	У	3
Microlaena stipoides	у	у	У	3
Monotoca elliptica	у	<u> </u>	,	1
Myoporum acuminatum	У	у		2
Myoporum insulare	,	у		1
Myoporum montanum		у		1
Myrsine howittiana	у	,		1
Myrsine variabilis	У	у	у	3
Notelaea longifolia	У	у	У	3

SPECIES NAME	AE 2023/4	ALA 2000-24	BioNET 2000-24	DATABASES
Olearia viscidula	у			1
Opercularia diphylla	у			1
Oplismenus aemulus	у	У	у	3
Oplismenus imbecilis	у	у	у	3
Oxalis exilis		у	у	2
Oxalis perennans	у	У	У	3
Ozothamnus diosmifolius	у	У	У	3
Pandorea jasminoides		У		1
Pandorea pandorana	у	У	у	3
Panicum simile	у			1
Parsonsia straminea	у	У	у	3
Paspalidium distans	у	У	у	3
Passiflora herbertiana	у	у	у	3
Pellaea falcata		У		1
Persicaria lapathifolia	у			1
Petrophile pulchella	у			1
Phyllanthus gunnii		у	у	2
Pimelea linifolia		У		1
Pittosporum multiflorum	у			1
Pittosporum revolutum	у	у	у	3
Pittosporum undulatum	у	у	У	3
Plectranthus parviflorus	у			1
Poa labillardieri	у			1
Podocarpus elatus	у	у	у	3
Podocarpus spinulosus	у	у	у	3
Polymeria calycina	у	У		2
Polyscias sambuccifolia	у	У	у	3
Pomaderris elliptica	у			1
Pomaderris ferruginea	у			1
Pomaderris intermedia		у	У	2
Pomaderris lanigera	у			1
Pomaderris ligustrina	у			1
Poranthera microphylla	у	у	У	3
Portulaca oleracea	у	у	У	3
Prostanthera incisa	у			1
Prostanthera ovalifolia	у			1
Pseuderanthemum variabile	у	у	У	3
Psilotum nudum		у		1
Pteridium esculentum		у	У	2
Pteris tremula	у	у	У	3
Pterostylis curta	у	у		2
Pterostylis erecta	у	у		2
Pterostylis nutans		у		1
Pterostylis oblonga		у		1
Pterostylis sp.	у			1

SPECIES NAME	AE 2023/4	ALA 2000-24	BioNET 2000-24	DATABASES
Pultenaea villosa		у		1
Rumex brownii	у	у	у	3
Rytidosperma fulvum		у	у	2
Rytidosperma racemosum		у	у	2
Rytidosperma tenuius		У	у	2
Samolus repens	у			1
Sannantha pluriflora	у	у		2
Sarcocornia quinqueflora	у	у	у	3
Sarcopetalum harveyanum	у	у	у	3
Scaevola calendulacea		у	-	1
Scaevola ramosissima	у			1
Scaevola spp.	-	У	у	2
Selliera radicans	у		-	1
Sigesbeckia orientalis	у			1
Solanum aviculare	у			1
Spergularia marina		у	у	2
Sporobolus creber	у	у	-	2
Sporobolus virginicus	у	у	у	3
Stenocarpus salignus	у			1
Stephania japonica var. discolor	у	у		2
Suaeda australis	у	у	у	3
Syncarpia glomulifera	у	у	У	3
Syzygium australe	у	у	У	3
Syzygium francisii (F.M.Bailey)		у	-	1
L.A.S.Johnson				
Syzygium luehmannii		у		1
Tetragonia tetragonoides	у	у	у	3
Themeda triandra	у	у		2
Thysanotus sp.		у		1
Trema aspera	у	у	у	3
Tricoryne elatior		у		1
Triglochin striata	у	у	у	3
Tristaniopsis laurina	у	у	у	3
Tylophora barbata		у	у	2
Typha domingensis	у	у	у	3
Veronica plebeia	у	у	у	3
Viminaria juncea	у			1
Viola banksii		у		1
Viola hederacea	у	у	у	3
Vittadinia cuneata	у			1
Wahlenbergia gracilis	у	у	у	3
Westringia fruticosa	у	у	у	3
Wilsonia backhousei		у	у	2
Wollemia nobilis	у			1
Zieria smithii	у	у	у	3

SPECIES NAME	AE 2023/4	ALA 2000-24	BioNET 2000-24	DATABASES
Zornia dyctiocarpa	У	У		2
Zoysia macrantha	у			1
TOTAL RECORDS	269	245	178	

# 8.2.2 Biodiversity values mapping

There are two main biodiversity values shown on the Biodiversity Values Map for City of Canada Bay LGA (Figure 71):

- Threatened species or communities with potential for serious and irreversible impacts (SAII)
- Coastal Management Act Wetlands

Most of the foreshore area is identified as having potential for SAII, with the remainder included in the Coastal Management Act 2016 wetlands mapping. Terrestrial areas with mapped biodiversity values were all areas with potential SAIIs (circled in red). These locations were examined to determine the mapped value and its current condition (Table 27). Many of the smaller areas, and particularly ones outside of council's management, have suffered serious impacts to the point where the mapped values could not be located. However alternative values are likely to be present in Majors Bay reserve where Eastern Ospreys nest and at Concord Golf Club where wetlands provide habitat for Latham's Snipes.

Table 27 Biodiversity values – mapped location, type of BV, and current condition

LOCATION	BIODIVERSITY VALUE	CURRENT CONDITION
Lovedale Place	Coastal wetlands	Fair to good
	TS or TEC with potential SAII	Fair to good
Rivendell School	Coastal wetlands	Fair to good
	TS or TEC with potential SAII	Fair to good
Yaralla west	TS or TEC with potential SAII	Good
Yaralla Estate	Coastal wetlands	Good
	TS or TEC with potential SAII	Poor
Yaralla east	TS or TEC with potential SAII	Poor to good
Concord Golf Course	TS or TEC with potential SAII	Very poor, or unable to locate
Mortlake Public School	TS or TEC with potential SAII	Unable to locate
Queen Elizabeth Park	TS or TEC with potential SAII	Very good
Five Dock Park	TS or TEC with potential SAII	Unable to locate
Russell Lea Public School	TS or TEC with potential SAII	Unable to locate

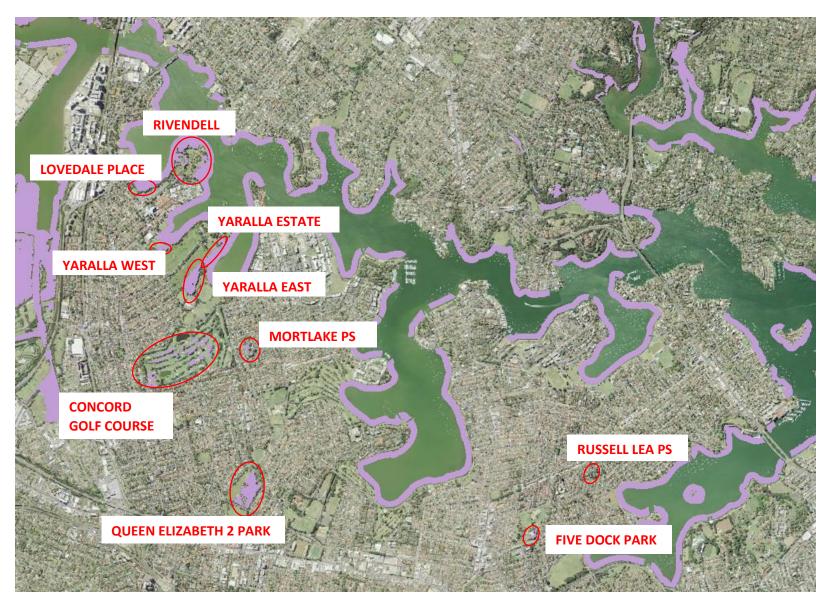


Figure 71 Biodiversity values mapping for City of Canada Bay (non estuarine BV areas circled in red)

#### 8.2.3

## 8.2.4 Estuarine saltmarsh mapping

The whole of the accessible foreshore within City of Canada Bay LGA was walked to search for saltmarsh patches. The threatened ecological community profile, identification guidelines and listing determination do not list any size restrictions to the community, therefore even patches of <1m2 are considered part of the EEC.

A total of 151 patches of saltmarsh were recorded along City of Canada Bay foreshores (Figure 72), which included a number of patches in Bicentennial Park, located along the shared path beside Homebush Bay Drive. This park is managed by Sydney Olympic Park Authority (SOPA), and is effectively outside of council's control. There are more and larger patches that have been mapped nearby but were not included in the current project because of the lack of capacity to manage anything other than potential external impacts for this location.

The main areas for saltmarsh in the LGA are on the western side of the Rivendell peninsula, at the upper end of Brays Bay, on the northwestern side of Yaralla Estate, at the upper end of Yaralla Bay, and on the northern foreshore of Iron Cove. The first two have saltmarsh on the upper side of mangroves while the Iron Cove habitat is developing beside Henley Marine Drive in response to changes in sea levels. As sediments begin to deposit and accumulate on the bedrock in this area it will quickly become ideal habitat for *Wilsonia backhousei*, a threatened species that has been sporadically recorded in the LGA (although not in the current survey). Wilsonia tends to grow at the upper limit of saltmarsh, and has been recorded in Brays Bay (2002) near Lovedale Place (although this record has not been accurately mapped on current records). All three of these areas have a high potential to be colonised by Wilsonia, although City of Canada Bay appears to be at the lower end of the main occurrences for the species in this catchment (Figure 73). A record that appears to be in Iron Cove is from 1917, suggesting that there is potential for this species to colonise the area, and one from 1965 along the eastern boundary of Concord Golf Course. There are also sporadic records from the northern side of Parramatta River opposite City of Canada Bay.

There is distinct zonation for many of the saltmarsh species considered to be characteristic of the community (Figure 74). Of the main indicator species for this PCT, Sarcocornia quinqueflora, Suaeda australis and Sporobolus virginicus were the most commonly occurring, followed by Juncus kraussii and Tetragonia tetragonoides. Baumea (now Machaerina) juncea, Ficinia nodosa and Triglochin striata were uncommon, and there were single records of Selliera radicans at Brays Bay and Zoysia micrantha at Cabarita Park. Saltmarsh was observed along the inside of the Norman Street boundary of Concord Golf Course, but when a site visit was undertaken to accurately map its location the saltmarsh plants were gone, possibly removed during maintenance of the drainage channel.

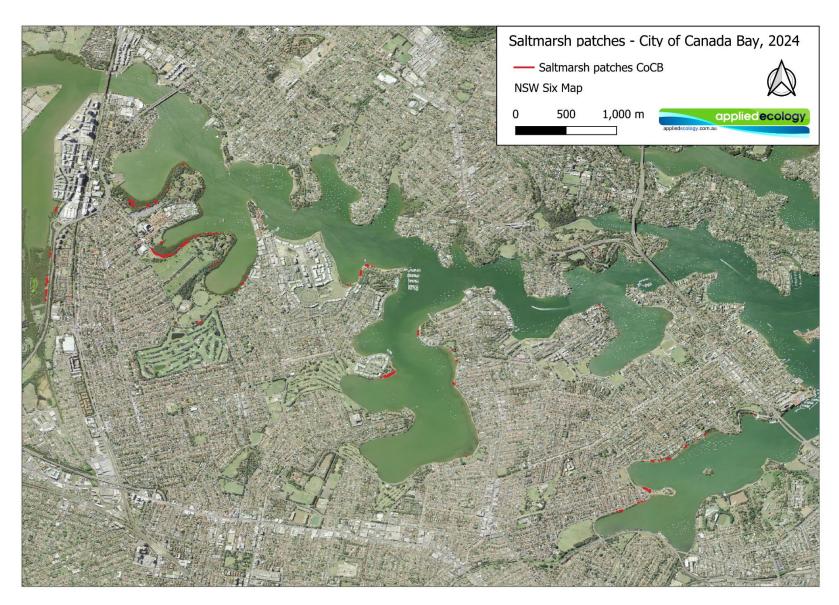


Figure 72 Saltmarsh patches identified along the publicly accessible sections of City of Canada Bay's foreshore

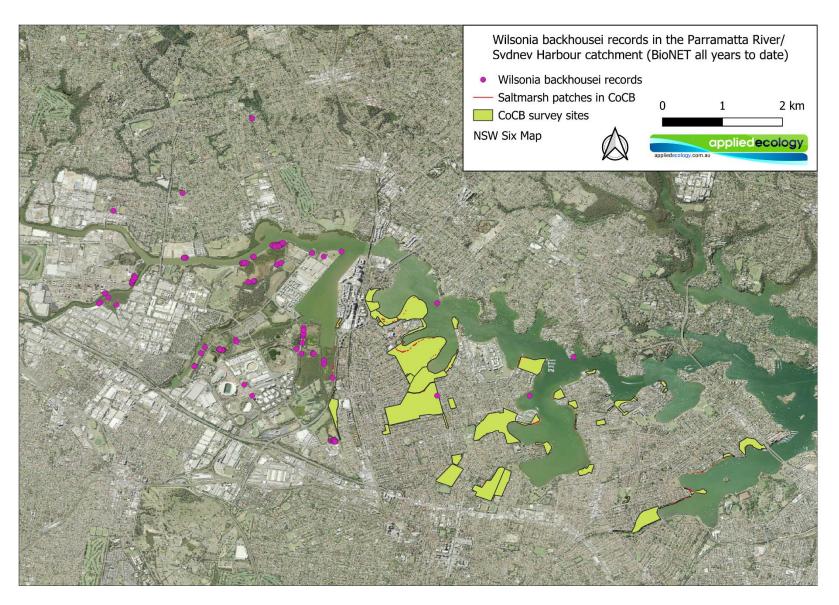


Figure 73 Locations of Wilsonia backhousei records in the Parramatta River/Sydney Harbour catchment

# Characteristic Species List

Coastal Saltmarsh is characterised by the species listed below. The species present at any site will be influenced by the size of the site, recent rainfall or drought condition and by its disturbance (including fire and grazing) history. There are over 200 plant species that occur in the Coastal Saltmarsh environment and as such NOT ALL the species listed below need to be present at any one site for it to constitute Coastal Saltmarsh.

Scientific Name	Common Name (Range)
Overstorey - Tree or Shrub layer Spe	
Aegiceras corniculatus	River Mangrove
Avicennia marina	Grey Mangrove
Baccharis halimifolia	Groundsel Bush * (W'Gong + N-Coffs)
Melaleuca ericifolia	Swamp Paperbark (S-P-Macq)
Sclerostegia arbuscula	The Saltbush (S-Syd)
Groundcover Species (0-1.5m)	
Rushes / Grasses / Reeds / Ferns / Herbs	
Austrostipa stipoides	Coastal Speargrass (S-J-Bay)
Baumea juncea	Twig Rush +
Bolboschoenus species	Marsh Club Rush
Cortaderia species	Pampas Grass * (Syd-only)
Ficinia nodosa (formerly Isolepis nodosa)	
Gahnia filum	Saw Sedge (S-Syd)
Juncus acutus	Sharp Rush *
Juneus kraussii	Sea Rush +
Limonium australe	Native Sea Lavender (S-Syd)
Phragmites australis	Tall Reed
Samolus repens	Creeping Brookweed +
Sarcocornia quinqueflora	Samphire +
Selliera radicans	Swampweed + (S-Gos)
Suaeda australis	Austral Seablite +
Sporobolus virginicus	Saltwater Couch +
Schoenoplectus species	Club Sedge
Tetragonia tetragonoides	Native Spinach
Triglochin striata	Streaked Arrowgrass +
Typha species	Bullrush
Zovsia macrantha	Prickly Couch +



Sharp Rush (Itencies acutus), a weed species commonly found invading Coastal Saltmarsh.





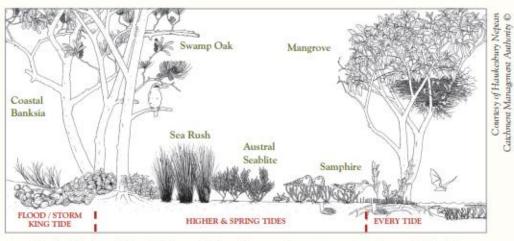
Mustrations © Boumle Gardens Trust



(hencus kranessii)

Prickly Couch (Zoysia macrantha)

+ = Key indicator species; \* = Weed species marked; N = North of; S = South of; Coffs = Coffs Harbour; Gos = Gosford; J-Bay = Jervis Bay; P-Macq = Port Macquarie; Syd = Sydney; W'Gong = Wollongong For further help with plant identification see: plantnet.rbgsyd.nsw.gov.au/search/simple.htm



A typical profile of the Coastal Saltmarsh Endangered Ecological Community between Mangroves and Swamp Oak Floodplain Forest. Examples of both the flora and fauna of the ecological community can be seen, including bats, birds and crustaceans.

Figure 74 Coastal Saltmarsh Identification Guidelines EEC Coastal Saltmarsh 110108.pdf (nsw.gov.au)

# 8.3 Key issues and recommendations

Key issues identified in previous studies and this study include:

- Overuse of natural areas Informal trail formation can lead to trampling of vegetation, compaction of soils, increases in nutrients from dog urine, littering, noise and disturbance of wildlife
- **Light spill and noise** reduces suitability and/or changes nesting/breeding/roosting and foraging behaviours of a wide variety of wildlife
- Domestic animals dogs in bushland and foreshore areas chasing and harassing wildlifeparticularly shorebirds reduces fitness of individual birds potentially impacting ability to
  undertake long migration flights; changes breeding and foraging behaviours of many other
  species. Roaming domestic cats: potential to kill or injure, changes breeding and foraging
  behaviours of many wildlife species
- **Simplified bushland habitats** leads to over abundance of some species, such as Noisy Miners, to the detriment of other species
- **Simplified foreshore/intertidal zone** seawalls and vegetation removal creates a hard simplified edge between terrestrial and aquatic habitats
- Abundant weeds outcompete native species, change soil chemistry and moisture, reduced light penetration
- **Isolated reserves with poor connectivity** impacts diversity from the gene to species level by limiting opportunities for dispersal and colonisation
- Lack of freshwater wetland habitats wildlife lack freshwater to drink and bath, few locations suitable for frog breeding, freshwater turtles and waterfowl
- Pest species direct impacts on wildlife through fox predation, secondary impacts through
  ingestion of poisons used in rat and mouse control; competition for limited resources both
  food and refugia
- **Climate change** Casuarina and mangrove encroachment: impacts saltmarsh distribution and shorebird habitats; extreme weather impacts nesting and foraging and bushland health

Actions to address identified issues are detailed in appendix A of this report along with detailed site-specific recommendations. An outline of these recommendations is provided below:

- Access management- closure of informal tracks, fencing in key locations, enforced dog-free areas
- Improve connectivity- increase buffer plantings and vegetation complexity on public lands, activate streetscaping and bush backyards programs in identified corridors through the urban matrix
- Increase available refugia introduce more fallen logs, wood debris, leaf litter, rock piles, nest boxes into reserves particularly where canopy is young; create high tide roosts for shore and water birds
- **Pest animal control** Ongoing Red Fox management and Black Rat control in selected locations. Educate residents of the impact of secondary poisoning on wildlife.
- **Domestic animal control** community education re roaming cats and off leash dogs; enforced dog-free areas in shorebird habitats

- Habitat creation create freshwater habitats in natural depressions on public lands; integrate
  ecological assets into stormwater system design upon renewal of old assets and for all new
  assets
- Habitat creation benching of foreshore where feasible and increased complexity at seawall interface.
- Undertake weed control treat canopy weeds such as Balloon Vine, implement a long-term staged removal plan for privet (currently provides resources for protected and threatened fauna)
- Undertake mangrove and casuarina removal in selected locations

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# 10 APPENDIX A DETAILED VEGETATION DESCRIPTONS BY ZONE & RESERVE/PARK

### 10.1 ZONE 1 – HOMEBUSH BAY / POWELLS CREEK

#### **10.1.1 POWELLS CREEK PARKS**

#### **Summary statistics**

RESERVE AREA		VEGETATED AREA	
No. native species	54	No. threatened species	0
No. introduced species	41	Priority control weeds	4

#### Flora and vegetation surveys

Random meander	Yes	Saltmarsh	Yes
Quadrat meander	Yes	BAM plot	No
MAPPED PCT #	nil	PCT NAME	N/A
PRE 1750 PCT #	3262	PCT NAME	Sydney Turpentine Ironbark Forest
PRE 1750 PCT #	4097	PCT NAME	Samphire Saltmarsh
OTHER LIKELY PCT #	4028	PCT NAME	Estuarine Swamp Oak Twig-rush Forest
PCT(S) CONFIRMED	4097	PCT NAME	Samphire Saltmarsh
PCT(S) CONFIRMED	4028	PCT NAME	Estuarine Swamp Oak Twig-rush
			Forest
PCT(S) tested but not confirmed	3262	PCT NAME	Sydney Turpentine Ironbark Forest

#### **Description of vegetation**

This 'reserve' includes a corridor of small parks along the eastern edge of Powells Creek, upstream of Homebush Bay Drive. Terrestrial vegetation consists of mature planted trees with some native garden style plantings (Image 118). Sydney Water has undertaken bank naturalisation in this section of Powells Creek, installing a sloping bank of sandstone boulders. Saltmarsh species were originally planted as part of the naturalisation works and they have become well established along both sides of the creek (Image 119). The whole area, especially to the west of Powells Creek, was formerly mudflats with mangroves and saltmarsh, of which a small section has been retained in the Mason Park Wetlands on the opposite bank.

The eastern side of the creek has been cleared and subject to some landfill, although terrestrial vegetation was mapped as present to a point fairly close to the existing creekline. Today, a shared user path runs along the edge of the creek, separated from the top of bank by densely planted Lomandras and other common native plantings (Image 120). Recreational facilities such as the tennis courts have the same garden style plantings around them, with mature planted canopy species. Further north a narrow driveway separates the an oval and cricket pitch with perimeter tree plantings from the more natural Swamp Oaks along the edge of the creek bank (Image 121). Away from the edge of the driveway the Swamp Oaks and young Paperbarks form an establishing occurrence of riverflat forest beside mature mangroves in Powells Creek (Image 122). The location of these mangroves is around the upper limit of mangroves in the Powells Creek channel, although they are well established in Mason Park Wetlands (in Strathfield LGA).

Three PCTs have been mapped as present, previously present, or are potentially present for the reserve, of which two were confirmed using diagnostic species counts, both of which are EECs:

- Samphire Saltmarsh
- Estuarine Swamp Oak Twig-rush Forest



Image 118 Terrestrial vegetation consists of mature planted trees and some garden style native plantings



Image 119 Saltmarsh species have established well following bank naturalisation works along Powells Creek



Image 120 A shared user path and tennis courts are surrounded by planted native species



Image 121 A narrow driveway separates perimeter plantings beside the oval from Swamp Oaks and weeds near the creek



Image 122 Swamp Oaks and Paperbarks form the riverflat forest beside mature mangroves in the tidal section of Powells Creek, with abundant weedy vines and grasses

# **10.1.2 POWELLS CREEK RESERVE**

# **Summary statistics**

RESERVE AREA		VEGETATED AREA	
No. native species	8	No. threatened species	0
No. introduced	7	Priority control weeds	1
species			

# Flora and vegetation surveys

Random meander	No	Saltmarsh	Yes
Quadrat meander	Yes	BAM plot	No
MAPPED PCT #	4091	PCT NAME	Grey Mangrove-River Mangrove Forest
PRE 1750 PCT	4091	PCT NAME	Grey Mangrove-River Mangrove Forest
OTHER LIKELY PCT #	4028	PCT NAME	Estuarine Swamp Oak Twig-rush Forest
OTHER LIKELY PCT #	4097	PCT NAME	Samphire Saltmarsh
PCT(S) CONFIRMED	4091	PCT NAME	Grey Mangrove-River Mangrove Forest
PCT(S) CONFIRMED	4028	PCT NAME	Estuarine Swamp Oak Twig-rush Forest
PCT(S) CONFIRMED	4097	PCT NAME	Samphire Saltmarsh

#### **Description of vegetation**

Powells Creek Reserve includes areas of terrestrial revegetation planting, predominantly canopy species, in areas such as the carpark (Image 123). Swamp Oaks have either been planted or have established naturally between the carpark and mangroves along the edge of Powells Creek (Image 124). Most of the reserve has mown grass and introduced plantings or garden style native plantings located among the visitor facilities (excluded from surveys). Large areas of mangroves are growing in a remnant estuarine wetland and have large patches of saltmarsh growing in higher areas (Image 125).



Image 123 Planted canopy species are becoming well established around the carpark



Image 124 Swamp Oaks have established (possibly) naturally between the carpark and mangroves on Powells Creek



Image 125 Areas of estuarine wetlands are mapped as having mangroves but have large areas of saltmarsh around the edges

#### **10.1.3 BICENTENNIAL PARK**

#### **Summary statistics**

RESERVE AREA		VEGETATED AREA	
No. native species	N/A	No. threatened species	N/A
No. introduced	N/A	Priority control weeds	N/A
species			

## Flora and vegetation surveys

Random meander	No	Saltmarsh	Yes
Quadrat meander	No	BAM plot	No
MAPPED PCT #	4091	PCT NAME	Grey Mangrove-River Mangrove Forest
PRE 1750 PCT	4091	PCT NAME	Grey Mangrove-River Mangrove Forest
OTHER LIKELY PCT #	4097	PCT NAME	Samphire Saltmarsh
PCT(S) CONFIRMED	4091	PCT NAME	Grey Mangrove-River Mangrove Forest
PCT(S) CONFIRMED	4097	PCT NAME	Samphire Saltmarsh

# **Description of vegetation**

Bicentennial Park is part of Sydney Olympic Park, and not managed by council. However, council's drainage and other activities have potential to impact on native vegetation in the vicinity. This includes Swamp Oaks and mangroves on either side of a shared path (Image 126). The path is on a raised bench that drops to the tidal area with mangroves and small patches of saltmarsh along the edges (Image 127). A swale runs between the path and Homebush Bay Drive and conveys stormwater to the bay. Vegetation here includes planted native trees with some weeds (Image 128).



Image 126 A shared path runs along the edge of Homebush Bay Drive in Bicentennial Park



Image 127 Many of the mangroves in this area are smaller and likely to be younger than other parts of the wetland



Image 128 A deep swale between Homebush Bay Drive and the pathway is planted with a mix of canopy species, and some weeds

#### **10.1.4 LEWIS BERGER PARK**

#### **Summary statistics**

RESERVE AREA		VEGETATED AREA	
No. native species	25	No. threatened species	0
No. introduced	17	Priority control weeds	2
species			

#### Flora and vegetation surveys

Random meander	yes	Saltmarsh	yes
Quadrat meander	no	BAM Plot	yes
MAPPED PCT #	4091	PCT NAME	Grey Mangrove-River Mangrove Forest
MAPPED PCT #	4097	PCT NAME	
PRE 1750 PCT	4091	PCT NAME	Grey Mangrove-River Mangrove Forest
OTHER LIKELY PCT #	3594	PCT NAME	Sydney Coastal Sandstone Foreshores
			Forest
OTHER LIKELY PCT #	3262	PCT NAME	Sydney Turpentine Ironbark Forest
PCT(S) CONFIRMED	4091	PCT NAME	Grey Mangrove-River Mangrove Forest
PCT(S) CONFIRMED	4097	PCT NAME	Samphire Saltmarsh
PCT(S) tested but not	3594	PCT NAME	Sydney Coastal Sandstone Foreshores
confirmed			Forest
PCT(S) tested but not	3262	PCT NAME	Sydney Turpentine Ironbark Forest
confirmed			

#### **Description of vegetation**

Lewis Berger Park is a small reserve on the western edge of Rhodes. The entire area is based on landfill, sloping gently towards the west. The upper part of the reserve is formalised with a lit shared path surrounded by mown lawns and garden style mixed plantings towards the road (Image 129). Below the path is a wide band of planted native canopy and shrub species that are becoming infilled with Swamp Oaks (Image 130), forming a dense screen between the park and estuarine vegetation in Homebush Bay.

The landfill slopes down to a benched dropoff, below which a series of small patches of saltmarsh plants are becoming established (Image 131). The saltmarsh is located immediately above a band of young Gray Mangroves along the edge of the bay (Image 132). Depending on patterns of sea level rise and sediment accretion, it is quite likely that the saltmarsh patches will enlarge and join together to form a longitudinal band behind the maturing mangroves.

Google Earth historical imagery shows the mangroves present in 2005 and the terrestrial plantings absent. In 2008 the mangroves have been almost entirely cleared while the formalisation works were undertaken in the park. By 2009 the terrestrial plantings were becoming well established and by 2010 the mangroves could be seen reestablishing in the tidal area below the reserve.



Image 129 The upper section is formalised with mown lawn and mixed garden plantings



Image 130 A band of native canopy and shrub plantings has established along the lower edge of the park



Image 131 Lewis Berger Park is based on landfill that ends in a benched dropoff, and saltmarsh species are establishing here



Image 132 Beyond the benched dropoff is a wide band of young mangroves that have established in recent years

#### 10.2 Zone 2 - BRAYS BAY TO CONCORD GOLF COURSE

#### 10.2.1 MCILWAINE park

#### **Summary statistics**

RESERVE AREA		VEGETATED AREA	
No. native species	25	No. threatened species	0
No. introduced	17	Priority control weeds	1
species			

#### Flora and vegetation surveys

Random meander	Yes	Saltmarsh	Yes
Quadrat meander	No	BAM plot	No
PRE 1750 PCT #	3594	PCT NAME	Sydney Coastal Sandstone Foreshores Forest
MAPPED PCT #	3594	PCT NAME	Sydney Coastal Sandstone Foreshores Forest
OTHER LIKELY PCT #	N/A		
PCT tested but not	3594	PCT NAME	Sydney Coastal Sandstone Foreshores Forest
confirmed			(close to diagnostic but predominantly planted)

#### **Description of vegetation**

McIlwaine Park is located to the east of Rhodes on an area with landfill behind a seawall, giving way to oyster laden mudflats. Parts of the park have planted native canopy species, while elsewhere the trees include introduced species. The native trees have gardens established using timber logs to create a 'no whip no mow' zone, designed to promote native groundcovers over introduced lawn grasses (Image 133).

Towards the foreshore the area has been completely transformed and now has a series of formalised non native gardens surrounding other infrastructure (Image 134). The seawall has been replaced by large sandstone sawn blocks that create more habitat opportunities for marine creatures to establish (Image 135). It includes two 'rock pools' that can function as wading pools, and was finished early in 2024. Despite the modifications/beautification/activation of the precinct, there are several more log delineated gardens below mature canopy trees, although these are generally less well established with groundcover vegetation (Image 136).

Overall the reserve is small and largely formalised, but has opportunities for habitat improvements through expansion of native vegetation and improving connectivity with surrounding areas.



Image 133 Several planted gardens have been established under some of the native canopy species, although some are quite weedy



Image 134 The area near the foreshore has formalised non native gardens



Image 135 A recently constructed sandstone sawn block seawall has been constructed to naturalise the foreshore edge



Image 136 Some of the understorey gardens have less groundcovers but more mature canopy species

#### **10.2.2 BRAYS BAY PARK**

### **Summary statistics**

RESERVE AREA		VEGETATED AREA	
No. native species	17	No. threatened species	0
No. introduced	11	Priority control weeds	0
species			

## Flora and vegetation surveys

Random meander	Yes	Saltmarsh	Yes
Quadrat meander	No	BAM plots	no
MAPPED PCT #	3594	PCT NAME	Coastal Sandstone Foreshores Forest
PRE 1750 PCT #	3594	PCT NAME	Coastal Sandstone Foreshores Forest
OTHER LIKELY PCT #	4091	PCT NAME	Grey Mangrove-River Mangrove Forest
PCT CONFIRMED	4091	PCT NAME	Grey Mangrove-River Mangrove Forest
PCT tested but not	3594	PCT NAME	Coastal Sandstone Foreshores Forest
confirmed			(close to diagnostic but predominantly planted)

## **Description of vegetation**

Brays Bay Park is predominantly highly modified, although some areas have native plantings of various ages. For example, there is a row of mature Paperbarks planted around the carpark and along the reserve perimeter (Image 137).



Image 137 Parking areas and park perimeters are planted with paperbarks and mature fig trees

Brays Bay Park commemorates some of the early industrial history of Sydney, including the ironworks and ship building yards on the site (Image 138). The large concrete platform with the old slipway route are the main relics of those eras. Mangroves have become established around the edges of the concrete platform, more sparsely on the north and eastern sides and more densely on the southern side where they merge with the mature mangrove forest along the upper end of Brays Bay (Image 139).



Image 138 Plaques commemorate the 20th century industrial history of Brays Bay



Image 139 Mangroves have become established around the edges of the historic section of the site

The site's early history is commemorated with several installation sculptures but they remain away from the main visitation areas (Image 140). The area behind the installation has native plantings that lack vegetation structure and have become quite weedy (Image 141). The species are predominantly native

and local, and have been selected to maintain sight lines, allowing walkers on the footpath to enjoy the views (Image 142). The footpath connects Brays Bay Park with Rhodes Park via the Kokoda Memorial Track, and even the Brays Bay section has sufficient structure to provide small bird habitat.



Image 140 Installations commemorate the site's history as iron works and ship building yards



Image 141 The area behind the installation has native plantings that have become weed infested



Image 142 A footpath connects Brays Bay Park with Rhodes Park via the Kokoda Memorial Track

#### 10.2.3 KOKODA TRACK

#### **Summary statistics**

RESERVE AREA		VEGETATED AREA	
No. native species	52	No. threatened species	1
No. introduced	18	Priority control weeds	1
species			

#### Flora and vegetation surveys

Random meander	Yes	Saltmarsh	Yes
Quadrat meander	Yes	BAM plot	No
MAPPED PCT #	4091	PCT NAME	Grey Mangrove-River Mangrove Forest
MAPPED PCT #	4097	PCT NAME	Samphire Saltmarsh
MAPPED PCT #	4028	PCT NAME	Estuarine Swamp Oak Twig-rush Forest
MAPPED PCT #	3594	PCT NAME	Coastal Sandstone Foreshores Forest
MAPPED PCT #	3448	PCT NAME	Castlereagh Ironbark Forest
PCT(S) CONFIRMED	4091	PCT NAME	Grey Mangrove-River Mangrove Forest
PCT(S) CONFIRMED	4097	PCT NAME	Samphire Saltmarsh
PCT(S) CONFIRMED	4028	PCT NAME	Estuarine Swamp Oak Twig-rush Forest
PCT tested – marginal	3594	PCT NAME	Coastal Sandstone Foreshores Forest
PCT tested - planted	3448	PCT NAME	Castlereagh Ironbark Forest

#### **Description of vegetation**

The Kokoda Track memorial walkway begins in Brays Bay Reserve in an area with mature planted Fig trees beside Homebush Bay Drive (Image 143). The track heads south-southeast and parallel to the foreshore, initially passing through an area with coastal riverflat forest indicated by the young paperbarks on the sloping bank down to mangroves (Image 144).

The track follows the top of bank above an area with Swamp Oaks, commonly found just metres above the tidal limit. The understorey is a mix of native groundcovers with abundant weeds, continuing down the embankment to meet the tidal foreshore and Grey Mangroves (Image 145). Above the track is also predominantly planted, with areas of mown grass interspersed between planted gardens with a mix of native and introduced species (Image 146).

The track then meanders through an area with memorials and information signage to commemorate the role of the Kokoda Track and the Australian Army in the WW2 war in the Pacific. This part of the track is through largely formalised gardens that have been planted with introduced species with lush green foliage that are reminiscent of the Papuan jungle (Image 147). From there the track stops at an area with picnic facilities, and the Kokoda Education Centre, before continuing through Rhodes Park and into Lovedale Place.



Image 143 The beginning of the Kokoda Track memorial walkway is on the edge of Brays Bay Park



Image 144 Coastal riverflat forest is indicated by the young paperbarks on the sloping bank down to mangroves



Image 145 The track follows the top of bank above Swamp Oaks and a mix of weeds and natives above mangroves



Image 146 Above the track are areas of mown grass interspersing planted mostly native gardens



Image 147 The track has species that suggest the lush green foliage of the Papuan jungle, but in a highly formalised setting

## **10.2.4 RHODES PARK**

# **Summary statistics**

RESERVE AREA		VEGETATED AREA	
No. native species	37	No. threatened species	1
No. introduced species	16	Priority control weeds	3

# Flora and vegetation surveys

Random meander	Yes	Saltmarsh	Yes
Quadrat meander	Yes	BAM plot	no
MAPPED PCT #	3594	PCT NAME	Sydney Coastal Sandstone Foreshores Forest
MAPPED PCT #	3448	PCT NAME	Castlereagh Ironbark Forest
OTHER LIKELY PCT #	4091	PCT NAME	Grey Mangrove-River Mangrove Forest
OTHER LIKELY PCT #	4097	PCT NAME	Samphire Saltmarsh
PCT(S) CONFIRMED	4091	PCT NAME	Grey Mangrove-River Mangrove Forest
PCT(S) CONFIRMED	4097	PCT NAME	Samphire Saltmarsh
PCT tested but not	3594	PCT NAME	Sydney Coastal Sandstone Foreshores Forest
confirmed			
PCT tested but not	3448	PCT NAME	Castlereagh Ironbark Forest
confirmed			

#### **Description of vegetation**

Rhodes Park includes a '5 Senses Garden' that aims to improve the health and well-being of the local community, especially those who are marginalized. It fosters friendships, belonging, and environmental sustainability. The garden is a safe and welcoming space for people of all abilities and backgrounds. Features include a nature play area, indigenous food area, sensory garden and edible garden (Image 148). The layout makes use of existing vegetation, in particular several mature native trees that provide natural shade to the garden.

The surrounding area includes a carpark for the sensory garden and Kokoda Trail facilities, and has been extensively revegetated with native groundcovers and grasses under existing mature native trees (Image 149). Beyond the carpark the Kokoda Trail walkway traverses the top of bank and is adjoined by an area with more natural vegetation that includes at least some remnant elements, although weeds have become established here as well (Image 150). Further downslope the bank levels off to the intertidal zone. At the lower end of the bank the vegetation is at least partially dominated by native and introduced vines, before transitioning directly to mangroves, or in some places to saltmarsh with Swamp Oaks and then to mangroves (Image 151).



Image 148 Rhodes Park includes a '5 senses garden' designed to foster community wellbeing and inclusiveness



 ${\it Image~149~Terrestrial~revegetation~planting~is~predominantly~local~and~has~become~well~established}$ 



Image 150 Planted areas around the carpark are linked with the more natural vegetation along the foreshore banks



Image 151 Beyond the native and introduced vines the expanse of mangroves is visible, with small patches of saltmarsh

## **10.2.5 LOVEDALE PLACE**

## **Summary statistics**

RESERVE AREA		VEGETATED AREA	
No. native species	25	No. threatened species	0
No. introduced	19	Priority control weeds	0
species			

## Flora and vegetation surveys

Random meander	Yes	Saltmarsh	Yes
Quadrat meander	Yes	BAM plot	Yes
MAPPED PCT #	nil	PCT NAME	N/A
PRE 1750 PCT #	3448	PCT NAME	Castlereagh Ironbark Forest
OTHER LIKELY PCT #	4028	PCT NAME	Estuarine Swamp Oak Twig-rush Forest
OTHER LIKELY PCT #	4091	PCT NAME	Grey Mangrove-River Mangrove Forest
PCT(S) CONFIRMED	4028	PCT NAME	Estuarine Swamp Oak Twig-rush Forest
PCT(S) CONFIRMED	4091	PCT NAME	<b>Grey Mangrove-River Mangrove Forest</b>
PCT tested but not	3448	PCT NAME	Castlereagh Ironbark Forest
confirmed			

#### **Description of vegetation**

Lovedale Place lies between Rhodes Park and Concord Hospital and connects to Rivendell School via the Foreshore Trail. The Kokoda Track walkway continues through Lovedale Place and then directly to the hospital via an area that is now used as a carpark. Most of the vegetated section of the park is on the lower side of the track and includes an area with Swamp Oaks of mixed ages, just above the tidal limit (Image 152).

Part of the existing carpark at Concord Hospital is currently under construction with a new multistorey carpark being developed. The area that was previously used for staff parking is now temporarily located in Lovedale Place, and has resulted in the trampling of most of the vegetation in this area. Additional vegetation impacts were noted in another area adjoining the worksite, where dozens of Swamp Oaks have been cleared for no obvious reason. The resulting gap in vegetation provides a view from the corner of the multistorey carpark to the mangroves that surround this part of Brays Bay, and mangrove seedlings can be seen spreading into the gap in the canopy created by the clearing (Image 153).

In other parts of the site there are patches with abundant native vines, such as Water Vine (Cissus antarctica) that mark the transition between terrestrial vegetation and areas subject to tidal influences (Image 154). A very narrow band of planted native species has been retained along the fence around the edge of the carpark building site and other parts of the hospital, providing a level of screening for walkers that continue to use the foreshore trail (Image 155).



Image 152 Swamp Oaks form a large part of the vegetated section of Lovedale Place, above the tidal limit



Image 153 A multistorey carpark is being constructed at Concord Hospital, and may be linked with clearing of Swamp Oaks



Image 154 Native vines are common in the transition between terrestrial and tidal influenced vegetation



Image 155 A narrow band on planted native species separates the Foreshore Trail from development at Concord Hospital

## **10.2.6 RIVENDELL POINT**

## **Summary statistics**

RESERVE AREA		VEGETATED AREA	
No. native species	73	No. threatened species	0
No. introduced	37	Priority control weeds	7
species			

## Flora and vegetation surveys

Random meander	Yes	Saltmarsh	Yes
Quadrat meander	Yes	BAM plot	Yes
MAPPED PCT #	4028	PCT NAME	Estuarine Swamp Oak Twig-rush Forest
MAPPED PCT #	3262	PCT NAME	Sydney Turpentine Ironbark Forest
MAPPED PCT #	3594	PCT NAME	Sydney Coastal Sandstone Foreshores Forest
MAPPED PCT #	4091	PCT NAME	Grey Mangrove-River Mangrove Forest
PCT(S) CONFIRMED	4028	PCT NAME	Estuarine Swamp Oak Twig-rush Forest
PCT(S) CONFIRMED	3262	PCT NAME	Sydney Turpentine Ironbark Forest
PCT(S) CONFIRMED	4091	PCT NAME	Grey Mangrove-River Mangrove Forest
PCT tested but not	3594	PCT NAME	Sydney Coastal Sandstone Foreshores Forest
quite confirmed			

#### **Description of vegetation**

Approaching from the west via the foreshore trail takes in a mix of vegetation, ranging from the mangrove forests along the tidal zone with small patches of saltmarsh species at the upper end, to areas of densely weedy shrubbery, often dominated by Bamboo (Image 156). On the peninsula the same situation applies – areas of densely weedy introduced vegetation scattered among largish patches of moderate to good quality native remnants (Image 157). Areas with good quality native shrub and groundlayer vegetation are of particular value, and some of these have been delineated using logs to create 'no whip no mow' zones around stands of trees (Image 158). Elsewhere, the understorey has been mown and the characteristic Turpentines have been retained (Image 159). Ironically, there are also areas with good native groundcovers in these mown spaces, often with fewer weeds, possibly because they are not able to establish with the ongoing maintenance. In particular, the weedy shrubs that are common in some of the remnant patches are absent from the open spaces. Also of note is that some of the delineated retention patches have a canopy dominated by the introduced Brush Box, but the understorey is consistent with that of Sydney Turpentine Ironbark Forest, a Critically Endangered Ecological Community. Management of this PCT within Rivendell's grounds could be enhanced with bush restoration activities including weed control and mapping of the better areas of groundcover and protecting these accordingly.

On the eastern side of the peninsula is a mix of native species from a range of vegetation communities, forming a visual and physical barrier between the foreshore trail and the rocky foreshores of Parramatta River and the entrance to Yaralla Bay (Image 160).

Formerly known as the Thomas Walker Convalescent Hospital, this once free facility was transferred to NSW Health when funding ran low. It is now used as a school for students with mental health issues who engage in a number of programs run out of many of the heritage buildings on the site (Image 161). Maybe bushcare could be added to this program.

The name Rivendell comes from J.R.R. Tolkien's The Hobbit and Lord of the Rings series of books as it was known as a place to rest and recuperate – a sanctuary for those on difficult journeys.



 ${\it Image~156~Signposts~show~the~alignment~of~the~Foreshore~Trail,~sometimes~through~large~stands~of~Bamboo}$ 



 ${\it Image 157 Some areas have good native diversity retained in the shrublayer and understorey}$ 



Image 158 The better areas have been clearly delineated using logs to create 'no whip no mow' zones



Image 159 In other places the characteristic Turpentines have been retained but the understorey has been mown



Image 160 On the eastern side a mix of native species forms a barrier between the path and the bay

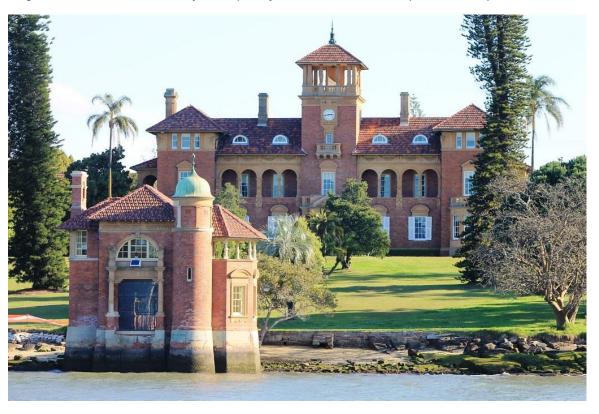


Image 161 Rivendell School for students with mental health issues still operates from heritage buildings (<u>Thomas Walker Convalescent Hospital | Mertie . | Flickr</u>)

### 10.2.7 YARALLA WEST (DAME EADITH WALKER RESERVE)

#### **Summary statistics**

RESERVE AREA		VEGETATED AREA	
No. native species	57	No. threatened species	0
No. introduced	30	Priority control weeds	5
species			

#### Flora and vegetation surveys

Random meander	Yes	Saltmarsh	Yes
Quadrat meander	Yes	BAM plot	Yes
MAPPED PCT #	3594	PCT NAME	Sydney Coastal Sandstone Foreshores Forest
MAPPED PCT #	3262	PCT NAME	Sydney Turpentine Ironbark Forest
MAPPED PCT #	4091	PCT NAME	Grey Mangrove-River Mangrove Forest
OTHER LIKELY PCT #	4097	PCT NAME	Samphire Saltmarsh
PCT(S) CONFIRMED	3262	PCT NAME	Sydney Turpentine Ironbark Forest
PCT(S) CONFIRMED	4091	PCT NAME	Grey Mangrove-River Mangrove Forest
PCT(S) CONFIRMED	4097	PCT NAME	Samphire Saltmarsh
PCT tested but not	3594	PCT NAME	Sydney Coastal Sandstone Foreshores Forest
confirmed			

#### **Description of vegetation**

Yaralla West is shown on some maps as Dame Eadith Walker Reserve. It includes the area west of the main estate to the southeastern boundary of Concord Hospital, and south to Nullawarra Ave and north to the upper end of Yaralla Bay. It includes a largish patch of good quality remnant native vegetation (Image 162). The patch includes a mix of native trees and groundcover species with only a moderate abundance of weeds. Canopy species on site include several stands of paperbarks that provide a dense canopy in those areas (Image 163). A miscommunication with arborists apparently led to inappropriate clearing of a large number of trees within the remnant vegetation patch (Image 164). Disastrous ecological outcomes were only slightly reduced by leaving the felled trees on site.

The area between the remnant vegetation and Concord Hospital is more degraded. Some revegetation planting has been undertaken, and appears to consist primarily of Acacias (Image 165). This area has a groundcover of weedy grasses and forbs, with some weedy shrubs, including Boneseed, a notifiable weed. Part of this area is currently used as a storage area by Concord Hospital and their grounds staff. Other open space areas in this reserve have been cleared but have quite a diverse native understorey retained, including native grasses and forbs, many of which have not been recorded elsewhere in Yaralla, or even in the LGA.



Image 162 A largish patch of good quality native vegetation has been retained



Image 163 Several stands of Paperbarks are present on site and provide a dense canopy in those locations



Image 164 Miscommunication has led to inappropriate clearing of trees within the site



Image 165 Nearby is a patch of revegetation plantings, mostly acacias, with an understorey of weeds

#### **10.2.8 YARALLA ESTATE**

#### **Summary statistics**

RESERVE AREA		VEGETATED AREA	
No. native species	23	No. threatened species	0
No. introduced species	33	Priority control weeds	5

#### Flora and vegetation surveys

Random meander	Yes	Saltmarsh	Yes
Quadrat meander	Yes	BAM plot	No
MAPPED PCT #	3594	PCT NAME	Sydney Coastal Sandstone Foreshores Forest
MAPPED PCT #	3262	PCT NAME	Sydney Turpentine Ironbark Forest
MAPPED PCT #	4091	PCT NAME	Grey Mangrove-River Mangrove Forest
MAPPED PCT #	4097	PCT NAME	Samphire Saltmarsh
MAPPED PCT #	4028	PCT NAME	Estuarine Swamp Oak Twig-rush Forest
PCT(S) CONFIRMED	4091	PCT NAME	Grey Mangrove-River Mangrove Forest
PCT(S) CONFIRMED	4097	PCT NAME	Samphire Saltmarsh
PCT(S) CONFIRMED	4028	PCT NAME	Estuarine Swamp Oak Twig-rush Forest
PCT tested but not	3594	PCT NAME	Sydney Coastal Sandstone Foreshores Forest
confirmed			
PCT tested but not	3262	PCT NAME	Sydney Turpentine Ironbark Forest
confirmed			

#### **Description of vegetation**

The foreshore trail continues from Rivendell and Concord Hospital and follows the perimeter of the main Yaralla Estate. This is another heritage site, closely related to Rivendell and early Sydney history. The trail follows the northwestern side of the peninsula, skirting small and large patches of saltmarsh (Image 166). The saltmarsh has mangroves on the seaward side, which form a wide band around this part of Yaralla Bay. The trail then passes through a patch of Estuarine Swamp Oak Forest that is only moderately degraded (Image 167). Towards the end of the peninsula the vegetation is considerably more degraded around the trail (Image 168), before passing through a large stand of Giant Bamboo which has spread throughout the area, and is one of the heritage plantings (Image 169).

A key feature of Yaralla Estate is the heritage plantings, documented in self guided walking tour brochures published by NSW Health. The result is a mix of native and introduced species planted at various locations around the estate, including along the embankment (Image 170). The trail is much closer to the foreshore on eastern side of the peninsula and there is a quite narrow band of mangroves along most of this foreshore (Image 171). Part of this eastern side of the estate is currently fenced off for maintenance (Image 172). The self guided tour describes this area as the Grotto, a place rich in succulents, spiky plants and oddities including a dragon's blood tree (*Dracaena draco*) from the Canary Islands. There is an endangered Chinese fan palm (*Livistona chinensis*) and *Trachelospermum asiaticum*, a low-growing scrambler with mottled leaves, cousin of the widely-grown star jasmine climber, *T. jasminoides*. The foreshore trail continues on to the eastern entry through an avenue of degraded vegetation, including a mix of native and introduced trees and shrubs with abundant weedy vines (Image 173). From there, the trail links to shared pathways through Majors Bay Reserve.



 ${\it Image~166~Smaller~and~larger~patches~of~saltmarsh~are~common~along~the~western~side~of~Yaralla~Estate}$ 



Image 167 Parts of the foreshore trail pass through a patch of Estuarine Swamp Oak Forest EEC



 ${\it Image 168 Towards the end of the peninsula the vegetation surrounding the trail is more degraded and mostly weedy}$ 



Image 169 A large stand of bamboo has spread towards some of the heritage plantings



Image 170 There is a mix of native and introduced heritage plantings an the embankment behind the trail



Image 171 Mangroves along the eastern side of the peninsula are younger and form a narrow band beside the trail



Image 172 The heritage gardens are currently fenced off, presumably while restoration works are underway



Image 173 The eastern entry to Yaralla Estate is through an area of degraded vegetation dominated by weedy trees, shrubs and vines

#### 10.2.9 YARALLA EAST

#### **Summary statistics**

RESERVE AREA		VEGETATED AREA	
No. native species	64	No. threatened species	0
No. introduced	30	Priority control weeds	5
species			

#### Flora and vegetation surveys

PCT(S) CONFIRMED	3262	PCT NAME	Sydney Turpentine Ironbark Forest
PCT(S) CONFIRMED	3594	PCT NAME	Sydney Coastal Sandstone Foreshores Forest
MAPPED PCT #	3262	PCT NAME	Sydney Turpentine Ironbark Forest
MAPPED PCT #	3594	PCT NAME	Sydney Coastal Sandstone Foreshores Forest
Quadrat meander	Yes	BAM plot	Yes
Random meander	Yes	Saltmarsh	No

### **Description of vegetation**

Another patch of remnant vegetation is located on the eastern side of the Yaralla Estate, behind Arthur Walker Reserve. This patch is fully fenced beside the Sydney Water pumping station, and is currently rarely visited. Originally fenced for conservation, areas to the southern end of the site have good quality native vegetation retained (Image 174). Evidence of past monitoring activities for the site include numbered tree tags and star pickets used to mark transect lines (Image 175). Further northeast the native vegetation is becoming invaded by weedy vines and shrubs, including Lantana (Image 176) until the northern end where weeds entirely dominate all the vegetation (Image 177).



Image 174 Parts of the fenced Yaralla East site have good quality intact native vegetation



 ${\it Image 175 This reserve has been the subject of ongoing monitoring, including tree tagging and transect surveys}$ 



Image 176 Weedy vines and shrubs, including Lantana have begun to invade better areas of the reserve

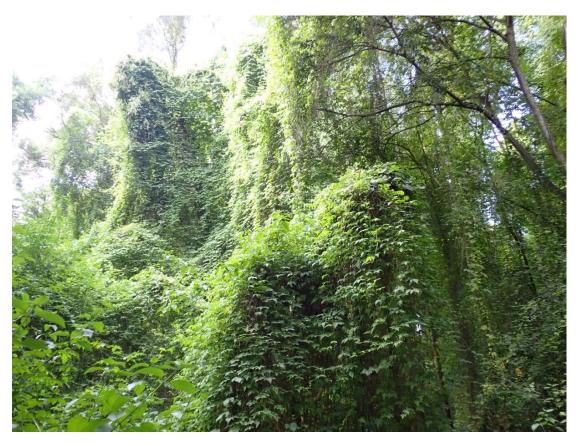


Image 177 Further north and east, the vegetation is dominated by weedy vines, shrubs and trees

#### 10.2.10 ARTHUR WALKER RESERVE

## **Summary statistics**

RESERVE AREA		VEGETATED AREA	
No. native species	64	No. threatened species	0
No. introduced	24	Priority control weeds	3
species			

### Flora and vegetation surveys

Random meander	Yes	Saltmarsh	No
Quadrat meander	Yes	BAM plot	No
MAPPED PCT #	3262	PCT NAME	Sydney Turpentine Ironbark Forest
MAPPED PCT #	3494	PCT NAME	Sydney Coastal Sandstone Foreshores Forest
PCT(S) CONFIRMED	3262	PCT NAME	Sydney Turpentine Ironbark Forest
PCT tested but not confirmed	3494	PCT NAME	Sydney Coastal Sandstone Foreshores Forest

## **Description of vegetation**

The focal point of Arthur Walker Reserve is a sports oval with cricket pitch and nets. Several mature trees have been retained and provide old growth structure for the vegetation (Image 178). A mix of remnant vegetation and supplementary plantings have resulted in good quality vegetation around

several sides of the reserve, especially on the boundary with Yaralla East reserve (Image 179). Mature Turpentines are among the diagnostic species that clearly indicate the original plant community for the area (Image 180).



Image 178 Several remnant mature trees have been supplemented with understorey planting



Image 179 Bush regeneration has helped to maintain good quality vegetation between this reserve and Yaralla East



Image 180 Mature Turpentines have been retained from the original vegetation in the area, supplemented with planting

## 10.2.11 MAJORS BAY RESERVE

## **Summary statistics**

RESERVE AREA		VEGETATED AREA	
No. native species	12	No. threatened species	0
No. introduced species	10	Priority control weeds	1

# Flora and vegetation surveys

Random meander	Yes	Saltmarsh	Yes
Quadrat meander	No	BAM plot	No
MAPPED PCT #	3594	PCT NAME	Sydney Coastal Sandstone Foreshores Forest
MAPPED PCT #	4091	PCT NAME	Grey Mangrove-River Mangrove Forest
PCT(S) CONFIRMED	4091	PCT NAME	Grey Mangrove-River Mangrove Forest
PCT tested but not	3594	PCT NAME	Sydney Coastal Sandstone Foreshores Forest
confirmed			

# **Description of vegetation**

Majors Bay Reserve was created on a landfill area and is predominantly used for recreational/sporting facilities, with more being constructed as part of the reserve's PoM. Shared paths are surrounded by mature introduced and native trees (Image 181). The main ecological asset for this reserve is the wide band on mangroves around the edge of Majors Bay (Image 182). Elsewhere, vegetation is limited to a

mix of mature native and introduced trees, with some Swamp Oaks starting to establish in some patches (Image 183).



Image 181 Majors Bay Reserve is dominated by sporting facilities with a mix of planted trees along paths and boundaries



Image 182 A wide swathe of mangroves are growing around the edge of Majors Bay



Image 183 A mix of native and introduced trees have been planted towards the eastern end of the reserve

# 10.2.12 CONCORD GOLF COURSE

# **Summary statistics**

RESERVE AREA		VEGETATED AREA	
No. native species	30	No. threatened species	1
No. introduced	20	Priority control weeds	2
species			

# Flora and vegetation surveys

Random meander	Yes	Saltmarsh	Yes
Quadrat meander	No	BAM plot	No
MAPPED PCT #	3594	PCT NAME	Sydney Coastal Sandstone Foreshores Forest
MAPPED PCT #	3262	PCT NAME	Sydney Turpentine Ironbark Forest
OTHER LIKELY PCT #	4028	PCT NAME	Estuarine Swamp Oak Twig-rush Forest
OTHER LIKELY PCT #	4097	PCT NAME	Samphire Saltmarsh
PCT(S) CONFIRMED	4097	PCT NAME	Samphire Saltmarsh
PCT(S) CONFIRMED	4028	PCT NAME	Estuarine Swamp Oak Twig-rush Forest
PCT tested but not	3594	PCT NAME	Sydney Coastal Sandstone Foreshores Forest
confirmed (relict)			
PCT tested but not	3262	PCT NAME	Sydney Turpentine Ironbark Forest
confirmed (relict)			

## **Description of vegetation**

Concord Golf Course is one of several council managed golf courses in the LGA. Established in 1899, for many years the original vegetation was retained in corridors between the fairways. Sydney Turpentine Ironbark Forest (STIF), a critically endangered ecological community, has been mapped as present on site as recently as 2016 (Image 184).

Mature trees have been supplemented with revegetation plantings around the carpark and golf course perimeter (Image 185). Both the dams have plantings around their perimeter, providing protection for the wildlife that inhabits the dams (Image 186).

One of the mapped STIF patches has semi mature Sydney Blue Gums, a diagnostic species, and other planted trees but the understorey has been completely cleared and a concrete path installed, and the area mulched (Image 187). Another STIF patch has young Turpentines, also a diagnostic species, but the understorey has been replaced with mulch (Image 188). The pattern is repeated almost entirely throughout the course. Another patch of STIF has mixed canopy species, some of which are diagnostic, and an understorey of mulch or mown grass (Image 189).

Towards the lower end of the course is an extensive network of drainage swales that back flood at very high tides. The saline influence has contributed to the establishment of Swamp Oaks in a corridor inside the fence (Image 190). In some places, small patches of saltmarsh have established in the lower areas of the drainage swale, however these were not relocated in subsequent surveys, possibly as a result of drainage management works to clear the channels.



Image 184 OEH (2016) vegetation mapping shows areas of Sydney Turpentine Ironbark Forest (purple) with weeds (pink)



Image 185 Mature trees are supplemented with revegetation plantings around the carpark



 ${\it Image~186~The~southern~dam~has~revegetation~plantings~surrounding~it,~most~of~which~are~native}$ 



Image 187 One of the STIF patches has semi-mature Sydney Blue Gums but the understorey has been completely removed



 ${\it Image~188~Another~STIF~patch~has~mostly~younger~Turpentines~but~the~understorey~has~been~completely~removed}$ 



Image 189 Yet another patch of mapped STIF has mixed canopy species, some of which are diagnostic, and no groundlayer



Image 190 Swamp Oaks have become established in tidally influenced drainage areas at the lower end of the golf course

## 10.2.13 STRATHFIELD NORTH PUBLIC SCHOOL

## **Summary statistics**

RESERVE AREA		VEGETATED AREA	
No. native species	18	No. threatened species	0
No. introduced	8	Priority control weeds	1
species			

## Flora and vegetation surveys

Random meander	Yes	Saltmarsh	No
Quadrat meander	No	BAM plot	No
MAPPED PCT #	3262	PCT NAME	Sydney Turpentine Ironbark Forest
PCT tested but not	3262	PCT NAME	Sydney Turpentine Ironbark Forest
confirmed			

## **Vegetation mapping**

Vegetation mapping for Strathfield North Public School shows the area is dominated by a mix of Urban/Exotics which includes planted native species, non local planted native species, and introduced species including weeds (Image 191). DCCEEW's Biodiversity Values mapping shows that no values have been mapped for this location.

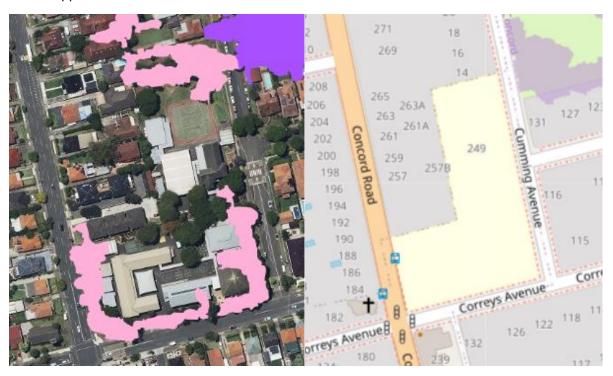


Image 191 (left) OEH 2016 vegetation mapping showing weeds and exotics; (right) Biodiversity values mapping showing none in this location

# **Description of vegetation**

Several large trees have been retained in the playground area of the school, with some understorey plantings and revegetation along the boundary fence (Image 192).



Image 192 Several large trees have been retained in the playground area of the school

Large trees have also been retained around the school perimeter and create areas of shade but with limited biodiversity value (Image 193).



Image 193 Large trees have been also been retained around the school perimeter

## 10.2.14 MORTLAKE PUBLIC SCHOOL

## **Summary statistics**

RESERVE AREA		VEGETATED AREA	
No. native species	16	No. threatened species	0
No. introduced	16	Priority control weeds	1
species			

## Flora and vegetation surveys

Random meander	Yes	Saltmarsh	No
Quadrat meander	No	BAM plot	No
MAPPED PCT #	3262	PCT NAME	Sydney Turpentine Ironbark Forest
PCT tested but not	3262	PCT NAME	Sydney Turpentine Ironbark Forest
confirmed			

## **Vegetation mapping**

Vegetation mapping for Mortlake Public School shows the school has large areas of Sydney Turpentine Ironbark Forest in the grounds (Image 194). DCCEEW's Biodiversity Values mapping shows that areas of biodiversity values have been mapped for this location with the criteria: Threatened species or communities with potential for serious and irreversible impacts.



Image 194 (left) OEH 2016 vegetation mapping showing STIF (purple); (right) Biodiversity Values mapping (purple)

## **Description of vegetation**

Mortlake Public School has a small area of moderately unkempt school yard on the corner of Brays Rd and Noble St (Image 195). A mix of native and introduced trees are common in this area and the understorey is a similar mix of native and weedy shrubs and groundcovers. Very few trees have any potential to be remnant in this location and throughout the school yard. Some of the planted trees along

Brays Rd are species that are considered diagnostic for STIF, however, this area is not in the mapped STIF patch on site (Image 196). Most, if not all, of these species are too young to be remnant, although some of them are diagnostic for STIF.

On the other side of the property the vegetation has a similar composition. Many of the trees along the Lancelot St and Archer St frontages were introduced Camphor Laurels and Brush Box, leaving little room for any canopy species that are diagnostic for STIF (Image 197). Trees through the middle of the school property are predominantly Brush Box with some native species, including mature Red Mahoganies (Image 198).



Image 195 Mortlake PS has a moderately unkept yard on the corner of Brays Rd and Noble St

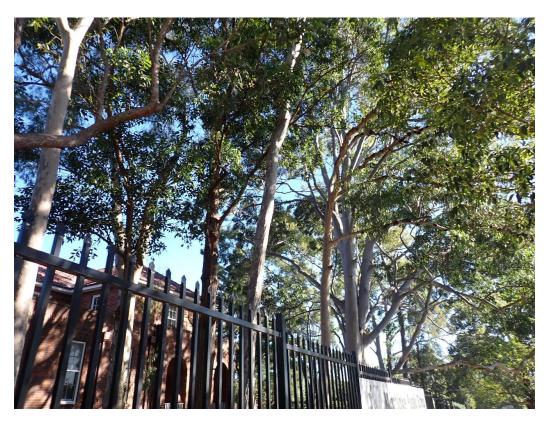


Image 196 Some of the planted trees along Brays Rd are species that are diagnostic for STIF



Image 197 Trees along Lancelot St and Archer St are a mix dominated by Camphor Laurels and Brush Box



Image 198 Trees through the middle of the school are predominantly Brush Box with a few mature Red Mahoganies

## 10.2.15 MAJORS BAY ROAD PARK

# **Summary statistics**

RESERVE AREA	VEGETATED AREA	
No. native species	No. threatened species	
No. introduced	Priority control weeds	
species		

# Flora and vegetation surveys

Random meander	Yes	Saltmarsh	No
Quadrat meander	No	BAM plot	No
MAPPED PCT #	3262	PCT NAME	Sydney Turpentine Ironbark Forest
PCT tested but not	3262	PCT NAME	Sydney Turpentine Ironbark Forest
confirmed			

# **Description of vegetation**

This small section of urban park is located in the centre of Majors Bay Rd. There are three main sections: the upper section has mixed aged Spotted Gums (Image 199). The middle section has the most intact native vegetation, with numerous mature Turpentines and some native grasses and forbs in the understorey (Image 200). The third section is closest to the shopping precinct and has a mix of Spotted Gums and Paperbarks with some Turpentines, with a lot of Spotted Gum recruitment (Image 201). Given its location in the centre of a busy road, this park has reduced ecological value.



 ${\it Image~199~The~upper~section~of~park~in~the~middle~of~Majors~Bay~Rd~has~multiple~Spotted~Gums}$ 



 ${\it Image~200~The~next~section~downhill~is~dominated~by~Turpentines~with~some~iron barks~and~some~native~ground covers}$ 



Image 201 The lower section has a mix of Spotted Gums and Paperbarks, with lots of regrowth

# 10.3 ZONE 3 - MAJORS BAY TO CABARITA

# **10.3.1 MAJORS BAY EASTERN FORESHORE**

# **Summary statistics**

RESERVE AREA		VEGETATED AREA	
No. native species	5	No. threatened species	0
No. introduced	6	Priority control weeds	2
species			

# Flora and vegetation surveys

Random meander	Yes	Saltmarsh	Yes
Quadrat meander	Yes	BAM plot	No
MAPPED PCT #	3594	PCT NAME	Sydney Coastal Sandstone Foreshores Forest
MAPPED PCT #	4091	PCT NAME	Grey Mangrove-River Mangrove Forest
OTHER LIKELY PCT #	4097	PCT NAME	Samphire Saltmarsh
PCT(S) CONFIRMED	4091	PCT NAME	Grey Mangrove-River Mangrove Forest
PCT(S) CONFIRMED	4097	PCT NAME	Samphire Saltmarsh
PCT tested but not	3594	PCT NAME	Sydney Coastal Sandstone Foreshores Forest
confirmed			

## **Description of vegetation**

This area includes a number of small foreshore reserves and foreshore areas from Majors Bay Reserve along the eastern foreshore of Majors Bay. The first section is a mown lawn link behind houses just north of Majors Bay Reserve, but with no pedestrian connection. This area has several smallish patches of saltmarsh established behind mangroves and with suitable conditions for the establishment of more (Image 202). Opportunities for landward migration of saltmarsh tend to be very limited in a highly urbanised environment and should be promoted in places such as this.

Younger Reserve/Shadrack Shaw Reserve is a small foreshore reserve with mown lawns and scattered plantings. The wide band of mangroves continues through the area, and a larger and more diverse patch of saltmarsh is present on the transition zone (Image 203). This reserve is linked northwards to Edwin Street Reserve via a footpath outside a row of residential villas (Image 204). In this location the foreshore vegetation is limited to a wide band of mangroves that provide deep shade behind the villas. Edwin Street Reserve is characterized by an old timber boardwalk that gave access through the mangroves for views and fishing, although it is currently 'closed for construction' (Image 205).

Further north is Northcote Street Reserve which has a partial foreshore link to Edwin Street (Image 206). A key feature of Northcote Street Reserve is the new boardwalk through the narrower band of mangroves (Image 207). This is a very popular place with local residents and provides views across Majors Bay to the Yaralla Estate. North of this reserve the foreshore is more recently formalised although there are still some disruptions to the footpath connection through to Wangal Park (Image 208). Vegetation through this section is limited to managed gardens of new apartment blocks and a narrowing band of mangroves.



Image 202 Link behind houses from Majors Bay Reserve to Shadrack Shaw Reserve with saltmarsh on the slope



Image 203 Shadrack Shaw Reserve has a similar but larger area of saltmarsh between mangroves and mown lawns



 ${\it Image~204~Linking~path~through~to~Edwin~Street~Reserve~has~a~wide~band~of~mangroves~along~the~foreshore}$ 



Image 205 A older timber boardwalk gave access through the mangroves for views and fishing opportunities



Image 206 Northcote Street Reserve has a partial foreshore link to Edwin Street, and a narrow band of mangroves



Image 207 A newer timber boardwalk provides popular access through the mangroves to views across the bay



Image 208 North of Northcote St the foreshore is more formalised and the foreshore path is almost completely connected to Wangal Centenary Reserve

#### 10.3.2 WANGAL CENTENARY RESERVE

## **Summary statistics**

RESERVE AREA		VEGETATED AREA	
No. native species	45	No. threatened species	1
No. introduced	11	Priority control weeds	1
species			

## Flora and vegetation surveys

Random meander	Yes	Saltmarsh	Yes
Quadrat meander	Yes	BAM plot	No
MAPPED PCT #	3594	PCT NAME	Sydney Coastal Sandstone Foreshores Forest
OTHER LIKELY PCT #	4028	PCT NAME	Estuarine Swamp Oak Twig-rush Forest
PCT(S) CONFIRMED	4028	PCT NAME	Estuarine Swamp Oak Twig-rush Forest
PCT tested but not confirmed	3594	PCT NAME	Sydney Coastal Sandstone Foreshores Forest

## **Description of vegetation**

Wangal Centenary Reserve is a small reserve on a narrow peninsula into Parramatta River at the northern end of Mortlake. It has multiple visitor facilities including a picnic area with barbeque, playground including nature play area, and is used informally for storage of kayaks and dinghies at the southern end (Image 209). The reserve has an interesting mix of plantings, most of which are native and many of which are locally relevant for the situation (Image 210). A number of mature native trees provide the backbone for the revegetation plantings, although the setting remains formalised throughout, with concrete paths between mulched garden beds, interspersed with areas of mown lawns.

The western foreshore has been completely formalised with a vertical sandstone wall topped with a new boardwalk (Image 211). Access to the foreshore is available towards the northern end of the reserve where the seawall is stepped rows of sandstone blocks, creating an opportunity for swimming and kayaking (Image 212). Information signs and historic relics briefly describe the locations early history as Greens Point shipyards, and these are surrounded by very sandy soils that support limited vegetation. A small beach lies to the east of this area, popular with dog walkers, and surrounded by mown grass open space (Image 213).

The centre of the reserve has a pleasant mix of native and exotic plantings in mulched garden beds and surrounded by mown grass (Image 214). Further south on the eastern side the vegetation gives way to a large stand of Swamp Oaks with the concrete path on the landward side. Looking back to the eastern foreshore from the park boundary the Swamp Oaks form a narrow but dense band of fringing vegetation above the seawall (Image 215). The foreshore footpath continues along the waterfront side of the row of new apartment buildings and connects Wangal Centenary Reserve with Punt Park (Image 216).



Image 209 Park visitors use the picnic facilities and nature playground, while neighbours store their dinghies on the seawall



Image 210 The reserve has a variety of mixed age plantings and some remnant trees



 ${\it Image~211~The~western~foreshore~has~been~completely~formalised~with~sandstone~seawalls~and~boardwalk}$ 



Image 212 The northern end of the peninsula has a stepped seawall and relics from the Green Point shipyards



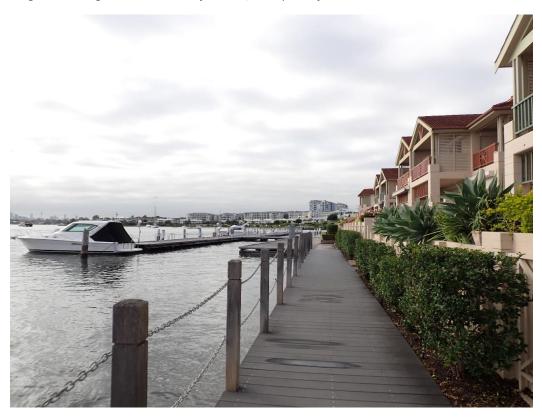
Image 213 A small beach sits on the eastern side of the park, with mown grass open space



Image 214 The centre of the reserve has a mix of native and exotic plantings in mulched garden beds



Image 215 Looking back to the eastern foreshore, Swamp Oaks form a dense narrow band above the seawall



 ${\it Image~216~The~foreshore~path~connects~Wangal~Centenary~Reserve~with~Punt~Park~via~a~boardwalk}$ 

# 10.3.3 WATERFRONT PARK/KENDALL BAY

# **Summary statistics**

RESERVE AREA	VEGETATED AREA	
No. native species	No. threatened species	
No. introduced	Priority control weeds	
species		

# Flora and vegetation surveys

Random meander	Yes	Saltmarsh	Yes
Quadrat meander	No	BAM plot	No
MAPPED PCT #	4091	PCT NAME	Grey Mangrove-River Mangrove Forest
OTHER LIKELY PCT #	4097	PCT NAME	Samphire Saltmarsh
PCT(S) CONFIRMED	4091	PCT NAME	Grey Mangrove-River Mangrove Forest
PCT(S) CONFIRMED	4097	PCT NAME	Samphire Saltmarsh

# **Description of vegetation**

Waterfront Park lies between the Breakfast Point Country Club and Kendall Bay (Image 217). The main ecological value of this park is not the manicured gardens with a mix of native and exotic species but the fringing mangroves along the upper end of Kendall Bay, and the small patches of saltmarsh plants sheltering between the mangroves and the weedy shrubs below the footpath in this area.



Image 217 Waterfront Park lies between the Breakfast Point Country Club and Kendall Bay

#### **10.3.4 CABARITA PARK**

## **Summary statistics**

RESERVE AREA		VEGETATED AREA	
No. native species	43	No. threatened species	0
No. introduced	28	Priority control weeds	4
species			

## Flora and vegetation surveys

Random meander	Yes	Saltmarsh	Yes
Quadrat meander	Yes	BAM plot	No
OTHER LIKELY PCT #	3594	PCT NAME	Sydney Coastal Sandstone Foreshores Forest
OTHER LIKELY PCT #	4097	PCT NAME	Samphire Saltmarsh
PCT tested but not	3594	PCT NAME	Sydney Coastal Sandstone Foreshores Forest
confirmed			
PCT(S) CONFIRMED	4097	PCT NAME	Samphire Saltmarsh

## **Description of vegetation**

Cabarita Park is a moderately sized reserve on a peninsula, with a range of visitor amenities, including swimming pool, marina and ferry wharf. The upper and eastern sections of the park have mixed native and introduced plantings in rows and stands, with Brush Box particularly common (Image 218). Native understorey plantings have been added to gardens outside the pool entrance (Image 219).

The outer foreshore of Cabarita Park, between the marina and the ferry wharf, has some 'wild' areas (Image 220). There are low sandstone cliffs along part of the foreshore above a stand of Sheoaks that are becoming smothered with weeds and weedy vines (Image 221). Further along the foreshore the slope is less steep. Mature canopy trees are more common towards Cabarita Wharf and surround the access roads through this area (Image 222).

East and west of the wharf there are patches of saltmarsh along the upper limit of the intertidal zone (Image 223). These are small linear patches of saltmarsh within a very narrow band of suitable habitat, but are considered to be saltmarsh regardless of the size of the patches.

A mix of planted native trees have been established at the western end of the park, close to the neighbouring residential area (Image 224). These include some mature specimens that may potentially be remnants of the original vegetation in the area.



 ${\it Image~218~The~upper~and~eastern~parts~of~Cabarita~Park~have~mixed~native~and~introduced~canopy~plantings}$ 



 ${\it Image~219~Some~native~understorey~plantings~have~been~added~outside~the~pool~entrance}$ 



Image 220 West of the marina the park has some 'wild' areas along the foreshore



Image 221 Sandstone low cliffs drop down through the weedy Swamp Oaks to the foreshore



Image 222 Mature canopy trees surround the access road to Cabarita Wharf



Image 223 East and west of the wharf are a number of small patches of saltmarsh



Image 224 A mix of planted native trees provide good shade at the western end of the park

## 10.4 ZONE 4 – HEN AND CHICKEN BAY WEST

## 10.4.1 QUEEN ELIZABETH 2 PARK

## **Summary statistics**

RESERVE AREA		VEGETATED AREA	
No. native species	87	No. threatened species	0
No. introduced	31	Priority control weeds	2
species			

## Flora and vegetation surveys

Random meander	Yes	Saltmarsh	No
Quadrat meander	Yes	BAM plot	Yes
MAPPED PCT #	3262	PCT NAME	Sydney Turpentine Ironbark Forest
PCT(S) CONFIRMED	3262	PCT NAME	Sydney Turpentine Ironbark Forest

#### **Description of vegetation**

Queen Elizabeth 2 Park is a moderate sized reserve surrounded by urban residential development. It is of particular importance because of its high quality native vegetation that is remnant of the original vegetation in the area (Image 225). These areas of STIF adjoin large open mown grass areas and playing fields. The remnant patches of STIF have been supplemented with understorey plantings in areas with existing STIF canopy species in open space areas (Image 226).

One of the main values for this reserve is that the vegetation is genuinely remnant and has achieved good floristic structure, and this has been continued with areas of revegetation (Image 227). The floristic diversity in the reserve is second highest in the LGA, second to Brett Park which has a diverse suite of revegetation plantings drawn from at least two different PCTs. Many of the plantings for Queen Elizabeth 2 Park are already found in the reserve or are appropriate for STIF, enhancing the local occurrence of STIF rather than diluting it with flora species more appropriate for other vegetation communities.

Council is undertaking ongoing management of bushland in this reserve through engagement with bushcare volunteers from the local community (Image 228). The park also provides opportunities for community education about local native flora and fauna and the importance of interactions between them, achieved through a range of different signage along footpaths and beside grassed open spaces (Image 229).



Image 225 Queen Elizabeth Park has areas of high quality native vegetation beside open grassed space



Image 226 Most of the trees within the park are appropriate for the mapped vegetation community - STIF



Image 227 Key assets for QE2 Park are that the vegetation is genuinely remnant and has good floristic structure



 ${\it Image~228~Council~is~undertaking~ongoing~management~of~bushland~through~engagement~with~the~local~community}$ 



Image 229 The park provides opportunities for education about native wildlife as well as the local plants

## **10.4.2 ROTHWELL PARK**

# **Summary statistics**

RESERVE AREA		VEGETATED AREA
No. native species	44	No. threatened species 0
No. introduced	23	Priority control weeds 0
species		

# Flora and vegetation surveys

Random meander	Yes	Saltmarsh	No
Quadrat meander	Yes	BAM plot	No
OTHER LIKELY PCT #	3262	PCT NAME	Sydney Turpentine Ironbark Forest
PCT(S) CONFIRMED	3262	PCT NAME	Sydney Turpentine Ironbark Forest

# **Description of vegetation**

Rothwell Park is opposite QE2 Park and downstream on the upper end of Saltwater Creek. A small area on the western side of park has remnant vegetation, supplemented with revegetation plantings (Image 230). An important characteristic of the vegetation is the mature Turpentines and other diagnostic tree species from STIF, which substantiate identifying the extant vegetation as STIF (Image 231). The understorey includes remnant species and appropriate plantings for this PCT.

The remainder of the park is a sports oval with clubhouse, and footpath connections to other parks and sporting facilities. Ironbarks and Sheoaks have been planted along many of the paths at the back of the clubhouse (Image 232). Elsewhere, mature Turpentines and Sydney Blue Gums have been retained or planted along the road perimeter of the park.



Image 230 A remnant patch of vegetation has been restored outside the sports clubhouse in Rothwell Park



Image 231 Some mature Turpentines validate the restoration plantings and the site has good floristics and structure

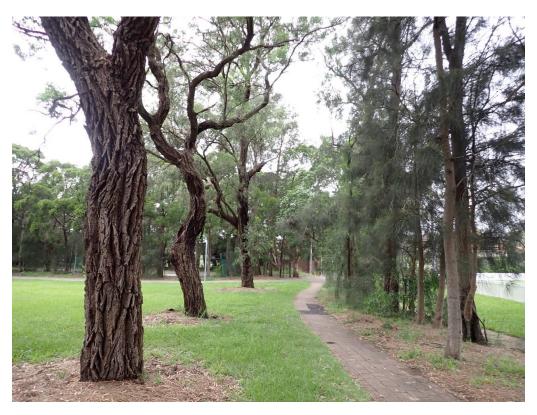


Image 232 Ironbarks and Sheoaks have been planted along the path around the back of the oval

## 10.4.3 MASSEY PARK GOLF COURSE

## **Summary statistics**

RESERVE AREA	VEGETATED AREA	
No. native species	No. threatened species	
No. introduced	Priority control weeds	
species		

## Flora and vegetation surveys

Random meander	Saltmarsh	
BAM Plot	Quadrat meander	
MAPPED PCT #	PCT NAME	
MAPPED PCT #	PCT NAME	
OTHER LIKELY PCT #	PCT NAME	
PCT(S) CONFIRMED		

## **Description of vegetation**

Massey Park Golf Course is located on an area of landfill, therefore any vegetation on site is planted. Some of canopy species are local native trees, although these are subsidiary to the core management of the site – as a golf course (Image 233). Stands and narrow corridors of trees such as Paperbarks form barriers between fairways, primarily for improving player safety (Image 234). Elsewhere the plantings are more sparse and include a mix of native and exotic species (Image 235). In reality, with the site's

history of landfill, the main opportunities for ecological gains are along the seawall around the edge of Exile Bay (Image 236).

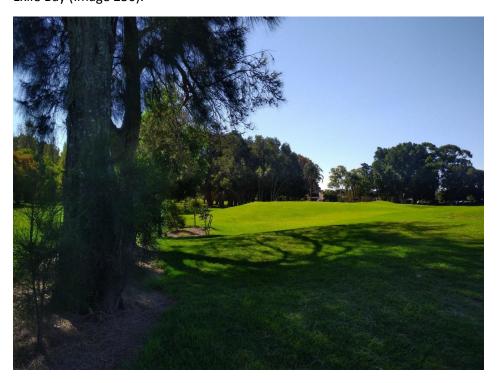


Image 233 Despite the presence of native trees such as Sheoaks, the site is still managed as a golf course



Image 234 Stands and corridors of trees such as Paperbarks form barriers between fairways, tees and greens



Image 235 Elsewhere plantings are more sparse and mixed, with introduced trees being common



Image 236 Since Massey Park is built on landfill, the main opportunities for ecological gains are along the Exile Bay seawall

#### **10.4.4 PRINCE EDWARD PARK**

### **Summary statistics**

RESERVE AREA		VEGETATED AREA	
No. native species	26	No. threatened species	0
No. introduced	14	Priority control weeds	0
species			

### Flora and vegetation surveys

Random meander	Yes	Saltmarsh	Yes
Quadrat meander	Yes	BAM plot	No
MAPPED PCT #	4097	PCT NAME	Samphire Saltmarsh
MAPPED PCT #	3594	PCT NAME	Sydney Coastal Sandstone Foreshores Forest
PCT(S) CONFIRMED	4097	PCT NAME	Samphire Saltmarsh
PCT tested but not confirmed	3594	PCT NAME	Sydney Coastal Sandstone Foreshores Forest

### **Description of vegetation**

Prince Edward Park is a smaller reserve located on a small peninsula onto Hen and Chicken Bay. The upper portion of the park has mature native plantings, many of which are relevant for the sandstone vegetation that would have been originally in the area (Image 237). To the north a foreshore footpath connects towards France Bay through manicured gardens (Image 238). A more informal path connects around the reserve foreshore to a small stand of Sheoaks (Image 239).

A key feature of Prince Edward Park is the large patch of saltmarsh that continues along much of the southern foreshore (Image 240). The saltmarsh has a high level of diversity which promotes good resilience in the community. From there, a formal foreshore path continues along the seaward side of new apartment buildings and on to connect with the foreshore path around Massey Park Golf Course and Exile Bay (Image 241).



Image 237 The upper portion of Prince Edward Park has mature native plantings, many of which are locally relevant



 ${\it Image~238~The~foreshore~footpath~connects~towards~France~Bay~through~manicured~gardens~outside~apartment~buildings}$ 



Image 239 A more informal path connects around the reserve foreshore to a small stand of Sheoaks



Image 240 A large patch of saltmarsh has good diversity along much of the southern foreshore



Image 241 The foreshore path continues along the front of apartment buildings and along the edge of Massy Park Golf Course

## **10.4.5 BAYVIEW PARK**

# **Summary statistics**

RESERVE AREA		VEGETATED AREA	
No. native species	23	No. threatened species	0
No. introduced	20	Priority control weeds	0
species			

# Flora and vegetation surveys

Random meander	Yes	Saltmarsh	Yes
Quadrat meander	Yes	BAM plot	No
MAPPED PCT #	3594	PCT NAME	Sydney Coastal Sandstone Foreshores Forest
MAPPED PCT #	4091	PCT NAME	Grey Mangrove-River Mangrove Forest
PCT(S) CONFIRMED	4091	PCT NAME	Grey Mangrove-River Mangrove Forest
PCT tested but not	3494	PCT NAME	Sydney Coastal Sandstone Foreshores Forest
confirmed			

# **Description of vegetation**

Bayview Park is a small peninsula park onto Hen and Chicken Bay. The upper sections of the park have a mix of remnant trees and plantings (Image 242). Many of these are appropriate for the original sandstone vegetation community. The lower parts of the park are more open and generally lack

anything other than mown grass for the understorey (Image 243). Mature paperbarks are scattered along the foreshore near the swimming pool and wharf (Image 244).

West of the boat ramp is a large stand of mangroves on the seaward side of the Chateauguay Walk (Image 245). The mangroves provide screening for the apartment buildings along this section of foreshore. Locals store their kayaks and dinghies under the mangroves in an area where the understorey vegetation consists of weed grasses and several other weedy species (Image 246). This area has a high potential for the establishment of saltmarsh as sea levels rise in response to climate change impacts, and should be monitored to prevent impacts when this happens.

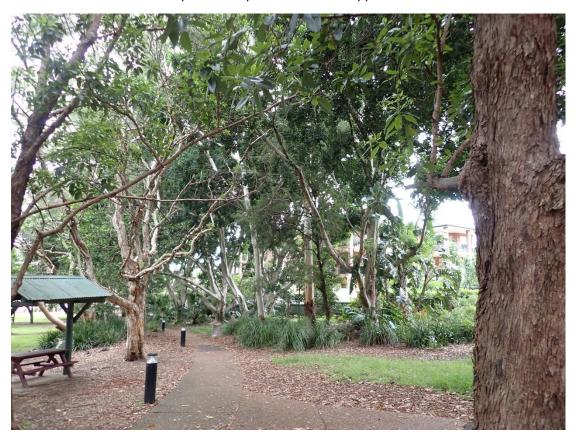


Image 242 The upper sections of the park have a mix of remnant trees and plantings that give good shade



Image 243 The lower parts of the park are more open and lack anything other than mown grass understorey



Image 244 Mature paperbarks are dotted along the foreshore near the swimming pool and wharf



Image 245 West of the boat ramp is a large stand of mangroves providing screening for Chateauguay Walk



Image 246 Locals store kayaks and dinghies under the mangroves where the understorey is weeds only

## 10.4.6 ST LUKES PARK

### **Summary statistics**

RESERVE AREA		VEGETATED AREA	
No. native species	44	No. threatened species	0
No. introduced	34	Priority control weeds	0
species			

### Flora and vegetation surveys

Random meander	Yes	Saltmarsh	No
Quadrat meander	Yes	BAM plot	No
PRE 1750 PCT #	3262	PCT NAME	Sydney Turpentine Ironbark Forest
OTHER LIKELY PCT #	4028	PCT NAME	Estuarine Swamp Oak Twig-rush Forest
PCT(S) CONFIRMED	4028	PCT NAME	Estuarine Swamp Oak Twig-rush Forest
PCT tested but not confirmed	3262	PCT NAME	Sydney Turpentine Ironbark Forest

### **Description of vegetation**

St Lukes Park is located between Concord High School and Cintra Park and predominantly has sports fields surrounded by mature and semi-mature planted native trees. Along Stanley Street these adjoin mature street plantings including fig trees (Image 247). On the other side of the park the plantings consist of a mix of STIF species, with some understorey plantings along the fences of residential properties (Image 248). On Gipps St, towards the canal, is a steeply sloping bank that has native shrubs and groundcovers planted (Image 249).

A long linear stand of Swamp Oaks have either been planted or become established along the edge of a concrete lined drainage channel (Image 250). The northern end of the park was originally mudflats with mangroves, and there has been extensive landfill to create level playing surfaces throughout the park, and none of the vegetation could be considered remnant. Despite this the plantings are now mature around the northern oval, with Sydney Blue Gums and Blackbutts growing along the road edge (Image 251). These trees are now old enough to develop hollows and provide an important resource for hollow dwelling fauna. The Blue Gums are underplanted with local native species from a range of vegetation communities, creating a series of native gardens that provide a visual barrier to the road and carpark areas (Image 252).



Image 247 Younger canopy plantings adjoin mature fig trees along Stanley St, beside the high school



Image 248 A mix of STIF canopy species has been planted near the community centre, with some shrub plantings nearby



 ${\it Image~249~Shrubs~and~ground covers~have~been~planted~on~a~slope~leading~down~to~Gipps~St}$ 



 ${\it Image~250~An~extensive~stand~of~Swamp~Oaks~has~become~established~along~the~edge~of~the~canal}$ 



Image 251 Mature Sydney Blue Gums and Blackbutts are growing around the northern end of playing fields



Image 252 The Blue Gums are underplanted with local native species, creating native gardens

#### 10.4.7 CINTRA PARK

## **Summary statistics**

RESERVE AREA		VEGETATED AREA	
No. native species	18	No. threatened species	0
No. introduced	19	Priority control weeds	0
species			

### Flora and vegetation surveys

Random meander	Yes	Saltmarsh	No
Quadrat meander	Yes	BAM plot	No
PRE 1750 PCT #	3262	PCT NAME	Sydney Turpentine Ironbark Forest
OTHER LIKELY PCT #	4028	PCT NAME	Estuarine Swamp Oak Twig-rush Forest
PCT(S) CONFIRMED	4028	PCT NAME	Estuarine Swamp Oak Twig-rush Forest
PCT tested but not confirmed	3262	PCT NAME	Sydney Turpentine Ironbark Forest

### **Description of vegetation**

Cintra Park adjoins St Lukes Park and has a similar preponderance of sporting facilities. Buffer planting consisting of canopy species has been established between Gipps St and the tennis courts carpark (Image 253). Several existing mature trees provide core habitat resources, and occasional patches of native groundcovers add to these. The tree plantings extend along the edge of the channel and around the edge of the tennis courts, using a mix of native species (Image 254).

Like St Lukes Park, the northern end of Cintra Park was previously an area of mudflats and mangroves, and most of the reserve is likely to have had some level of landfill to achieve a level playing surface. Just north of the tennis courts are a large area of bitumen netball courts surrounded by semi mature tree plantings that create a visual and noise barrier to the adjoining residential area (Image 255). The northern end of the park fronts onto Lyons Rd West and is separated by a dense band of native trees planted in several rows (Image 256).



Image 253 More recent tree plantings have supplemented existing mature trees, with patches of native understorey

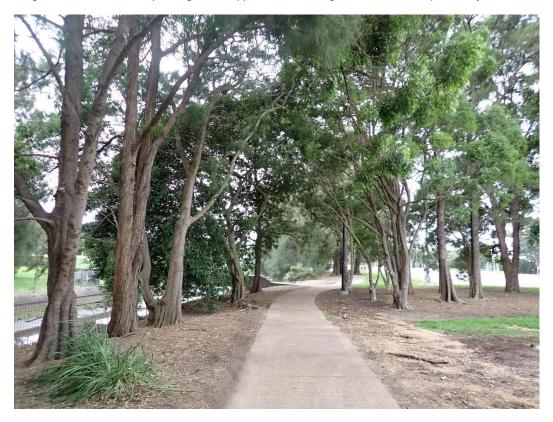


Image 254 Tree plantings are extended along the channel and around the edge of the tennis courts



Image 255 Tree plantings provide a visual and noise barrier between netball courts and adjacent residential areas



Image 256 Plantings along Lyons Rd West form a dense vegetation barrier between the oval and the road

### 10.4.8 CONCORD HIGH SCHOOL

## **Summary statistics**

RESERVE AREA		VEGETATED AREA	
No. native species	43	No. threatened species	0
No. introduced	29	Priority control weeds	1
species			

# Flora and vegetation surveys

Random meander	Yes	Saltmarsh	No
Quadrat meander	Yes	BAM plot	No
PRE 1750 PCT #	3262	PCT NAME	Sydney Turpentine Ironbark Forest
PCT tested but not	3262	PCT NAME	Sydney Turpentine Ironbark Forest
confirmed			

# **Vegetation mapping**



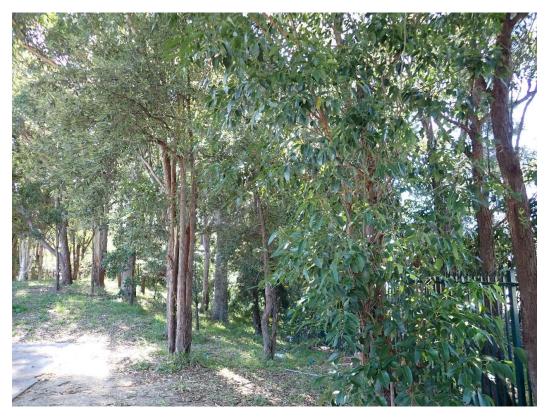
Image 257 (left) OEH 2016 vegetation mapping showing Urban Natives & Exotics (pink); (right) Biodiversity Values mapping showing no values on this site

# **Description of vegetation**

Concord High School has no mapped native vegetation and no biodiversity values mapped for the site (Image 257). Despite this there are some mature native trees along the boundary fence with St Lukes Park and in a central feature garden within the school grounds (Image 258). Younger plantings along the Lyons Rd West boundary fence are mainly from STIF (Image 259) which is the vegetation community most likely to be in the area prior to development.



Image 258 A mix of predominantly native species has been planted in a central feature garden



 ${\it Image~259~Younger~plantings~along~the~Lyons~Rd~West~boundary~fence~are~mainly~from~STIF}$ 

# 10.5 ZONE 5 – HEN AND CHICKEN BAY EAST

# 10.5.1 HALLIDAY PARK/WYMSTON PDE FORESHORE

## **Summary statistics**

RESERVE AREA		VEGETATED AREA	
No. native species	N/A	No. threatened species	0
No. introduced	N/A	Priority control weeds	N/A
species			

## Flora and vegetation surveys

Random meander	No	Saltmarsh	Yes
Quadrat meander	No	BAM plot	No
MAPPED PCT #	4091	PCT NAME	Grey Mangrove-River Mangrove Forest
OTHER LIKELY PCT #	4097	PCT NAME	Samphire Saltmarsh
PCT(S) CONFIRMED	4091	PCT NAME	Grey Mangrove-River Mangrove Forest
PCT(S) CONFIRMED	4097	PCT NAME	Samphire Saltmarsh

## **Description of vegetation**

Halliday Park and Wymston Parade have connecting foreshores onto the eastern side of Hen and Chicken Bay. Both are urbanised environments with a younger but dense stand of mangroves along most of Halliday Park's foreshore (Image 260). The mangroves are more sparse further north along Wymston Parade (Image 261). The rest of the foreshore is predominantly mudflats used by migratory waders for foraging (Image 262).



Image 260 Young mangroves along Halliday Park foreshore

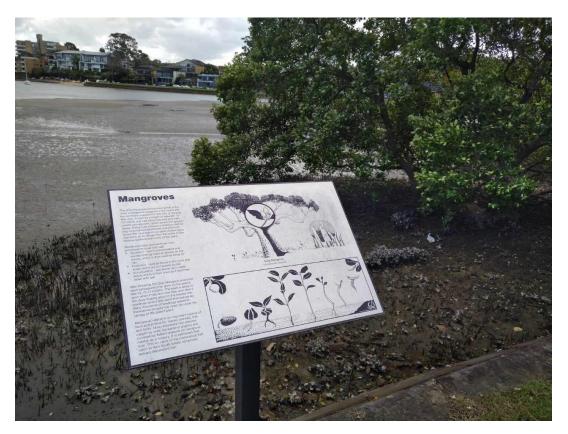


Image 261 Scattered mangroves towards Wymston Parade

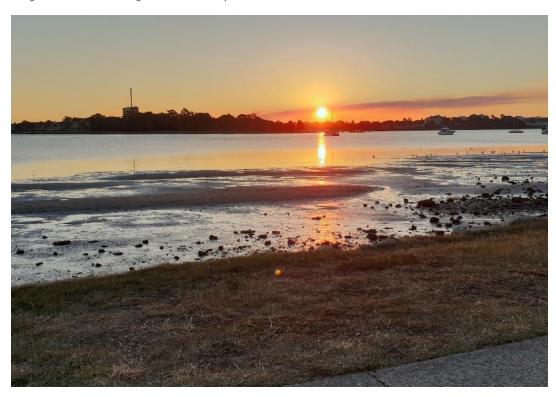


Image 262 Most of the foreshore is mudflats used by seasonal migratory waders for foraging

#### **10.5.2 MAYNE LANE FORESHORE**

## **Summary statistics**

RESERVE AREA		VEGETATED AREA	
No. native species	12	No. threatened species	0
No. introduced	24	Priority control weeds	5
species			

# Flora and vegetation surveys

Random meander	No	Saltmarsh	Yes
Quadrat meander	No	BAM plot	No
MAPPED PCT #	4091	PCT NAME	Grey Mangrove-River Mangrove Forest
OTHER LIKELY PCT #	4097	PCT NAME	Samphire Saltmarsh
PCT(S) CONFIRMED	4091	PCT NAME	Grey Mangrove-River Mangrove Forest
PCT(S) CONFIRMED	4097	PCT NAME	Samphire Saltmarsh

# **Description of vegetation**

Mayne Lane Reserve connects Wymston Parade to Henry Lawson Park. There is a section of seawall that has saltmarsh establishing as a result of higher high tides and backflooding through the local drainage system (Image 263). Young mangroves are forming a dense stand in this area (Image 264). Further south, vegetation is predominantly weedy along the bank where Mayne Lane meets Wymston Parade (Image 265). Below the weeds, however, is a series of smaller patches of saltmarsh that will soon join to form a much larger patch unless impacts from informal boat storage affects the success of this (Image 266).



Image 263 Small patches of saltmarsh are established on the top of the seawall



Image 264 Young mangroves are becoming established in the area of Mayne Lane reserve



Image 265 Vegetation is predominantly weeds along the bank where Mayne Lane meets Wymston Parade



Image 266 Below the weedy bank is a series of smaller patches of saltmarsh being impacted by boat storage

### **10.5.3 HENRY LAWSON PARK**

## **Summary statistics**

RESERVE AREA		VEGETATED AREA	
No. native species	39	No. threatened species	0
No. introduced species	30	Priority control weeds	2

# Flora and vegetation surveys

Random meander	Yes	Saltmarsh	Yes
Quadrat meander	Yes	BAM plot	No
MAPPED PCT #	3594	PCT NAME	Sydney Coastal Sandstone Foreshores Forest
PCT(S) CONFIRMED	3594	PCT NAME	Sydney Coastal Sandstone Foreshores Forest

## **Description of vegetation**

Henry Lawson Park is a moderate sized reserve on the eastern side of Hen and Chicken Bay. It is located in a natural amphitheatre, with steep slopes up to Abbotsford Parade and St Albans St (Image 267). From the upper vantage point the vegetation can be seen to be a mix of native and introduced species, which is a mix of garden plantings and species that have become weedy in the area (Image 268). The centre of the park is a large flatter area near the foreshore that is surrounded by footpaths and the children's playground (Image 269). Amongst these exotics is enough remnant native flora to give some integrity to the overall vegetation (Image 270). Towards the southern end is a series of low sandstone cliffs topped with remnant native species (Image 271). The park has a sandstone seawall that includes a small inlet for a sandy beach near the playground (Image 272).



Image 267 View across Henry Lawson Park from Abbotsford Parade



Image 268 Parts of the park have a mix of mature introduced trees and mixed understorey species



Image 269 The core area of the park is a large flat area surrounded by footpaths and plantings



Image 270 Some remnant species add to the integrity of the overall vegetation



 ${\it Image~271~Low~sandstone~cliffs~and~remnant~native~species~are~most~common~on~the~southern~side~of~the~park}$ 



Image 272 Henry Lawson Park has a small beach area below the children's playground

## **10.5.4 QUARANTINE RESERVE**

### **Summary statistics**

RESERVE AREA		VEGETATED AREA	
No. native species	54	No. threatened species	0
No. introduced	32	Priority control weeds	2
species			

### Flora and vegetation surveys

Random meander	Yes	Saltmarsh	Yes
Quadrat meander	Yes	BAM plot	Yes
PRE 1750 PCT #	3594	PCT NAME	Sydney Coastal Sandstone Foreshores Forest
OTHER LIKELY PCT #	4028	PCT NAME	Estuarine Swamp Oak Twig-rush Forest
OTHER LIKELY PCT #	4091	PCT NAME	Grey Mangrove-River Mangrove Forest
OTHER LIKELY PCT #	4097	PCT NAME	Samphire Saltmarsh
PCT(S) CONFIRMED	3594	PCT NAME	Sydney Coastal Sandstone Foreshores Forest
PCT(S) CONFIRMED	4028	PCT NAME	Estuarine Swamp Oak Twig-rush Forest
PCT(S) CONFIRMED	4091	PCT NAME	Grey Mangrove-River Mangrove Forest
PCT(S) CONFIRMED	4097	PCT NAME	Samphire Saltmarsh

### **Description of vegetation**

Quarantine Reserve once housed the Animal Quarantine Station after the one at Bradleys Head closed, and operated from around 1930 to 1980. Today the park has open space with mature local native trees surrounded by mown lawns, picnic facilities and historic outbuildings. A concrete path separates this area from the adjoining bushland area (Image 273). From the diversity in the bushland patch, the area has had extensive revegetation planting, most of which is appropriate for the original vegetation community. Revegetation has been undertaken below the sewer popup that is known to overflow, located below the path in the northeastern side of the reserve (Image 274).

Below this point, gently sloping sandstone cliffs drop down to flatter land on the foreshore. Apart from some typical environmental weeds, the vegetation is predominantly native (Image 275). The flatter areas below have extensive stands of Swamp Oaks, a species that may have established naturally as it is known to grow in this location, within several metres of the high tide mark (Image 276). Several patches of mature mangroves are scattered along the northern foreshore (Image 277), adjoining a sandy beach on the corner of the headland, between the mangroves and a west-facing seawall. Samphire saltmarsh has become established at the top of the seawall and is likely to continue to spread along this edge as the conditions continue to favour the species (Image 278). Current park management includes mowing to the top of the seawall, so that the saltmarsh is also mown. Establishing a no whip, no mow zone here would assist with conserving the saltmarsh in the area.



Image 273 A footpath separates mature trees and mown grass from the extensively revegetated lower slopes



Image 274 Good revegetation has been implemented in the area around the Sydney Water overflow zone



Image 275 Gently sloping sandstone low cliffs have predominantly native species



Image 276 Flat areas above the foreshore have characteristic Swamp Oaks



 ${\it Image~277~Several~small~patches~of~mature~mangroves~are~dotted~along~the~foreshore}$ 



Image 278 Samphire saltmarsh has become established on top of the seawall and needs to be protected from mowing

# **10.6 ZONE 6 – FIGTREE BAY**

### 10.6.1 WERRELL RESERVE

## **Summary statistics**

RESERVE AREA		VEGETATED AREA	
No. native species	23	No. threatened species	0
No. introduced	22	Priority control weeds	2
species			

## Flora and vegetation surveys

Random meander	Yes	Saltmarsh	No
Quadrat meander	Yes	BAM plot	No
PRE 1750 PCT #	3594	PCT NAME	Sydney Coastal Sandstone Foreshores Forest
PCT tested but not	3594	PCT NAME	Sydney Coastal Sandstone Foreshores Forest
confirmed			

# **Description of vegetation**

Werrell Reserve is located above Abbotsford Ferry Wharf (Image 279). This is a small park that combines grassed open space with some remnant trees, sandstone outcrops, and children's play equipment (Image 280). Revegetation planting towards the eastern end of the reserve consists of groundcovers and shrubs, and aims to restore some of the character of the pre-existing vegetation (Image 281).

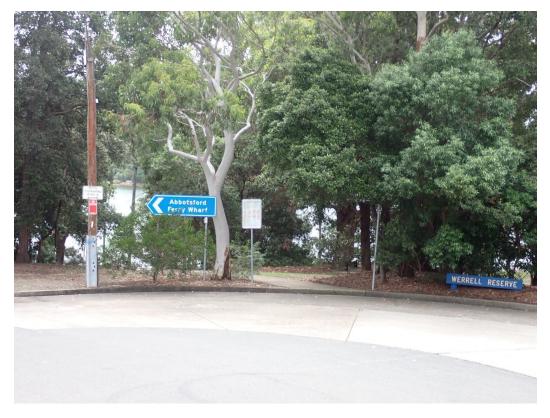


Image 279 Werrell Reserve is a small park located above Abbotsford Ferry Wharf



 ${\it Image~280~Sandstone~outcrops~and~mature~trees~are~remnant~from~earlier~days}$ 



Image 281 A small area of understorey revegetation aims to restore some of the characteristic vegetation to the area

#### 10.6.2 MONTROSE ROAD RESERVE

## **Summary statistics**

RESERVE AREA		VEGETATED AREA	
No. native species	20	No. threatened species	0
No. introduced	22	Priority control weeds	3
species			

# Flora and vegetation surveys

Random meander	Yes	Saltmarsh	No
Quadrat meander	Yes	BAM plot	No
PRE 1750 PCT #	3594	PCT NAME	Sydney Coastal Sandstone Foreshores Forest
PCT tested but not	3594	PCT NAME	Sydney Coastal Sandstone Foreshores Forest
confirmed			

### **Description of vegetation**

Montrose Road Reserve is a narrow strip of land beside apartment buildings that connects to Figtree Bay foreshore path (Image 282). Part of the reserve is dedicated to a pedestrian footpath/staircase. Most of the vegetation has been cleared from the lower part of this reserve, possibly for access to underground utilities or to manage unsafe trees (Image 283). The other side of the reserve adjoins another patch of degraded bushland (Image 284), although based on signage on site this patch is private property and therefore outside of council's care and control (Image 285).



Image 282 Montrose Rd Reserve is a narrow strip of land connecting to Figtree Bay foreshore path



Image 283 Most of the vegetation appears to have been removed although it is unclear why



Image 284 The reserve is closely linked to an adjoining patch of degraded bushland



Image 285 However, the neighbouring patch is apparently outside of council's control

## **10.6.3 WIREMILL PARK**

# **Summary statistics**

RESERVE AREA		VEGETATED AREA	
No. native species	29	No. threatened species	0
No. introduced species	24	Priority control weeds	1

## Flora and vegetation surveys

Random meander	Yes	Saltmarsh	No
Quadrat meander	Yes	BAM plot	No
MAPPED PCT #	3594	PCT NAME	Sydney Coastal Sandstone Foreshores Forest
PCT tested but not	3594	PCT NAME	Sydney Coastal Sandstone Foreshores Forest
confirmed			

# **Description of vegetation**

Wiremill Park is named after one of the early industries in the area – Lysaght Bros' Sydney Wire Mills, which were established in 1859 to make wire mesh for rabbit proof fencing, among other products. Today the site has blocks of new apartments lining the foreshore and fronting onto Wiremill Park (Image 286). Parts of the park have a mix of native and exotic species, many of which are common in urban gardens (Image 287). A key feature of the park is the foreshore path and the remnant infrastructure from the old wire mill (Image 288). Steeper sections of foreshore have been planted with predominantly local native species on flat benches between low sandstone cliffs (Image 289).



Image 286 Blocks of apartments front onto mown open space in Wiremill Park



Image 287 Parts of the park have an eclectic mix of native and exotic species



 ${\it Image~288~Looking~along~the~foreshore~path~with~the~wiremill~in~the~background}$ 

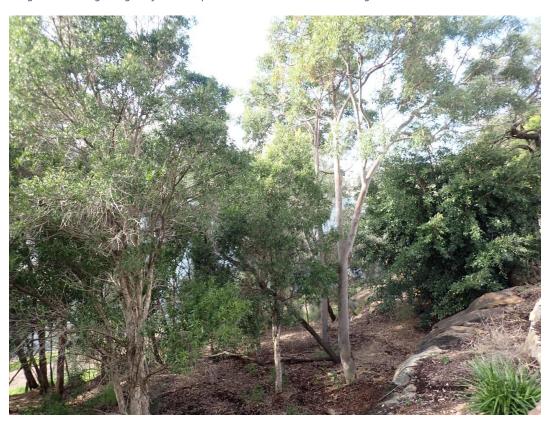


Image 289 Steeper sections of foreshore have revegetation plantings on benches along sandstone low cliffs

#### **10.6.4 FIG TREE BAY RESERVE**

#### **Summary statistics**

RESERVE AREA		VEGETATED AREA	
No. native species	41	No. threatened species	0
No. introduced	16	Priority control weeds	1
species			

# Flora and vegetation surveys

Random meander	Yes	Saltmarsh	No
Quadrat meander	Yes	BAM plot	No
PRE 1750 PCT #	3594	PCT NAME	Sydney Coastal Sandstone Foreshores Forest
PCT tested but not	3594	PCT NAME	Sydney Coastal Sandstone Foreshores Forest
confirmed			

# **Description of vegetation**

Fig Tree Bay Reserve is a small reserve off Fortescue St, Abbotsford. Extensive revegetation planting has been undertaken in this reserve (Image 290). The plantings are old enough to create a complex floristic and habitat structure, especially in the understorey (Image 291). The adjoining neighbour uses a strip of land along the park boundary for a vegetable garden and beehive, storage of firewood and other items (Image 292).



Image 290 Fig Tree Bay Reserve is a small park with abundant revegetation planting



Image 291 The plantings are old enough to create complex habitat structure in the understorey



Image 292 The adjoining neighbour is using the park boundary for vegetables and bee hives

#### 10.6.5 ABBOTSFORD PUBLIC SCHOOL

#### **Summary statistics**

RESERVE AREA	VEGETATED AREA	
No. native species	No. threatened species	
No. introduced	Priority control weeds	
species		

#### Flora and vegetation surveys

Random meander	No	Saltmarsh	No
Quadrat meander	No	BAM plot	No
PRE 1750 PCT #	3262	PCT NAME	Sydney Turpentine Ironbark Forest
PCT tested but not	3262	PCT NAME	Sydney Turpentine Ironbark Forest
confirmed			

#### **Vegetation mapping**



Image 293 (left) OEH 2016 vegetation mapping showing Urban Exotic/Native; (right) no biodiversity values are mapped for this site

# **Description of vegetation**

Vegetation mapping for Abbotsford Primary School shows no native vegetation in the site, and no biodiversity values (Image 293). Trees along the front of the school are predominantly Brush Box, an introduced species (Image 294). There are some local native trees in the back part of the school, as seen from Blackwall Point Rd (Image 295). Given the level of development within the school grounds there is limited opportunity for any real ecological values on site.

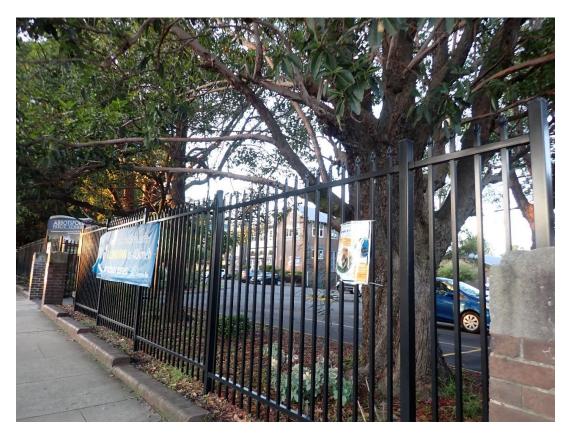


Image 294 Trees along the front of Abbotsford Public School are all introduced



Image 295 Some local native tree species were evident from Blackwall Point Rd

#### 10.7 ZONE 7 - FIVE DOCK BAY

#### **10.7.1 DRUMMOYNE PARK**

### **Summary statistics**

RESERVE AREA		VEGETATED AREA	
No. native species	18	No. threatened species	0
No. introduced	18	Priority control weeds	1
species			

## Flora and vegetation surveys

Random meander	Yes	Saltmarsh	No
Quadrat meander	Yes	BAM plot	No
PRE 1750 PCT #	3594	PCT NAME	Sydney Coastal Sandstone Foreshores Forest
PCT tested but not	3594	PCT NAME	Sydney Coastal Sandstone Foreshores Forest
confirmed			

# **Description of vegetation**

Drummoyne Park includes Drummoyne Oval. It has a row of veteran introduced Brush Box and Camphor Laurels along the boundary fence (Image 296). Younger plantings are more common in the centre of the park and are a mix of native and introduced (Image 297). Canopy plantings near Bayswater Rd are predominantly local native species (Image 298). The land slopes down to the oval and has had some stabilisation work, including coir logs and groundcover plantings (Image 299).



Image 296 Veteran Brush Box and Camphor Laurel trees are growing along the residential boundary fence



Image 297 Younger plantings are more common in the centre of the park



Image 298 Canopy plantings near Bayswater St are predominantly local native species



Image 299 Some of the slopes above Drummoyne Oval have groundcover plantings to help stabilise soils

#### **10.8 ZONE 9 – IRON COVE**

#### **10.8.1 BRETT PARK**

#### **Summary statistics**

RESERVE AREA		VEGETATED AREA	
No. native species	89	No. threatened species	0
No. introduced	35	Priority control weeds	1
species			

#### Flora and vegetation surveys

Random meander	Yes	Saltmarsh	No
Quadrat meander	Yes	BAM plot	No
PRE 1750 PCT #	3594	PCT NAME	Sydney Coastal Sandstone Foreshores Forest
PRE 1750 PCT #	4028	PCT NAME	Estuarine Swamp Oak Twig-rush Forest
PCT(S) CONFIRMED	3594	PCT NAME	Sydney Coastal Sandstone Foreshores Forest
PCT(S) CONFIRMED	4028	PCT NAME	Estuarine Swamp Oak Twig-rush Forest

#### **Description of vegetation**

Brett Park is a larger reserve on sloping land above Henley Marine Drive in Drummoyne. Extensive revegetation has been undertaken in the reserve, primarily focused in two bands. One is located at the top of steep slopes down to Henley Marine Drive and has a mix of species that have become well established, creating a structured habitat (Image 300). Further west on the same slope is a large mixed age stand of Swamp Oaks with an understorey of native vines and weedy grasses (Image 301).

A second band of revegetation is through the centre of the park, with a different mix of species planted along the upper and lower areas of a low sandstone cliff (Image 302). The drainage patterns around this cliff create conditions that are favourable for native ferns and grasses and these are common on the lower part of the drop (Image 303). The overall diversity in this park is greater than elsewhere in the LGA, largely because the species selected for planting are not strictly limited to those that are appropriate for any given vegetation community. However, it does create a variety of habitat opportunities for local wildlife.

The surrounding areas of the park have canopy trees surrounded by mown grass. The park is popular for walking, picnicking and other passive recreation activities. A small children's play area is located at the eastern end, along with picnic facilities and a small amenities block. This part of the park has good shade from mature street plantings such as Brush Box and Port Jackson Figs (Image 304) and is a popular location for mobile gyms and personal trainers. The southern end of the park is more open. Mature trees scattered through the area have recently been supplemented with new plantings that will fill the spaces between the existing trees (Image 305).



Image 300 There are several bands of revegetation through the reserve, including along Henley Marine Drive



Image 301 Swamp Oaks are growing in a large stand above Henley Marine Drive, with a mixed understorey



Image 302 A second band of revegetation is through the centre of the reserve, with a mix of remnant and planted species

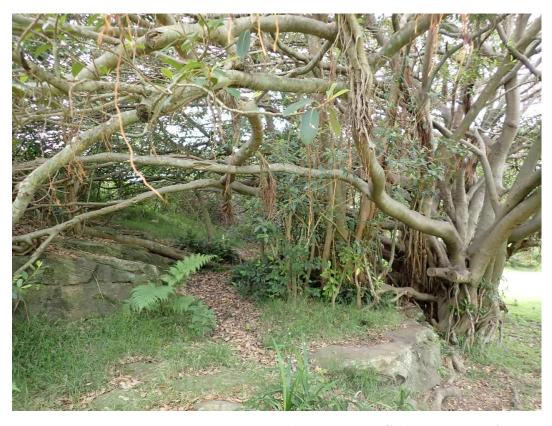


Image 303 Ferns and native grasses are common along the sandstone low cliff through the centre of the park



Image 304 The eastern end of the park has mature street plantings that provide good shade in this part of the park



Image 305 The southern end is more open and has recent tree plantings that will fill the gaps between existing trees

# 10.8.2 BAY RUN (SISTERS BAY/HALF MOON BAY)

# **Summary statistics**

RESERVE AREA		VEGETATED AREA	
No. native species	18	No. threatened species	0
No. introduced	12	Priority control weeds	0
species			

# Flora and vegetation surveys

Random meander	Yes	Saltmarsh	No
Quadrat meander	Yes	BAM plot	No
MAPPED PCT #	3594	PCT NAME	Sydney Coastal Sandstone Foreshores Forest
PCT(S) CONFIRMED	3594	PCT NAME	Sydney Coastal Sandstone Foreshores Forest

# **Description of vegetation**

The Bay Run follows the outer edge of Henley Marine Drive and has views over the foreshore of Iron Cove. Vegetation on the rocky clifftops includes remnant native vegetation (Image 306). The cliffs range from moderate to steeply sloping and are covered with predominantly native species (Image 307). The local bushcare group plays an important role in maintaining the good condition of the vegetation in this area (Image 308).



Image 306 The Bay Run follows the outer edge of Henley Marine Drive and has remnant native vegetation



Image 307 Moderate to steeply sloping sandstone cliffs are covered with predominantly remnant vegetation



Image 308 The local bushcare group is important in maintaining the good condition of this site

#### 10.8.3 SISTERS BAY

#### **Summary statistics**

RESERVE AREA		VEGETATED AREA	
No. native species	23	No. threatened species	0
No. introduced	18	Priority control weeds	3
species			

#### Flora and vegetation surveys

Random meander	Yes	Saltmarsh	Yes
Quadrat meander	Yes	BAM plot	No
MAPPED PCT #	3594	PCT NAME	Sydney Coastal Sandstone Foreshores Forest
MAPPED PCT #	4091	PCT NAME	Grey Mangrove-River Mangrove Forest
MAPPED PCT #	4028	PCT NAME	Estuarine Swamp Oak Twig-rush Forest
PCT(S) CONFIRMED	3594	PCT NAME	Sydney Coastal Sandstone Foreshores Forest
PCT(S) CONFIRMED	4091	PCT NAME	Grey Mangrove-River Mangrove Forest
PCT(S) CONFIRMED	4028	PCT NAME	Estuarine Swamp Oak Twig-rush Forest

#### **Description of vegetation**

Sisters Bay has steep, rocky and moderately high cliffs dropping down to a rocky foreshore with areas of rock benching. The vegetation is a mix of native and introduced species, with numerous weedy shrubs growing on the more inaccessible parts of the slopes (Image 309). Fig trees are an important component of the local vegetation, providing food resources at various times of the year. Several veteran aged individuals are growing from the top of the cliff where their giant buttressing roots help to stabilize the cliff face (Image 310). In some places there are low sections of rock benching topped with soil that have been colonised with Swamp Oaks in a process that is repeated throughout the Sydney Basin, resulting in a small but dense cluster of mixed age trees with an understorey of weeds and native species (Image 311).

Mangroves of mixed ages are common on the mudflats below the sandstone cliffs (Image 312). However, there is evidence of something staining the seepage and the mudflats are a soft mix of organic material such as decomposing deciduous leaves. Further south the foreshore changes again and has oyster covered sandstone boulders on a sandy substrate (Image 313). The diverse mix of intertidal communities provides habitat resources for a range of estuarine fauna species.



Image 309 Sisters Bay has a rocky foreshore and steep rocky sides, with moderately good vegetation



 ${\it Image 310 \ Veteran \ fig \ trees \ are \ important \ parts \ of \ the \ local \ vegetation, \ with \ several \ hanging \ over \ the \ cliff \ edge}$ 



Image 311 Low sections of sandstone rock benches have Swamp Oaks in a small but dense cluster



Image 312 Mangroves of mixed ages are common on the mudflats below the sandstone



Image 313 Looking across Sisters Bay from the south, oyster covered boulders add to habitat resources

# 10.8.4 HALF MOON BAY

# **Summary statistics**

RESERVE AREA		VEGETATED AREA	
No. native species	30	No. threatened species	0
No. introduced species	28	Priority control weeds	3

# Flora and vegetation surveys

Random meander	Yes	Saltmarsh	Yes
Quadrat meander	Yes	BAM plot	No
MAPPED PCT #	3594	PCT NAME	Sydney Coastal Sandstone Foreshores Forest
MAPPED PCT #	4091	PCT NAME	Grey Mangrove-River Mangrove Forest
MAPPED PCT #	4097	PCT NAME	Samphire Saltmarsh
PCT(S) CONFIRMED	3594	PCT NAME	Sydney Coastal Sandstone Foreshores Forest
PCT(S) CONFIRMED	4091	PCT NAME	Grey Mangrove-River Mangrove Forest
PCT(S) CONFIRMED	4097	PCT NAME	Samphire Saltmarsh

# **Description of vegetation**

Half Moon Bay is smaller than the neighbouring Sisters Bay. The vegetation is a mix of remnant and planted natives with weedy shrubs beginning to dominate (Image 314). The foreshore has larger patches of saltmarsh surrounded by mangroves in the eastern end (Image 315), and smaller patches of saltmarsh below steep and moderately weedy slopes towards the western end of the bay (Image 316).



Image 314 Looking over Half Moon Bay from the Bay Run, the vegetation is a mix of remnant and planted natives



Image 315 Larger saltmarsh patches are surrounded by mangroves on the eastern bay foreshore



Image 316 Smaller patches of saltmarsh site below steep and moderately weedy slopes

#### 10.8.5 IRON COVE BAY RUN NORTH

#### **Summary statistics**

RESERVE AREA		VEGETATED AREA	
No. native species	14	No. threatened species	0
No. introduced	10	Priority control weeds	1
species			

# Flora and vegetation surveys

Random meander	Yes	Saltmarsh	Yes
Quadrat meander	No	BAM plot	No
MAPPED PCT #	4091	PCT NAME	Grey Mangrove-River Mangrove Forest
MAPPED PCT #	4097	PCT NAME	Samphire Saltmarsh
PCT(S) CONFIRMED	4091	PCT NAME	Grey Mangrove-River Mangrove Forest
PCT(S) CONFIRMED	4097	PCT NAME	Samphire Saltmarsh

# **Description of vegetation**

The Bay Run continues along the edge of Iron Cove and beside Henley Marine Drive, heading towards Rodd Point. The foreshore varies along that length with rocky slopes planted with native shrubs above scattered patches of saltmarsh (Image 317) to lower grassed banks and more common patches of saltmarsh (Image 318). Saltmarsh colonises areas within a narrow intertidal band in suitable conditions – flat or nearly so, fine particulate sediments with a depth of several centimetres (less will do), irregular inundation (therefore at the upper limit of tidal coverage), and limited freshwater inflows.

Construction of seawalls and rocky bank stabilisation limits opportunities for colonisation and for landward migration in response to sea level rise. Despite this, saltmarsh patches are forming along the Iron Cove foreshore in all sorts of places. Fairly recent stabilisation works have imported sandstone boulders to an area near Burnell St. Patchy saltmarsh and young mangroves are both establishing in this area (Image 319).

Opposite Nield Park and near the end of First Ave is a much larger patch of saltmarsh (Image 320). This has developed in the low gradient sediments towards the back of Iron Cove where boat wash is limited. Several mangroves have begun to colonise the saltmarsh patch but appear restricted by the bathymetry of the bay. Information signs have been installed to encourage citizen science monitoring of the intertidal vegetation in this location (Image 321) and increasing interactions for users of the Bay Run with the local ecology.



Image 317 Saltmarsh below native plantings along Henley Marine Drive on the northern shore of Iron Cove



Image 318 Saltmarsh with grassed banks to Henley Marine Drive near Burnell St



Image 319 Patchy saltmarsh and young mangroves establishing below a sandstone boulder seawall



Image 320 A larger patch of saltmarsh has several mangroves establishing, east of First Ave

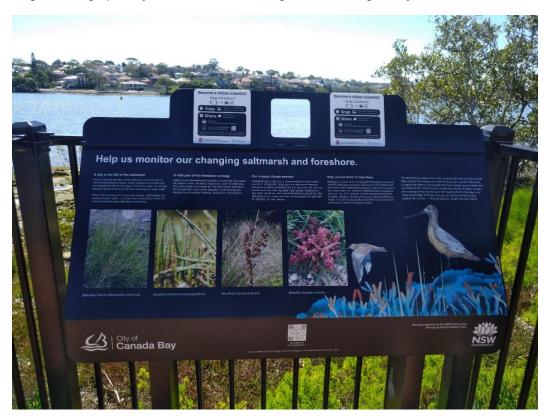


Image 321 Information signs encourage citizen science monitoring of saltmarsh around Iron Cove

#### **10.8.6 RODD PARK**

#### **Summary statistics**

RESERVE AREA		VEGETATED AREA	
No. native species	29	No. threatened species	0
No. introduced	8	Priority control weeds	0
species			

# Flora and vegetation surveys

Random meander	Yes	Saltmarsh	Yes
Quadrat meander	Yes	BAM plot	No
MAPPED PCT #	3594	PCT NAME	Sydney Coastal Sandstone Foreshores Forest
PCT tested but not	3594	PCT NAME	Sydney Coastal Sandstone Foreshores Forest
confirmed			

#### **Description of vegetation**

Rodd Park is a small park on the end of Rodd Point, a narrow peninsula towards the upper end of Iron Cove. The southern side has a large area of mown grass with several newly planted trees (Image 322). The seaward end of Rodd Park has extensive sandstone outcrops and benches, with lawn grasses on flatter areas where sediment has accumulated, and shrubby plantings on the steeper sections (Image 323). The flat area on top of Rodd Point has mature plantings that have recently been supplemented with additional planting (Image 324). The park also has a historic family vault for the Rodd family, pioneers of the Five Dock area, picnic tables and an aquatic club (boating).



Image 322 New plantings along the southern side of Rodd Park



Image 323 The seaward end of Rodd Park has extensive sandstone outcropping with lawn grasses and planted shrubs



 ${\it Image~324~The~flat~area~on~top~of~Rodd~Point~has~mature~plantings~that~have~been~recently~supplemented}$ 

#### 10.8.7 IRON COVE BAY RUN SOUTH

#### **Summary statistics**

RESERVE AREA		VEGETATED AREA	
No. native species	9	No. threatened species	0
No. introduced	14	Priority control weeds	1
species			

# Flora and vegetation surveys

Random meander	Yes	Saltmarsh	Yes
Quadrat meander	No	BAM plot	No
MAPPED PCT #	4091	PCT NAME	Grey Mangrove-River Mangrove Forest
MAPPED PCT #	4097	PCT NAME	Samphire Saltmarsh
PCT(S) CONFIRMED	4091	PCT NAME	Grey Mangrove-River Mangrove Forest
PCT(S) CONFIRMED	4097	PCT NAME	Samphire Saltmarsh

# **Description of vegetation**

The Bay Run continues south from Rodd Park, following Henley Marine Drive. A larger patch of saltmarsh is located above mangroves and just south of Rodd Point (Image 325). The mangroves continue in a wide band along the foreshore from this point to the intersection with Timbrell Drive (Image 326). High levels of visitation to the Bay Run means that information signs have the potential to reach a wide audience and increase visitor understanding of the local ecology (Image 327).



Image 325 A larger patch of saltmarsh is located just south of Rodd Point off the Bay Run



Image 326 Mangroves continue along the foreshore south to the intersection with Timbrell Drive



Image 327 High visitor use of the Bay Run means that information signage can reach a wide audience

#### **10.8.8 TIMBRELL PARK**

#### **Summary statistics**

RESERVE AREA		VEGETATED AREA	
No. native species	34	No. threatened species	0
No. introduced	32	Priority control weeds	1
species			

#### Flora and vegetation surveys

Random meander	Yes	Saltmarsh	No
Quadrat meander	Yes	BAM plot	No
PRE 1750 PCT #	3594	PCT NAME	Sydney Coastal Sandstone Foreshores Forest
PCT tested but not	3594	PCT NAME	Sydney Coastal Sandstone Foreshores Forest
confirmed			

#### **Description of vegetation**

Most of Timbrell Park has been constructed on landfill, so that most, if not all of the observed vegetation is planted. User amenities include numerous touch football and baseball fields, some picnic tables and seating, a children's playground, a 'mini mountain bike trail', and an outdoor café. A mix of natives and exotics have been planted along a footpath along Timbrell Drive (Image 328) and these are interspersed with open space and mature trees (Image 329). Towards the Iron Cove Creek channel is a large stand of paperbarks with Lomandras forming the only understorey (Image 330). Trees beside the canal and near the bike track are mostly introduced (Image 331). Native plantings have been used to create a vegetation screen around the children's playground (Image 332).



Image 328 A mix of native and exotics have been planted either side of the footpath near Timbrell Drive



Image 329 Mature trees are present beside Timbrell Drive along with open space areas



 ${\it Image~330~Dense~stands~of~Paperbarks~with~an~understorey~of~Lomandras~are~located~in~the~downstream~corner}$ 



Image 331 Trees beside Iron Cove Creek canal are mostly introduced species



Image 332 Garden beds of native species have been planted around the children's play area to provide screening

#### **10.8.9 FIVE DOCK PARK**

#### **Summary statistics**

RESERVE AREA		VEGETATED AREA	
No. native species	10	No. threatened species	0
No. introduced species	5	Priority control weeds	0

#### Flora and vegetation surveys

Random meander	Yes	Saltmarsh	No
Quadrat meander	No	BAM plot	No
MAPPED PCT #	3262	PCT NAME	Sydney Turpentine Ironbark Forest
PCT tested but not	3262	PCT NAME	Sydney Turpentine Ironbark Forest
confirmed			

# **Vegetation mapping**

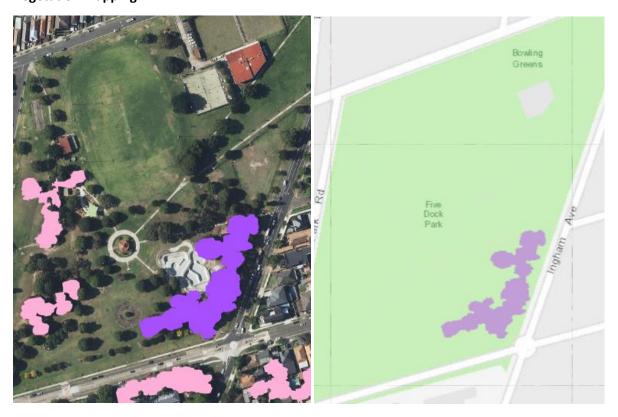


Image 333 (left) OEH 2016 vegetation mapping showing STIF in the southeastern corner; (right) biodiversity values in the same location

# **Description of vegetation**

Five Dock Park is a highly urbanised park that OEH 2016 vegetation mapping indicates has an area of STIF, also shown on biodiversity values mapping (Image 333). Most of this park has grassed open space and canopy trees (Image 334). Towards the southern corner some of the canopy species are characteristic of STIF but many are too young to be remnant (Image 335). A regional cycleway is located along the edge of the mapped STIF, although it appears more like a concrete footpath (Image 336). From

there, there doesn't appear to be any native vegetation, other than a few canopy trees, and it appears unlikely that the vegetation mapping is correct.

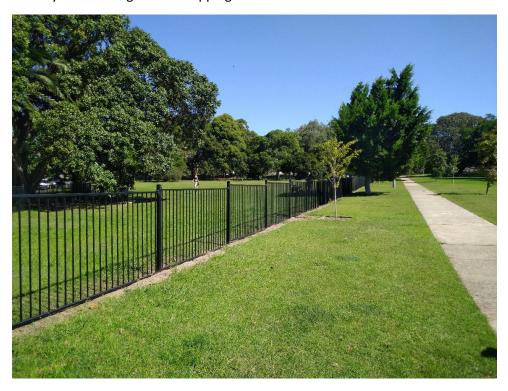


Image 334 Large sections of Five Dock Park are grassed open space, including the dog park



Image 335 Some of the canopy species are characteristic of STIF, but are too young to be remnant



Image 336 The footpath through Five Dock Park is part of a regional cycleway

# 10.8.10 RUSSELL LEA PUBLIC SCHOOL

# **Summary statistics**

RESERVE AREA		VEGETATED AREA	
No. native species	14	No. threatened species	0
No. introduced	6	Priority control weeds	0
species			

# Flora and vegetation surveys

Random meander	Yes	Saltmarsh	No
Quadrat meander	No	BAM plot	No
MAPPED PCT #	3262	PCT NAME	Sydney Turpentine Ironbark Forest
PCT tested but not	3262	PCT NAME	Sydney Turpentine Ironbark Forest
confirmed			

#### Vegetation mapping



Image 337 OEH 2016 vegetation mapping showing STIF in the southeastern corner; (right) biodiversity values in a somewhat similar location

#### **Description of vegetation**

OEH 2016 vegetation mapping shows STIF around the western half of the school's boundaries and this is partially repeated in the biodiversity values mapping for the area (Image 337). Site inspections focused on these areas, aiming to validate the accuracy of the mapping. The Whittall Street boundary has a new path and new plantings, and no native vegetation (Image 338) and may explain the discrepancy in the mapping for the site – with the BV map shows the updated site conditions. A similar situation exists on the western boundary fence, where more new plantings are in mulched beds (Image 339) and the only indication that there may previously have been STIF in this location is the few younger tagged Turpentines, noting that the tree tagging is part of a statewide schools tree monitoring program, not for ecological purposes. And a similar situation exists in the relevant section of the northern boundary which can be seen to have a paling fence and little else.

Street trees appear to also be part of the STIF mapped for the site. On McCulloch St these are mature Hills Weeping Figs, a commonly planted non local fig species that provides good shade and is incredibly hardy in the urban environment (Image 340). These are not a component of STIF, and nor is the introduced Camphor Laurel on Whittall St (Image 341). Overall, it appears that while there may have been STIF in the area previously, there certainly isn't now.



Image 338 New plantings in mulched beds in an area previously shown to have STIF



Image 339 New plantings in mulched beds in an area previously shown to have STIF, Turpentines have been retained



Image 340 Street trees on McCulloch St are mature Hills Weeping Figs, not a STIF species



Image 341 Street tree on Whittall St is an introduced Camphor Laurel, not a STIF species

# 11 APPENDIX B BIONET PLANT COMMUNITY TYPE DESCRIPTIONS

The following sections reproduce the descriptions of PCTs from DPIE's BioNet Vegetation Classification – BioNet Plant Community Type Data.

## 11.1 PCT 3594 - Sydney Coastal Sandstone Foreshores Forest

The equivalent map unit from OEH's Vegetation Map - Sydney Metro Area v3.1 2016 E - VIS 4489 is S\_DSF06 Coastal Sandstone Foreshores Forest.

A tall, occasionally very tall, sclerophyll open forest with a mixed understorey of dry shrubs and mesic small trees found along the foreshores of major waterways and coastal escarpments of Sydney. The tree canopy is very frequently dominated by Angophora costata with occasional local stands of Eucalyptus botryoides or rarely other eucalypt species. A sparse taller layer in the mid-stratum commonly includes Banksia integrifolia or Allocasuarina littoralis and occasionally Ficus rubiginosa. A combination of hardy mesic small trees including Pittosporum undulatum, Glochidion ferdinandi and Elaeocarpus reticulatus are almost always present with Notelaea longifolia also common. In the suburban environment, the proliferation of these mesic species in the understorey at long unburnt sites has generated considerable debate, particularly as there appears to be strong correlation between time since fire and their density. Our data suggests these species are also more common in these littoral zones than other sheltered sandstone forests situated further away from the coast. Sclerophyll shrubs are less frequent however include Acacia longifolia, Acacia suaveolens, Breynia oblongifolia and Monotoca elliptica. The ground layer is characterised by a mid-dense cover of ferns, graminoids, climbers and grasses. The low elevations adjoining major waterways expose the vegetation to a maritime influence brought by salt laden southerly winds. This PCT is, or was, present in areas with sandstone derived soils such as rocky foreshores and peninsulas in City of Canada Bay LGA.

# 11.2 PCT 4028 - Estuarine Swamp Oak Twig-rush Forest

The equivalent map unit from OEH's Vegetation Map - Sydney Metro Area v3.1 2016 E - VIS 4489 is S\_FoW08 Estuarine Swamp Oak Forest.

A tall to very tall open forest or woodland featuring Casuarina glauca and usually Machaerina juncea and Juncus kraussii subsp. australiensis, occurring on the edges of tidal estuarine flats and tidal creek flats along the NSW coast, usually at elevations of below 10 metres asl. Casuarina glauca almost always forms a sparse to mid-dense tree layer, rarely accompanied by Melaleuca quinquenervia. A sparse or very sparse small tree or scrub layer of Melaleuca ericifolia is occasionally present, while other Melaleuca species and other trees or shrubs only rarely occur. The mid-dense ground layer is primarily comprised of sedges, rushes, reeds and grasses that are tolerant of inundation, very frequently including Machaerina juncea and Juncus kraussii subsp. australiensis, commonly with Phragmites australis. Other species occasionally occurring in the ground layer include Samolus repens, Lobelia anceps and Gahnia clarkei, while more rare species include Sporobolus virginicus, Apium prostratum and Hemarthria uncinata, the latter three with variable cover from site to site. This PCT occurs along the NSW coast on the margins of brackish water bodies and watercourses. It is floristically related to PCT 4026 which occurs in similar environments, however PCT 4028 has a more consistent cover of Casuarina glauca and includes more species that are not tolerant of saline conditions. PCT 4028 occurs at slightly higher elevations than PCT 4026, or further upstream in areas with less frequent inundation. PCT 4028 is common in City of Canada Bay LGA on low lying areas above the tidal limit.

# 11.3 PCT 4091 - Grey Mangrove-River Mangrove Forest

The equivalent map unit from OEH's Vegetation Map - Sydney Metro Area v3.1 2016 E - VIS 4489 is S\_SW01 Estuarine Mangrove Forest.

A low, mid-high or tall mangrove open forest or woodland, sometimes including a saltmarsh ground layer, occurring on tidal flats of the NSW coast. The tree canopy is sparse, mid-dense or sometimes dense and is almost always dominated by grey mangrove Avicennia marina subsp. australasica. River mangrove Aegiceras corniculatum is common, occurring at around half of the known locations, however usually with a more sparse projected foliage cover than Avicennia marina subsp. australasica. Other trees are rare, however may include a sparse cover of red mangrove Rhizophora stylosa, or on mangrove fringes Casuarina glauca, Melaleuca linariifolia or Ficus rubiginosa. Salt-tolerant ground cover species make a significant contribution to the species richness of this PCT overall, however are not always present. Where present, the ground layer is sparse to mid-dense. Sarcocornia quinqueflora subsp. quinqueflora occasionally occurs with sparse cover, while Sporobolus virginicus or Samolus repens rarely occur however generally with higher projected foliage cover. Other rare species with variable cover include Juncus kraussii subsp. australiensis, Tecticornia arbuscula, Sesuvium portulacastrum and Spergularia marina amongst other salt-tolerant grasses, forbs and sedges. This PCT is weakly floristically related to the saltmarsh PCT 4097, however PCT 4097 has only sparse mangroves, a more consistent cover of saltmarsh species, and occurs at sites with less frequent or shorter periods of tidal inundation. PCT 4091 is the only community in the Mangrove Swamps vegetation class that occurs in the Sydney Basin.

# 11.4 PCT 4097 - Samphire Saltmarsh

The equivalent map unit from OEH's Vegetation Map - Sydney Metro Area v3.1 2016 E - VIS 4489 is S\_SW02 Estuarine Saltmarsh.

A mid-high saline forbland, closed forbland or sparse to open tall shrubland, featuring Sarcocornia quinqueflora subsp. quinqueflora and occurring on littoral salt flats, estuaries, saline lagoons or tidal creek flats along the NSW coast at or very close to sea level. The succulent Sarcocornia quinqueflora subsp. quinqueflora almost always forms a mid-dense ground layer in the saltmarsh, occasionally accompanied by sparse Sporobolus virginicus or rarely very sparse Samolus repens, Suaeda australis or Juncus kraussii subsp. australiensis. Other forbs can occur at high density at individual sites, such as Tecticornia arbuscula and Sesuvium portulacastrum. Mangroves, commonly Avicennia marina subsp. australasica and rarely Aegiceras corniculatum, often form a sparse or very sparse cover, sometimes only as seedlings or scattered small bushes. The median native species richness for this PCT is low, with rarely more than seven species recorded in a plot. This PCT is likely to be more widely distributed than standard plots suggest, as saltmarsh dominated by Sarcocornia quinqueflora subsp. quinqueflora is known to be widespread along the NSW coast. The community is found on a wide range of substrates, from coarse sands to fine-grained silts and muds. This PCT occurs in similar environments as PCT 4091 (which has a greater dominance of mangroves and only very sparse Sarcocornia quinqueflora subsp. quinqueflora). This community occurs in broadly distributed areas of tidal inundation in City of Canada Bay LGA.

# 11.5 PCT 3262 - Sydney Turpentine Ironbark Forest

The equivalent map unit from OEH's Vegetation Map - Sydney Metro Area  $v3.1\ 2016\ E$  - VIS 4489 is S\_WSF09 Sydney Turpentine Ironbark Forest.

A tall to very tall sclerophyll open forest with mid-stratum of mixed sclerophyll and mesophyll shrubs and a ground layer of grasses and forbs, found on shale or sheltered shale-sandstone soils mainly in the northern suburbs of Sydney and lower Blue Mountains. The tree canopy very frequently includes Syncarpia glomulifera either as a canopy dominant or as a smaller tree or both. Other species which are localised and occasionally dominant or co-dominant occasionally include Eucalyptus pilularis, Angophora costata and Eucalyptus punctata, rarely with one of several species from the ironbark, stringybark or mahogany eucalypt groups of which Eucalyptus paniculata, Eucalyptus globoidea and Eucalyptus resinifera are the most frequent of each group. The mid-stratum is layered, with a sparse cover of small trees that includes eucalypts, occasionally Acacia parramattensis and Allocasuarina torulosa, rarely with Allocasuarina littoralis. The lower shrub layer very frequently includes Pittosporum undulatum and Leucopogon juniperinus, commonly with Breynia oblongifolia, Polyscias sambucifolia, Ozothamnus diosmifolius and Notelaea longifolia. The ground layer includes a diverse cover of grasses that very frequently includes Microlaena stipoides and Entolasia stricta, commonly with Imperata cylindrica, Entolasia marginata and Themeda triandra. Small forbs including Lobelia purpurascens are also very frequent, together with Lomandra longifolia. This PCT occurs as small remnants in mosaics of urban land use in the shale-dominated landscapes in higher rainfall zones of the Sydney Metropolitan area. The northern suburbs between Baulkham Hills and Ku-ring-gai include the highest number of remnants, however small areas remain in Sutherland, Heathcote, Menai, lower Blue Mountains and Oakdale plateau west of Picton. Only a small number of remnants remain on the Wianamatta Group shales of the eastern Cumberland Plain between Villawood and Bankstown. This community was broadly present in the LGA prior to colonisation but now is sparsely present as very small and often degraded remnants in City of Canada Bay.

# 11.6 PCT 3448 - Castlereagh Ironbark Forest

The equivalent map unit from OEH's Vegetation Map - Sydney Metro Area v3.1 2016 E - VIS 4489 is S\_DSF01 Castlereagh Ironbark Forest.

A tall sclerophyll open forest with a dense mid-stratum of Melaleucas and a patchy ground layer of grasses and graminoids or a dense thicket of Melaleucas with emergent eucalypts that is found on the Cumberland Plain to the west of Sydney. It is one of a suite of forests that are associated with the subtle intergrade between clay-rich shale soil and the sandier substrates. The canopy almost always includes ironbark eucalypts (primarily Eucalyptus fibrosa), occasionally accompanied by stringybark eucalypts (Eucalyptus sparsifolia, Eucalyptus oblonga or Eucalyptus globoidea). The dense shrub to small tree layer almost always includes melaleucas and acacias of which Melaleuca decora and Acacia falcata are the most frequent. The smaller shrubs Bursaria spinosa and Daviesia ulicifolia are both common. The ground layer is a sparse cover of graminoids, forbs, twiners and a hardy fern. Entolasia stricta is almost always present while Aristida vagans, Cheilanthes sieberi subsp. sieberi, Microlaena stipoides, Dianella revoluta, Lomandra multiflora subsp. multiflora, Lepidosperma laterale and Opercularia diphylla are very frequent. The ground layer may be depauperate in locations where the dense mid-stratum excludes light and suppresses plant growth. This PCT is associated with moderately fertile soils derived from Tertiary alluvial deposits, shale and ironstone gravels and residual soils derived from shale or from sandstone with enrichment from nearby shales. It is extensive around Castlereagh, Holsworthy and the catchment of the Cooks River where Melaleuca thickets are prevalent, possibly the result of humaninduced changes to the original forest structure. This PCT has been extensively cleared and often occurs in small, fragmented patches. It typically occurs in a moist, warm climate at elevations below 150 metres asl, though it may reach 400 metres asl in the southern most part of its range. The occurrences at higher

elevation on the southern and western edge of the Cumberland Plain represent an extended interpretation of this PCT compared to previous studies. This PCT intergrades frequently with a range of other PCTs in response to the level of shale in the ambient soils. Within the survey areas this PCT was only rarely present, predominantly limited to an area inland from Brays Bay.

## 11.7 PCT 3176 - Sydney Enriched Sandstone Moist Forest

The equivalent map unit from OEH's Vegetation Map - Sydney Metro Area v3.1 2016 E - VIS 4489 is S WSF02 Coastal Enriched Sandstone Moist Forest.

A very tall, occasionally extremely tall moist shrubby and ferny sclerophyll open forest found in enriched sandstone gullies of the Sydney coastal sandstone plateaus. The tree canopy very frequently includes a high cover of *Angophora costata, Syncarpia glomulifera* and *Eucalyptus pilularis* with occasional *Eucalyptus piperita. Eucalyptus saligna* is rare however abundant on creek lines downslope of shale soils. Commonly there is a tall mid-stratum of *Allocasuarina torulosa*, less frequently *Allocasuarina littoralis*, with *Elaeocarpus reticulatus*, *Pittosporum undulatum* and *Notelaea longifolia*. A smaller shrub layer includes *Leucopogon lanceolatus* and *Polyscias sambucifolia*. Typically the ground layer is ferny, very frequently with a high cover of *Calochlaena dubia*, *Pteridium esculentum* and occasionally *Blechnum cartilagineum*. A diversity of graminoids, small climbers and grasses adds to a high ground cover amongst the sandstone boulders. This PCT is most extensively distributed within the low elevation gullies that incise the shale rich landscapes of the north shore of Sydney where rainfall exceeds 1100 mm per annum. However, the degree of shale influence and sheltering also sustains the persistence of the PCT in lower rainfall outliers near Campbelltown and Menai. This community is mapped as present in the LGA towards the western end but did not appear in any of the reserves and parks that were surveyed.

# 11.8 Threatened Ecological Communities

#### 11.8.1 Estuarine Swamp Oak Forest

**TEC name**: Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions

Conservation status in NSW: Endangered Ecological Community

Commonwealth status: Not listed

This community is found on the coastal floodplains of NSW. It has a dense to sparse tree layer in which *Casuarina glauca* (swamp oak) is the dominant species northwards from Bermagui.

Other trees including *Acmena smithii* (lilly pilly), *Glochidion* spp. (cheese trees) and *Melaleuca* spp. (paperbarks) may be present as subordinate species, and are found most frequently in stands of the community northwards from Gosford. The understorey is characterised by frequent occurrences of vines, *Parsonsia straminea*, *Geitonoplesium cymosum* and *Stephania japonica* var. *discolor*, a sparse cover of shrubs, and a continuous groundcover of forbs, sedges, grasses and leaf litter.

The composition of the ground stratum varies depending on levels of salinity in the groundwater. Under less saline conditions prominent ground layer plants include forbs such *Centella asiatica, Commelina cyanea, Persicaria decipiens* and *Viola banksii*; graminoids such as *Carex appressa, Gahnia clarkei, Lomandra longifolia, Oplismenus imbecillis*; and the fern *Hypolepis muelleri*.

On the fringes of coastal estuaries, where soils are more saline, the ground layer may include the threatened grass species, *Alexfloydia repens*, as well as *Baumea juncea*, *Juncus kraussii*, *Phragmites australis*, *Selliera radicans* and other saltmarsh species.

#### 11.8.2 Estuarine Saltmarsh

**TEC name**: Coastal Saltmarsh in the New South Wales North Coast, Sydney Basin and South East Corner Pierceions

Bioregions

**Conservation status in NSW**: Endangered Ecological Community

Commonwealth status: Not listed

Coastal Saltmarsh occurs in the intertidal zone on the shores of estuaries and lagoons that are permanently or intermittently open to the sea. It is frequently found as a zone on the landward side of mangrove stands. Characteristic plants include *Baumea juncea*, Sea Rush (*Juncus krausii* subsp. *australiensis*), Samphire (*Sarcocornia quinqueflora* subsp. *quinqueflora*), Marine Couch (*Sporobolus virginicus*), Streaked Arrowgrass (*Triglochin striata*), Knobby Club-rush (*Ficinia nodosa*), Creeping Brookweed (*Samolus repens*), Swamp Weed (*Selliera radicans*), Seablite (*Suaeda australis*) and Prickly Couch (*Zoysia macrantha*). Occasionally mangroves are scattered through the saltmarsh. Tall reeds may also occur, as well as salt pans.

## 11.8.3 Sydney Turpentine Ironbark Forest

**TEC name**: Sydney Turpentine-Ironbark Forest in the Sydney Basin Bioregion **Conservation status in NSW**: Critically Endangered Ecological Community

Commonwealth status: Not listed

Open forest, with dominant canopy trees including Turpentine *Syncarpia glomulifera*, Grey Gum *Eucalyptus punctata*, Grey Ironbark *E. paniculata* and Thin-leaved Stringybark *E. eugenoides*. In areas of high rainfall (over 1050 mm per annum) Sydney Blue Gum *E. saligna* is more dominant. The shrub stratum is usually sparse and may contain mesic species such as Sweet Pittosporum *Pittosporum undulatum* and Elderberry Panax *Polyscias sambucifolia*. Contains many more species.

#### 11.8.4 Castlereagh Ironbark Forest

**TEC name**: Cooks River/Castlereagh Ironbark Forest in the Sydney Basin Bioregion

**Conservation status in NSW**: Endangered Ecological Community

Commonwealth status: Not listed

Ranges from open forest to low woodland, with a canopy dominated by Broad-leaved Ironbark (*Eucalyptus fibrosa*) and Paperbark (*Melaleuca decora*). The canopy may also include other eucalypts such as Woolybutt (*E. longifolia*). The dense shrubby understorey consists of Prickly-leaved Paperbark (*Melaleuca nodosa*) and Peach Heath (*Lissanthe strigosa*), with a range of 'pea' flower shrubs, such as *Dillwynia tenuifolia*, Hairy Bush-pea (*Pultenaea villosa*) and Gorse Bitter Pea (*Daviesia ulicifolia*) (can be locally abundant). The sparse ground layer contains a range of grasses and herbs. Contains many more species.

# 12 APPENDIX C – Bird survey dates

Site	Dates							
Arthur	16/12/2023	11/12/2023	21/12/2023	2/01/2024	7/02/2024	26/04/2024	17/04/2024	15/04/2024
Walker/Yaralla Estate								
east/Majors Bay west	26/03/2024							
Bangalla Rd	15/02/2024							
Battersea Park	28/02/2024							
Blackwall Park	30/01/2024	28/02/2024				<u> </u> 		
Breakfast Point								
foreshore	2/01/2024	23/04/2024						
Brett Park	7/12/2023	28/12/2023	2/01/2024	9/01/2024	28/02/2024	 	i   	 
Cabarita Park	16/12/2023	17/04/2024	23/04/2024					
Canada Bay	27/02/2024					<u> </u>		
Chambers Reserve	30/01/2024	28/02/2024						
Cintra Park/Canal	7/02/2024	17/04/2024	28/02/24					
Colane St	15/02/2024							
Concord Golf Club	9/01/2024							
Concord Highschool	23/04/2024							
Coonong Rd	15/02/2024							
Drummoyne								
Park/Taplin Oval	23/04/2024							
Exile Bay	15/12/2023	23/04/2023						
Figtree Bay Reserve	7/12/2023							
Five Dock Bay	30/01/2024	13/02/2024	23/04/2024					
Five Dock Park	11/12/2023	15/02/2024	9/04/2024					
France Bay	2/01/2024							
Halliday Park	15/12/23	21/12/2023	12/07/2023	28/12/2023	13/02/2023			
Henry Lawson Park	7/12/2023	11/12/2023	15/12/2023	28/12/2023	13/02/2024	2/03/2024		
Henry Lawson Park	15/12/2023							
Iron Cove Part A						<del> </del>		
foreshore	16/12/2023	7/02/2024	9/04/2024					
Iron Cove Part D								
foreshore	16/12/2023	7/02/2024	9/04/2024			 		 
kendall bay	23/04/2024							
Kendall Bay	2/01/2024	23/04/2024				<u> </u>		
Kings Bay	11/12/2023							
Lewis Berger/Rhodes run/Homebush Bay	7/12/2023	13/02/2024	14/05/2024					
Lancelot St	15/02/2024							
Llewellyn St	15/02/2024							
Lovedale Place/Brays Bay/Rhodes Rotary Park	2/01/2024	27/02/2024	1/02/2024	2/07/2024				
Majors Bay Road	15/02/2024	23/04/2024	1,02,2024	2,01,2024		ļ		
Majors Bay Reserve	2/01/2024	27/01/2024	11/12/2023	23/04/2024	15/04/2024	29/03/2024	23/05/2025	
iviajors bay iteserve	2/01/2024	27/01/2024	11/12/2023	23/04/2024	15/04/2024	29/03/2024	25/05/2025	<u>i</u>

Site	Dates							
Massey Golf Club	7/02/2024	23/04/2024	6/02/2024					
McIlwaine Park Brays Bay	2/02/2024	7/02/2024						
Montrose/ Rokeyby /Walton Crescent	9/04/2024							
Mortlake Public School								
Northcote Street Reserve								
Powells Creek	13/02/2024	15/02/2024	14/03/2024	26/03/2024				
Prince Edward	7/12/2023	11/12/2023	15/12/2023	8/02/2024	23/05/2024			
Quarantine Reserve	28/12/2023	30/01/2024	13/02/2024					
Queen Elizabeth	11/12/2023	28/12/2023	7/02/2024	28/02/2024	21/03/2024			
Rhodes run								
Rhodes/Lewis Berger								
Rivendell peninsula	2/01/2024	27/02/2024	14/05/2024					
Russel park	11/12/2023	30/01/2024						
Rodd Park	16/12/2023	11/12/2023	7/02/2024	17/04/2024	15/04/2024	9/04/2024		
Sisters Bay-Half Moon Bay	7/12/2023	11/12/2023	21/12/2023	2/01/2024	7/01/2024	28/02/2024	17/04/2024	
Smythes St	15/02/2024							
Strathfield North Public School								
Timbrell Park	16/12/23	15/12/2023	28/12/2023	9/04/2024				
Werrell Reserve	21/12/2023	28/12/2023						
Wire Mill Reserve	7/12/2024							
Wymston Parade	15/12/23	21/12/2023	12/07/2023	11/12/2023	13/02/2024	28/12/2023	17/04/2024	16/12/2023
foreshore south	02/01/24	27/01/2024	15/02/2024	2/03/2024	26/03/2024	23/05/2024		
Wymston Parade	15/12/24	21/12/2023	12/07/2023	11/12/2023	13/02/2024	28/12/2023	17/04/2024	16/12/2023
foreshore north	02/01/25	27/01/2024	15/02/2024	2/03/2024	26/03/2024	23/05/2024		
	16/12/2023	11/12/2023	16/12/2023	21/12/2023	2/01/2024	2/01/2024	27/01/2024	2/03/2024
Yaralla peninsula	23/04/2024	17/04/2024	15/04/2024	15/04/2024	26/03/2024	26/03/2025	15/05/2024	23/05/2024

# 13 APPENDIX D PROJECT SENIOR STAFF – ABOUT THE AUTHORS

#### **Fauna Surveys- Anne Carey**

Anne carried out field work and report writing. Anne has a Degree in Science (Conservation Biology) and a Masters Degree in Wildlife Management and post graduate qualifications in GIS. She has over 25 years industry experience. Prior to Applied Ecology, Anne worked as the Operations Manager at Australian Wetlands (Sydney Design group), as an Environmental Manager for PSP- an alliance of private companies delivering infrastructure projects for Sydney Water, as field ecologist, undertaking fauna and flora assessments and vegetation mapping, for various companies including NSW National Parks and Wildlife Service.



## Flora Surveys- Dr. Meredith Brainwood

Meredith holds a Bachelor of Applied Science (Environmental Science), a Master of Science (Honours) and completed a PhD in Ecohydromorphology.

Meredith has extensive experience in preparing plans of management, aquatic and terrestrial flora and fauna surveys, and the development of rigorous scientific methodologies. She held contract roles with companies such as A&S Bushcare Services, National Trust Bushland Management Services, Good Bush People and NSW National Parks and Wildlife Service. Meredith worked as a senior environmental scientist with Australian Wetlands before joining Applied Ecology Pty Ltd.

