

CITY OF  
CANADA BAY

## FLORA INVENTORY

## Report for City of Canada Bay

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## Executive Summary

A flora inventory of the City of Canada Bay area has been completed. The aim of this survey was to document flora diversity across the Canada Bay City area. The project is part of the City's contribution to implementation of the NSW Biodiversity Strategy adopted by the NSW Government in 1999.

The survey involved a literature review and field survey of Council reserves, public land and golf courses throughout the City of Canada Bay area.

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 flora within the City of Canada Bay area is surprisingly diverse given the long history of development within the area and the traditional lack of recognition of the value of remnant vegetation.

A number of recommendations are made to improve knowledge of the native flora and the area and to protect and manage remnants. The importance of building linkages and possibilities for re-planting with locally indigenous plant species are issues which are highlighted.

## 1. Introduction

City of Canada Bay was formed recently as a result of the amalgamation of Concord and Drummoyne Municipal Councils. The Council is seeking to establish a biological inventory of the new Council area. It is intended that this inventory will be used to develop Plans of Management for open space within the City area and to develop policies and innovative mechanisms to ensure and promote biodiversity conservation within the City.

As part of this work an inventory of flora occurring within the City has been undertaken. This report presents the results of the inventory. The historic vegetation patterns within the City of Canada Bay area are discussed. The current remnant vegetation patches within the City are described. The management needs for existing vegetation are discussed and a vision is presented for the future.

## 2. Historic Vegetation Patterns in the Canada Bay Area

Benson & Howell (1990) review and describe the vegetation patterns associated with Sydney's urban bushland. In doing so, they discuss the plant communities which exist in the Sydney area and the past distribution of these communities, the impact of European settlement post 1788 and the distribution of bushland within each local government area.

They discuss the local government areas of Concord and Drummoyne as they were in 1990 when the book was written.

For the Concord area, Benson & Howell provide a map of the 1788 vegetation patterns across the local government area. The map indicates that low lying areas fringing bays supported estuarine complex vegetation: mangrove forests and saltmarsh. On rocky headlands such as at Rhodes, Mortlake, Cabarita a eucalypt woodland occurred. The clay soils derived from Wianamatta shales on undulating ridges, hills and valleys over the rest of the Concord area supported Turpentine-Ironbark Forest.

The vegetation patterns in the Drummoyne local government area showed a similar pattern of development to that of the Concord area. Estuarine complex vegetation was present in areas like Hen & Chicken Bay, Five Dock Bay and Iron Cove. Sandstone geology is more widespread and forests of Blackbutt (*Eucalyptus pilularis*), Smooth-barked Apple (*Angophora costata*) and Sydney Peppermint (*E. piperita*) were present (Benson & Howell 1990). Turpentine-Ironbark Forest occurred on the areas of shale geology which occur in the Five Dock area.

### 2.1 Estuarine Complex

Mangrove forests and saltmarsh occurred on tidal flats at the head of the bays. Whilst Grey Mangrove (*Avicennia marina*) dominated, River Mangrove (*Aegiceras corniculata*) was also present. Extensive saltmarsh flats occurred featuring species such as *Sarcocornia quinqueflora*, *Juncus kraussii* and *Suaeda australis*. On the landward side a strip of Swamp Oak (*Casuarina glauca*) may have been present.

### 2.2 Turpentine-Ironbark Forest

An open, grassy forest community dominated by Turpentine (*Syncarpia glomulifera*) and Grey Ironbark (*E. paniculata*) occurred in areas of shale-derived soils. Associated tree species included White Stringybark (*E. globoidea*), Red Mahogany (*E. resinifera*), Broad-leaved Apple (*Angophora floribunda*) and Blackbutt (*E. pilularis*).

### 2.3 Sydney Sandstone Woodland

Sandy soils associated with Hawkesbury sandstone geology supported a eucalypt woodland. Tree species present included Blackbutt (*E. pilularis*), Smooth-barked Apple (*Angophora costata*), Sydney Peppermint (*E. piperita*) and Red Bloodwood (*Corymbia gummifera*). Small tree species included Coast Banksia (*Banksia integrifolia*), Black She-oak (*Allocasuarina littoralis*), Cheese Tree (*Glochidion ferdinandii*) and Rusty Fig (*Ficus rubiginosa*). Dense scrubby patches occurred on shallow soils on headlands. Shrub species included Tick Bush (*Kunzea ambigua*) and *Melaleuca nodosa*. Deeper soils on headlands also supported taller trees such as Forest Red Gum (*E. tereticornis*) and Smooth-barked Apple (*Angophora costata*).

### 3. Previous Vegetation Survey Reports

Apart from surveys conducted by Benson & Howell in the course of compiling the Sydney 1:100 000 vegetation map and their book, 'Taken for Granted', surveys of vegetation within the City of Canada Bay area have been sporadic and largely restricted to species lists compiled as part of bush regeneration projects.

The vegetation of the Dame Eadith Walker Reserve at Concord West was surveyed by The National Trust of Australia (NSW) (the National Trust) in 1986. A floristic list was prepared. This list has been updated over the years by bush regeneration supervisors working for the National Trust.

Urban Bushland Management (UBM) prepared a floristic list for Majors Bay in June 1993.

Greening Australis prepared a report entitled 'Inventory of Remnant Vegetation, Lovedale Place Park, Concord West' in 1998 for Concord Council. The report includes a description of the structure and floristics of the vegetation present, together with management recommendations and a floristic list.

Queen Elizabeth Park at Concord has been the subject of more intensive research. A management plan for "Remnant Turpentine Woodland Rehabilitation" was prepared by Tein McDonald and David Ford in August 1992. Evan Rowse, a Council employee has also prepared a report on the bushland remnant. Volunteer bush regenerators working at Queen Elizabeth Park have maintained a species list.

### 4. Survey Methods

The preparation of this flora inventory included a field survey component. Field survey work was focussed on public land within the City of Canada Bay area, with an emphasis on parks and reserves under the care, control and management of council. Incidental records of locally indigenous flora occurring within private land or properties such as schools and churches were also made.

The field survey component sought to:

- identify all native plant species occurring within the City, including any endangered ecological communities;
- assess the condition of remnant stands of native vegetation; and
- note threats to the integrity of native plant communities such as weed invasion, rubbish dumping and inappropriate management.

The flora survey involved foot transects and targeted searching for threatened and regionally significant species. During these searches records were made of all indigenous plant species observed, the height and structure of canopy species, the presence of weeds and non-local native species, the condition of soils supporting indigenous plant species and disturbance factors limiting the distribution of indigenous species. The field survey took place during a period of low rainfall across the Sydney region and it is expected that additional species would be detected during more favourable conditions.

Species unable to be identified in the field were collected for later identification. Identification was undertaken by reference to the Flora of New South Wales (Harden 1990-2002).

Initial field work was undertaken in winter, with the bulk of the field work undertaken in spring. Additional field work was completed in autumn 2003 co-inciding with a return to average rainfall in the months of March and April.

An Excel based spreadsheet was prepared which details the plant species present and their occurrence within the City.

## 5. Canada Bay Vegetation in 2002

The City of Canada Bay has been the subject of intense development pressure over the years since 1788. Native vegetation is now restricted to very small areas, all of which are valuable remnants of the original vegetation which covered the City area. This section of the report provides a description of vegetation remnants occurring at various locations across the City area.

### Bayview Park

Bayview Park supports estuarine species, including *Suaeda australis* and New Zealand Spinach (*Tetragonia tetragonoides*) and Grey Mangrove (*Avicennia marina*).

### Bicentennial Park and Badu Mangroves

Bicentennial Park and Badu Mangroves form part of the Sydney Olympic Park. The Park and Badu Mangroves cover land within both City of Canada Bay and the Auburn local government areas. In Canada Bay the Park & Badu Mangroves occur to the east of Powells Creek. The Badu Mangroves within Canada Bay City support mangrove forest dominated by Grey Mangrove (*Avicennia marina*) on tidal flats. River Mangrove (*Aegiceras corniculatum*) is also present.

Management of the Park & Badu Mangroves is the responsibility of the Sydney Olympic Park Authority. A draft Plan of Management for Sydney Olympic Park is in the process of finalisation.

### Cabarita Park

Elements of the original woodland remain at Cabarita Park. This includes indigenous ground layer species which remain in areas where growth of introduced grasses is patchy. Native ground layer species observed in Cabarita Park include Weeping Meadow Grass (*Microlaena stipoides*), Blady Grass (*Imperata cylindrica*), *Glycine tabacina*, Kidney Weed (*Dichondra repens*), Queensland Blue Couch (*Digitaria didactyla*), Wallaby Grasses (*Danthonia* spp.), Wiregrass (*Aristida vagans*), Brown's Lovegrass (*Eragrostis brownii*) and Kangaroo Grass (*Themeda australis*). The native vine, *Hardenbergia violacea* is also present.

Some native trees which occur in the Park may be remnants. These include Rusty Fig (*Ficus rubiginosa*), Cheese Tree (*Glochidion ferdinandii*) and Swamp Oak (*Casuarina glauca*).

Along the shoreline estuarine plants are present. These include Samphire (*Sarcocornia quinqueflora*), New Zealand Spinach (*Tetragonia tetragonoides*), *Juncus kraussii*, Sand Couch (*Sporobolus virginicus*), Grey Mangrove (*Avicennia marina*), Austral Seablite (*Suaeda australis*),

Some patches of native vegetation were apparently removed when the Rivercat wharf was constructed. These have been replaced with native plants such as Kangaroo Grass (*Themeda australis*) and Spiny Mat-rush (*Lomandra longifolia*) grown from non-local stock.

### Concord Golf Course

Benson & Howell (1990) reported that forest previously occurred at Concord Golf Course. They state that Grey Ironbark (*E. paniculata*) trees remain along Majors Bay Road, with a healthy stand of Forest Red Gum (*E. tereticornis*) trees on the Cumming Avenue side.

In fact the Golf Course retains many native plant species, particularly trees, but also several ground layer species and a few species of shrubs. This includes a number of species of conservation significance due to their now restricted distribution on the Cumberland Plain, east of Parramatta.

Amongst the remnant tree species present are Forest Red Gum (*E. tereticornis*), Broad-leaved Apple (*Angophora floribunda*), Grey Ironbark (*E. paniculata*), another Grey Ironbark (*E. siderophloia*), Red Mahogany (*E. resinifera*), Grey Gum (*E. punctata*) and Swamp Oak (*Casuarina glauca*).

The main remnant stand occurs near the south-eastern corner of the Golf Course. It consists of remnant trees, scattered shrubs and a disturbed ground layer which retains a few native ground layer plants. Along Majors Bay Road, the road verge includes several native grass species.

Other remnants within the Golf Course occur:

- near the south-western corner near Cumming Avenue where remnant trees of Forest Red Gum (*E. tereticornis*), Red Mahogany (*E. resinifera*), Broad-leaved Apple (*Angophora floribunda*) and Grey Gum (*E. punctata*) occur. Understorey plants are few although a reasonable population of Climbing Saltbush (*Einadia nutans*) is present;
- in small pockets left as "rough" along fairways and close to holes. One of these patches supports the only known population within the City of Canada Bay area of the native lily, *Laxmannia gracilis*; and
- in low-lying areas near the northern boundary where estuarine complex species are present. Re-planting of saltmarsh plants has been undertaken in this area.

Locally indigenous plant species have also established on banks of dams within the Golf Course. The use of local soil in dam construction has enabled establishment of these species from soil stored seed. Amongst the plants which have established on the banks is the regionally significant plant species, *Acacia stricta*.

## Dame Eadith Walker Reserve

A remnant stand of Turpentine-Ironbark Forest remains at Dame Eadith Walker Reserve. Tree species present include Grey Ironbark (*E. paniculata*), Red Mahogany (*E. resinifera*), Grey Gum (*E. punctata*), White Stringybark (*E. globoidea*), Turpentine (*Syncarpia glomulifera*) and Rough-barked Apple (*Angophora floribunda*).

There is a diverse understorey with over 70 species of shrubs, herbs and grasses having been recorded (Benson & Howell 1990).

## Five Dock Bay

Remnant vegetation along the foreshore of Five Dock Bay is now rare, with a few Grey Mangrove (*Avicennia marina*) plants at Lysaght Park.

## Five Dock Park

At Five Dock Park a few remnant Grey Ironbark (*Eucalyptus paniculata*) trees remain in the south-eastern corner of the Park. A species of mistletoe, *Muellerina eucalyptoides*, was observed in one of the trees. Surprisingly, given the long history of development of the Park and regular mowing, some native understorey plants also remain. These include a bluebell (*Wahlenbergia gracilis*), Brown's Lovegrass (*Eragrostis brownii*) and *Poranthera microphylla*.

The root zone of some of the Grey Ironbark trees has been compacted due to bicycle riding.

## Hen and Chicken Bay

The foreshores of Hen & Chicken Bay support scattered examples of estuarine plant species. Species present include Grey Mangrove (*Avicennia marina*) and Samphire (*Sarcocornia quinqueflora*).

## Henry Lawson Park

Remnant trees of sandstone woodland remain at Henry Lawson Park in Abbotsford. These include a Blackbutt (*E. pilularis*) tree on the slope on the northern side of the Park and a number of Cheese Trees (*Glochidion ferdinandii*) in the same area. A Rusty Fig, (*Ficus rubiginosa*) is present on a sandstone bench near the middle of the Park. The tall shrub, Hickory (*Acacia implexa*) is present. Ground layer species include *Juncus krausii* and Scurvy Weed (*Commelina cyanea*).

## Iron Cove

Remnant Bangalay (*E. botryoides*) trees occur close to the foreshores at Iron Cove.

## Lovedale Place Park, Brays Bay

At Lovedale Place Park pockets of native vegetation remain, including remnants of Turpentine-Ironbark Forest, estuarine complex vegetation and a paperbark swamp woodland.

Tree species present include Coastal Grey Box (*E. moluccana*) at its eastern limit, Forest Red Gum (*E. tereticornis*), Prickly Paperbark (*Melaleuca styphelioides*) and *Melaleuca decora*.

Estuarine species present include Grey Mangrove (*Avicennia marina*), Swamp Oak (*Casuarina glauca*), Samphire (*Sarcocornia quinqueflora*), New Zealand Spinach (*Tetragonia tetragonoides*), *Juncus krausii*, Sand Couch (*Sporobolus virginicus*), Creeping Brookweed (*Samolus repens*), Streaked Arrowgrass (*Triglochin striata*) and Austral Seablite (*Suaeda australis*). The regionally rare species, Narrow-leaved *Wilsonia* (*Wilsonia backhousei*) is also present.

## Majors Bay and Yaralla Bay Foreshores

Elements of estuarine complex vegetation remain on the foreshores of Majors Bay with more extensive patches of Mangrove forest remaining in Yaralla Bay.

Tree species include Grey Mangrove (*Avicennia marina*) and Swamp Oak (*Casuarina glauca*). Saltmarsh species include Samphire (*Sarcocornia quinqueflora*), New Zealand Spinach (*Tetragonia tetragonoides*), *Juncus krausii*, Sand Couch (*Sporobolus virginicus*) and Austral Seablite (*Suaeda australis*).

## Majors Bay Road

The northern island along Majors Bay Road between Links Avenue and Correys Avenue supports a stand of three original Turpentine (*Syncarpia glomulifera*) trees. Additional Turpentine trees have been planted in these islands more recently. Beneath the Turpentine trees are some indigenous understorey plants including *Einadia polygonoides*, and Queensland Blue Couch (*Digitaria didactyla*).

## Mortlake Public School

The grounds of this school support remnant Broad-leaved Apple (*Angophora floribunda*) trees and Weeping Meadow Grass (*Microlaena stipoides*).

## Prince Edward Park

Prince Edward Park at Cabarita has an area of saltmarsh including Samphire (*Sarcocornia quinqueflora*), New Zealand Spinach (*Tetragonia tetragonoides*), *Juncus krausii*, Sand Couch (*Sporobolus virginicus*) and Austral Seablite (*Suaeda australis*). A few Grey Mangrove (*Avicennia marina*) seedlings are scattered through the saltmarsh patches. A single Forest Red Gum (*E. tereticornis*) tree occurs in the north of this Park. Rusty Fig (*Ficus rubiginosa*) trees in the middle of the Park appear to be locally indigenous.

## Quarantine Reserve

Quarantine Reserve at Abbotsford retains some remnant vegetation, together with some native plant species of unknown provenance.

Locally indigenous tree species include Rusty Fig (*Ficus rubiginosa*), Swamp Oak (*Casuarina glauca*), Grey Mangrove (*Avicennia marina*), Forest Red Gum (*E. tereticornis*), Smooth-barked Apple (*Angophora costata*) and Cheese Tree (*Glochidion ferdinandii*). Local understorey plants include Hickory (*Acacia implexa*), Tick Bush (*Kunzea ambigua*), Sweet Pittosporum (*Pittosporum undulatum*), Queensland Blue Couch (*Digitaria didactyla*) and Scurvy Weed (*Commelina cyanea*).

## Queen Elizabeth Park

At Queen Elizabeth Park the Turpentine-Ironbark Forest which remains is in a recovery phase. Tree species include Turpentine (*Syncarpia glomulifera*), White Stringybark (*E. globoidea*) and Blackbutt (*E. pilularis*).

Concord Council had previously made steps to protect the Turpentine-Ironbark Forest by fencing off islands of the Forest and co-ordinating work by local bush regeneration volunteers. This work has resulted in an increase in the distribution and abundance of ground layer species within the fenced off islands of the Forest.

Ground layer species present include Weeping Meadow Grass (*Microlaena stipoides*), Wiregrass (*Aristida vagans*), Wallaby Grass (*Danthonia tenuior*), *Entolasia marginata*, Hedgehog Grass (*Echinopogon caespitosus*), *Lomandra filiformis* ssp. *filiformis* and *Pseuderanthemum variable*.

Bush regeneration works have included enrichment planting with Turpentine-Ironbark plant species obtained from other reserves in the area such as Dame Eadith Walker Reserve as well as the Strathfield community nursery.

## Russell Lea Infants School

A small pocket of remnant Sydney Turpentine-Ironbark Forest occurs within the grounds of Russell Lea Infants School. The remnant is mainly Turpentine (*Syncarpia glomulifera*) and Forest Red Gum (*E. tereticornis*) trees, although Weeping Meadow Grass (*Microlaena stipoides*) is a component of the understorey.

## Strathfield North Public School

Benson & Howell (1990) refer to several tree species which remain in the grounds of Strathfield North Public School. These include Rough-barked Apple (*Angophora floribunda*) and White Stringybark (*E. globoidea*). At least some of these trees remain including an old White Stringybark tree along the Correys Road side of the administration building. Associated with this tree is an understorey of native grasses including Weeping Meadow Grass (*Microlaena stipoides*), Red-leg Grass (*Bothriochloa macra*) and Basket Grass (*Oplismenus aemulus*). Broad-leaved Apple trees occur along Cumming Avenue and in the play area near the northern boundary of the school grounds. The canopies of these trees are close to canopies of remnant Red Mahogany (*E. resinifera*) and Broad-leaved Apple trees within the grounds of Concord Golf Course. Indigenous ground layer plants are also present along Cumming Avenue. These include Small-flowered Wallaby Grass (*Austrodanthonia setacea*), Climbing Saltbush (*Einadia nutans*) and *Carex inversa*.

### 5.1 Plant Species of Conservation Significance

A number of plant species which occur within the Canada Bay City area are identified as vulnerable in western Sydney. This indicates that the species are found in few conservation reserves in western Sydney and may indicate that these species are vulnerable to extinction on the Cumberland Plain. Within the City of Canada Bay area most of these species occur in very small populations and are subject to a high level of risk of extinction from the City of Canada Bay area. They are important elements of the biodiversity of the City area and should be protected from development and activities which threaten their existence.

## Acacia stricta

*Acacia stricta* is an erect or spreading smooth-barked tree or shrub that can grow as high as 6m. It flowers between July and October, and is widespread in wet and dry sclerophyll forest, mainly in the ranges. It can be found in the coastal and tableland regions of NSW, and in Queensland, Victoria, Tasmania and SA.

It is considered to be vulnerable in western Sydney as it is known from fewer than 3 conservation reserves in that area (James et al 1999). It has been recorded at Dame Eadith Walker Reserve and Concord Golf Course.

## Aegiceras corniculatum

*Aegiceras corniculatum* is a mangrove shrub with fragrant flowers that usually grows to around 4m. It is most common growing north from Port Hacking, but is also found throughout coastal NSW and on Lord Howe Island.

It is considered to be vulnerable in western Sydney as it is known from fewer than 3 conservation reserves in that area (James et al 1999). It has been recorded from Yaralla Bay and the Badu Wetlands.

## Digitaria didactyla

*Digitaria didactyla* is a perennial grass that up to 40cm in height. It flowers in summer and grows in damp sandy soil. It is found in the Northern and Central NSW coastal areas, and on the Central Western Slopes. It also grows in Queensland and in Asia.

It is considered to be vulnerable in western Sydney as it is known from fewer than 3 conservation reserves in that area (James et al 1999). It is present at Quarantine Reserve, Queen Elizabeth Park, Concord Golf Course and Cabarita Park.

## White Stringybark (*E. globoidea*)

*Eucalyptus globoidea* is a medium sized tree that grows on sandy and gravelly loams and on shale capping over sandstone soil. It is quite common on the coast near Sydney, and can be found in the lower Blue Mountains, and southern highlands and in the Megalong Valley.

It is considered to be vulnerable in western Sydney as it is known from fewer than 3 conservation reserves in that area (James et al 1999). It occurs at Queen Elizabeth Park, Dame Eadith Walker Reserve and North Strathfield Public School.

## Grey Ironbark (*E. paniculata*)

*Eucalyptus paniculata* is a medium to tall tree with deeply furrowed bark on the trunk and on the branches. It flowers from May to August and dominates in open forest on heavy soils. It can also be found in association with other eucalypts. Its range extends in coastal NSW from Bega to Coffs Harbour.

It is considered to be vulnerable in western Sydney as it is known from fewer than 3 conservation reserves in that area (James et al 1999). It is known from several locations in the Canada Bay City area including Dame Eadith Walker Reserve, Lovedale Place Park, Strathfield North Public School and Five Dock Park.

## Grey Ironbark (*E. siderophloia*)

*Eucalyptus siderophloia* is a tree which, in favourable conditions, may reach 45 metres in height. Its range extends north from Sydney along the Central and North Coasts into Queensland. It is locally frequent and generally occurs in wet forests on soils of moderate fertility (Harden 2002).

On the Cumberland Plain *Eucalyptus siderophloia* occurs at South Maroota, in the Mitchell Park section of Cattai National Park and the East Hills-Milperra area where it is at its known southern limit. It has been recorded from Concord Golf Course.

### **Euchiton sphaericus**

*Euchiton sphaericus* is a herb which ranges from 5-15 cm in height. It flowers throughout the year and is widespread in various habitats throughout NSW. It can be found in all States.

It is considered to be vulnerable in western Sydney as it is known from fewer than 3 conservation reserves in that area (James et al 1999). It has been recorded from Lovedale Place Park.

### **Halosarcia pergranulata**

*Halosarcia pergranulata* is an erect shrub which may reach 1 metre in height. It has succulent, swollen branches with reduced entire lobes. It is widespread in inland Australia, but less common in coastal saline areas. It is found associated with saltmarsh communities on the Central Coast.

This species has been recorded from the saltmarsh area within the Badu Mangroves, not far from the boundary of City of Canada Bay.

### **Juncus krausii**

*Juncus krausii* subsp. *australiensis* grows in tussocks up to 1.5m high. It often dominates in saline or brackish areas, and can be found in coastal NSW and in all States.

It is considered to be vulnerable in western Sydney as it is known from fewer than 3 conservation reserves in that area (James et al 1999). It occurs along the foreshore at Lovedale Place Park, Henry Lawson Park, Yaralla Bay and Cabarita Park.

### **Lampranthus tegens**

This species has been recorded from the saltmarsh area within the Badu Mangroves, not far from the boundary of Canada Bay City. It is a native of South Africa, which is now possibly extinct from its original range. The population in Homebush Bay may be the only remaining population in the wild.

### **Muellerina eucalyptoides**

*Muellerina eucalyptoides* is a spreading parasitic shrub that mainly flowers in summer. It is usually found on species of *Eucalyptus*. It can be found on the coast, throughout the tablelands and on the western slopes and plains of NSW.

It is considered to be vulnerable in western Sydney as it is known from fewer than 3 conservation reserves in that area (James et al 1999). It was found growing in a Grey Ironbark tree at Five Dock Park.

### **Pultenaea microphylla**

*Pultenaea microphylla* is a small shrub with yellow and red flowers. Its range extends north from Canberra, including the Central Coast, the tablelands and western slopes into Queensland. Its favoured habitat is dry sclerophyll woodland or forest on clayey or gravelly soils (Harden 2002).

On the Cumberland Plain *Pultenaea microphylla* is uncommon and disjunct from larger populations above 1000 metres in the Central Tablelands. It is considered to be regionally significant in western Sydney (James et al 1999).

It has been recorded on Sydney Water land adjacent to Dame Eadith Walker Reserve.

## **Samolus repens**

*Samolus repens* is a herb with wrinkled or warty stems between 5-60 cm long. It flowers usually between September and April and grows on the edge of salty coastal streams, lakes and swamps. It can be found in Coastal NSW and also in Queensland, Victoria, Tasmania, SA and WA. s

On the Cumberland Plain *Pultenaea microphylla* is uncommon and disjunct from larger populations above 1000 metres in the Central Tablelands. It is considered to be regionally significant in western Sydney (James et al 1999). It has been recorded from Lovedale Place Park.

## **Sarcocornia quinqueflora**

*Sarcocornia quinqueflora* is a perennial that spreads upwards to 30cm. It is found mainly in coastal areas, although it can also be seen in habitats that are frequently flooded with salt water. It grows in coastal NSW and throughout the Australian coast.

It is considered to be vulnerable in western Sydney as it is known from fewer than 3 conservation reserves in that area (James et al 1999). *Sarcocornia quinqueflora* is found at several locations along the foreshore in the Canada Bay City area, including Lovedale Place Park, Cabarita Park, Yaralla Bay and Hen & Chicken Bay.

## **Sporobolus virginicus**

*Sporobolus virginicus* is a perennial that grows up to 50cm. It has leaves less than 1mm wide, and flowers that generally appear during summer. It grows in coastal areas of NSW, as well as in Queensland, Victoria, NT, SA and WA.

It is considered to be vulnerable in western Sydney as it is known from fewer than 3 conservation reserves in that area (James et al 1999). It is found at several locations along the foreshore in the Canada Bay City area, including Lovedale Place Park, Cabarita Park and Yaralla Bay.

## **Triglochin striata**

*Triglochin striata* is a slender perennial herb that grows in lakes with fresh or brackish water, in coastal salt marsh areas and inland. It can be found in coastal and in the western plains of NSW. It is a cosmopolitan species.

It is considered to be vulnerable in western Sydney as it is known from fewer than 3 conservation reserves in that area (James et al 1999). It has been recorded at Lovedale Place Park. Concord Golf Course have re-planted this species near the northern boundary of the Course.

## **Wilsonia (Wilsonia backhousei)**

*Wilsonia* is a small mat-forming plant which is associated with saltmarsh communities. Its range extends from the Sydney area to Jervis Bay and Victoria, Tasmania, South Australia and Western Australia (Fairley & Moore 1989).

Populations in the Sydney area have been severely impacted on by urban development and reclamation. It occurs at Salt Pan Creek and within the Sydney Olympic Parklands. Within the Canada Bay area it is known from Lovedale Place Park.

*Wilsonia* is listed as a Vulnerable species in Schedule 2 of the Threatened Species Conservation Act. Particular threats mentioned by the Scientific Committee include loss of habitat, trampling, vehicle use, altered salinity regimes, and invasion by the weed, *Juncus acutus*.

## Zornia dyctiocarpa

Zornia dyctiocarpa is a small twining plant which has paired leaflets borne on long stalks. Flowers are yellow and red and appear in late spring. It is widespread in grassland and forest communities and is found along the coast, tableland and western slopes.

It is considered to be vulnerable in western Sydney as it is known from fewer than 3 conservation reserves in that area (James et al 1999). It has been recorded from Queen Elizabeth Park.

### 5.2 Plant Communities of Conservation Significance

Whilst all examples of native vegetation in the Canada Bay area are of conservation and educational significance due to the extent of past development, Turpentine-Ironbark Forest remnants are of particular significance as Turpentine-Ironbark Forest is listed as an Endangered Ecological Community in Schedule 1 of Part 3 of the Threatened Species Conservation Act. The Scientific Committee's Final Determination in relation to Sydney Turpentine-Ironbark Forest extends to remnant trees, as well as woodland and forest formations.

Disturbance to any stand of remnant forest, including remnant trees, would require assessment of impacts following the procedures set out in the Threatened Species Conservation Act. This means that activities such as the construction of paths or fences under the root zone of Ironbark trees require consideration in terms of their likely impact on Sydney Turpentine-Ironbark Forest. In assessing applications under a Tree Preservation Order for removing or lopping trees Council must ensure that they have considered the likely impact of such activities in accordance with the requirements of the Threatened Species Conservation Act.

The remnants of 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 objective of City of Canada Bay should be to retain all present examples of Sydney Turpentine-Ironbark Forest, including remnant trees, and seek to restore Turpentine-Ironbark Forest to suitable areas. It is important to source seedstock or tubestock grown from trees of local provenance in any re-planting program.

## 6.0 Current Management Needs

### Building Knowledge within Council

This report and the associated fauna report are an important step in building knowledge of biodiversity within the City of Canada Bay area. This knowledge needs to be extended to Council staff, particularly those who manage and work in the reserves and along the foreshores where native plant and animal species exist, those who assist in the process of determination of development applications and those who plan the City's future.

A workshop should be held to inform Council staff and Councillors of the findings of these studies. Information from the flora and fauna reports should be built into any training manuals and modules. Other opportunities and programs could be developed to assist in the knowledge building process.

### Management of Remnants Within Developed Parks

Whilst Concord Council previously moved towards improved management of some remnants within its area, additional steps are needed to protect plant biodiversity within the City of Canada Bay area.

The first step is recognition that remnant vegetation exists within the City area. The current report represents the first systematic survey across the City, although some parks and reserves remain unsurveyed.

Protection of indigenous vegetation needs to be taken into account when developing management or landscape plans for parks and reserves. Where stands of Sydney Turpentine-Ironbark Forest, or remnant trees of this community, procedures laid out in the Threatened Species Conservation Act must be followed in relation to activities which may harm remnant trees or remnant vegetation.

At larger parks and reserves which retain vegetation remnants there need to be areas set aside for bush regeneration and restoration of populations of indigenous species. Parks where such projects should be undertaken include Cabarita Park, Five Dock Park and Queen Elizabeth Park. Consideration should also be given to re-planting projects within other reserves which are currently large expanses of largely unused grassland. Bush regeneration and re-planting projects need to be designed to provide for fauna habitat as well as the protection and re-planting of native species.

Bush regeneration projects in Canada Bay City reserves should involve Council staff, contract bush regeneration teams and community volunteers. The projects need adequate resourcing covering issues such as training and supervision of volunteers, occupational health and safety, effective fencing and signposting and communication with local people, potential volunteers and Council staff.

City of Canada Bay should, at this stage, commit to funding and support for bush regeneration projects in at least 3 reserves within the City area, with the continuation of work at Queen Elizabeth Park and Lovedale Place Park being of highest priority.

Remnant trees are a valuable resource, not only as they provide evidence of the forests and woodlands which previously covered the City, but also as a potential source of seed for re-planting programs. Improved management of remnant trees, such as by restricting activity in the root zone would improve their health and likely longevity.

## Propagation Stock

The preferred source for seed and cuttings for use in replanting programs is from within the catchment of the replanting site. Due to the extent of past clearance, this will not be possible for all potential replanting sites. In these cases propagation stock will need to be sourced from other catchments and possibly outside the Canada Bay City area. Council should investigate partnerships with neighboring or nearby councils which have community nurseries and with organisations such as the Sydney Olympic Park Authority or Greening Australia to source appropriate stock.

## Remnants on school and church grounds

Remnant vegetation exists on grounds of schools and churches reflecting the time since establishment of these public institutions and a different use pattern than that for public reserves and private land.

These remnants, particularly those within schools are a valuable educational resource as a demonstration of the natural environment which existed in the area prior to urban development.

Council should provide assistance to school and church groups who wish to protect, manage and re-plant indigenous vegetation. This could be through sponsorship of school greening projects, assistance with technical advice or through linking schools to community groups and individuals who can contribute to such projects.

## Golf Courses

Golf Courses can provide important areas for habitat of native plants and animals. Elements of biodiversity can be built into Golf Course design. Concord Golf Course retains elements of Sydney Turpentine-Ironbark Forest, even though development of the Course took place almost 100 years ago. Current management of the Course respects the biodiversity values of the remnant vegetation, with efforts made to propagate indigenous tree species for planting in appropriate locations within the grounds of the Course.

A number of golf courses in the northern beaches area are implementing programs in association with their local councils to protect and maintain stands of native vegetation and waterbird habitat as part of their operations. This includes involvement in bushcare activities and bush regeneration work.

City of Canada Bay should work in a similar way to work with golf course management to protect existing remnant vegetation and incorporate local trees and shrubs in plantings on golf courses in the area.

## Linkages

Public and community land, like schools, golf courses and church grounds can assist in building linkages between larger bushland patches on Council reserves and foreshore habitats. Whilst in an area as developed as the City of Canada Bay it may not be possible to physically link areas of remnant vegetation, any islands or fingers of native vegetation or re-plantings can play a significant part in providing pathways for fauna, such as birds to move through the landscape.

Earlier programs which sought to develop vegetation linkages through the Canada Bay area were associated with the Sydney 2000 Olympic Games. Greening Australia were involved in this work which focussed on plantings along the route of the marathon, including places such as Cintra Park and the Drummoyne and Iron Cove areas. These plantings involved a mix of locally indigenous and non-local species. Concord High School participated in the project. Greening Australia have also worked with a number of other local schools on projects growing plants. Schools involved include Lucas Gardens Special School and Concord West Primary School.

Council should use opportunities to combine recreational linkages such as walking tracks or bike paths with biodiversity linkages.

## Foreshores and the tidal zone

Changes in management of waterways over the past 40 years and improvements in water quality along the Parramatta River have allowed native vegetation to consolidate and re-establish along foreshores within the City area. Programs to protect foreshore land and bring areas back into public ownership have contributed to the re-establishment of foreshore vegetation.

Foreshore remnants require protection although several agencies have an interest in their management in addition to that of the City of Canada Bay. These agencies include the Department of Land & Water Conservation and Waterways.

## Further Studies

The 2002 survey took place during a prolonged dry period including the driest ever six monthly period since meteorological records began in the mid 19th century. Accordingly it is inevitable that some species would have been overlooked. Once rainfall returns to normal or above average it is likely that soil stored seed will germinate and that additional plant species will be able to be detected. It is recommended that another search for native plant species be undertaken in spring of 2003. This need only involve a few days work with any new findings incorporated into the flora spreadsheet developed for the current project. The flora inventory spreadsheet could then be maintained by Council staff such as a bush regeneration co-ordinator.

## 7.0 Legislation

A number of pieces of legislation can be used to protect native vegetation and constrain activities which are damaging.

## Threatened Species Conservation Act

The Threatened Species Conservation Act (1995) seeks to conserve threatened species, populations and ecological communities of animals and plants. Object a) of the Act is: "to conserve biological diversity and promote ecologically sustainable development".

One endangered ecological community, listed in Part 3 of Schedule 1 of the Act occurs in the City of Canada Bay area. This is Sydney Turpentine-Ironbark Forest. The Scientific Committee's Final Determination in relation to Sydney Turpentine-Ironbark Forest extends to remnant trees, as well as woodland and forest formations. This means that removal of remnant Sydney Turpentine-Ironbark Forest trees under Council's Tree Preservation Order requires an assessment of significant effect.

Two listed threatened species which may occur along foreshores within the City of Canada Bay area are *Lampranthus tegens* and *Wilsonia* (*Wilsonia backhousei*).

## Rivers and Foreshores Improvement Act

The River and Foreshores Improvement Act 1948 seeks to control activities which, amongst other matters, have the potential to cause increased erosion or siltation of streams, lakes or estuaries or to cause ecological deterioration. This could extend to native vegetation occurring along foreshores and creek and river channels within the City of Canada Bay area. The Act also applies to artificial channels such as that occurring next to Cintra and St Lukes Parks and along Iron Cove Creek.

A wide range of development activities are covered by the Act. The Act applies to the bank, shore or bed of foreshores, creek and river channels and to adjacent land within 40 metres of the top of banks or shores.

This Act could prove useful in controlling activities which threaten estuarine plant communities and species, particularly saltmarsh.

## 8.0 The Way Forward

Canada Bay Council should implement strategies and procedures to ensure that all areas of remnant vegetation identified in this report are protected and appropriately managed. An important step will be to improve the knowledge of Council staff and Councillors in relation to biodiversity within the City area.

The Queen Elizabeth Park Sydney Turpentine-Ironbark Forest is an important icon for biodiversity conservation within the City area. Council needs to put resources into the facilitation of bush regeneration and re-planting works within the Forest. Management of the remnant should be changed so that the current islands of Forest are joined together. The long term aim should be to ensure that a diverse and robust Sydney Turpentine-Ironbark Forest remnant is maintained with no further loss of indigenous plant species.

City of Canada Bay should develop a plan for combined recreational and biodiversity linkages across the City. These should build on foreshore linkages commenced by the former Concord and Drummoyne Councils. A priority should be linking the range of communities from estuarine complex and sandstone forest to Turpentine-Ironbark Forest in the Majors Bay area and consolidating links around Hen & Chicken Bay.

Council should work with local schools to promote the establishment of bushland management areas at all schools in the City of Canada Bay area.

In the medium term Council should establish and manage a bushland area based on the Grey Ironbark trees at Five Dock Park.

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