Street Tree
MASTERPLAN

Waverley Council 2008

Street Tree Masterplan
CONTENTS

1 Introduction

Waverley Council is committed to the preservation and enhancement of our street trees. We recognise their value and importance and their contribution to the community's well-being.

There are an estimated 10,000 street trees growing in our streets. The main aim of this masterplan is to provide a framework for street tree planting now and into the future, with a focus on protecting and enhancing the Waverley area's wonderful tree resources and streetscapes.

1.1 Methodology

This masterplan divides the Waverley Council area into eight zones based on topography, soils and climate. These zones recognise the range of influences on street tree selection and performance.

A list of preferred tree species for each planting zone has been prepared using a performance based approach. This involves assessing planting zone factors e.g. soil depth, coastal exposure, light requirements etc, then compiling a list of suitable trees. From this list the preferred species is selected for individual sites depending on more detailed site assessment e.g. site constraints such as overhead wires; width of naturestrip etc.

The recently completed street tree database records information on the 10,000 street trees in Waverley. This information will be used to select suitable locations for increased tree planting; improve or 'green' existing streetscapes; trial new tree species and most importantly increase the urban tree canopy cover. The database will also assist in long term planning of our streets by highlighting where trees need to be planted, which trees may be in decline and which are the best performing trees in given situations.

The street tree masterplan will be a major part of the Greening Masterplan. The Greening Masterplan will be the overall tree planting strategy for the Waverley Council area, with an emphasis on establishing habitat corridors linking remnant bushland with adjacent council bushland areas and larger open spaces such as Centennial and Moore Parks.

1.2 Urban Canopy Cover

Urban canopy cover is defined as the "totality of trees and shrubs on all public land and private land in and around urban areas, including bushland, parkland, garden and street trees and is measured as a canopy cover percentage of the total area" (Local Government Association of NSW, 2003).

Our urban cover of street trees has increased enormously over the last sixty years. However, in recent years, urban consolidation, the effects of long dry summers and the decline of a number of over-mature trees has had a detrimental impact on the quantity and quality of our urban forest.

To offset these recent losses we have expanded our street tree planting program and will use the street tree database to identify suitable opportunities for future large scale planting. With the use of aerial mapping we will aim to maintain and increase the existing level of canopy cover within the Waverley area.

Above: Aerial photo of Bondi Junction and Queens Park 2005 showing extent of tree canopy cover

Above: Aerial photo of Bondi Junction and Queens Park 1943 showing minimal tree c*over*
(photo courtesy of RTA 'From the Skies' – CD-ROM)

1.3 Benefits of Trees

Street trees are often the dominant landscape factor in the community and one of the most effective ways of improving the image and character of our streets and suburbs. They bring benefits in a number of ways by:

Environmentally

- Creating a microclimate by providing shade and absorbing heat and deflecting strong winds
- Improving air and soil quality by absorbing air and soil pollutants in their tissue
- Minimising the intensity of water run-off through the interception of showers and reducing the quantity of flows
- Reducing soil erosion and run-off
- Providing a habitat for local fauna

Culturally and aesthetically

- Softening the hard surfaces of the built environment
- Creating a sense of local character or reinforcing a 'sense of place'
- Reflecting the history of an area e.g. the formal avenue of Fig trees in Chesterfield Parade, Bronte, leading to the cemetery

Functionally

- Screening unsightly views and providing privacy
- Providing shade
- Helping to link urban zones with green open spaces
- Improving the appearance and amenity of a street or suburb

Flood Street, Bondi

2 Planting Zones

Because of the wide range of urban landscapes in Waverley, the area has been divided into eight distinct planting zones. Six of the zones relate to the topography, soils and coastal exposure of the area as these are the dominant factors that determine the long term success and viability of tree survival. The other two zones are heritage listed streets and commercial zones. Each zone is distinct in character from the others. The selection of trees is based on those differences.

The zones are:

1. **Frontline Coastal**: the areas directly exposed to strong salt-laden winds with little or no protection.

2. **Coastal Slopes and Basin**: within one kilometre of the coast but directly and indirectly affected by coastal winds.

3. **Exposed Ridge-lines / Shallow Soils over Sandstone**: the streets on the high ridge-line exposed to coastal winds around Dover Heights, Vaucluse and Tamarama and the westerly and southerly winds around Bondi Junction and Charing Cross. Also the areas of shallow soil overlying sandstone. These areas once supported low growing heath communities.

4. **Heritage Streets**: heritage listed streets recognised for the significance of their trees and their contribution to the immediate area.

5. **Commercial**: the areas around the main commercial precincts and local village precincts.

6. **North Bondi / Rose Bay**: the area that once supported large stands of Eastern Suburbs Banksia Scrub and is known to have deep sandy soils.

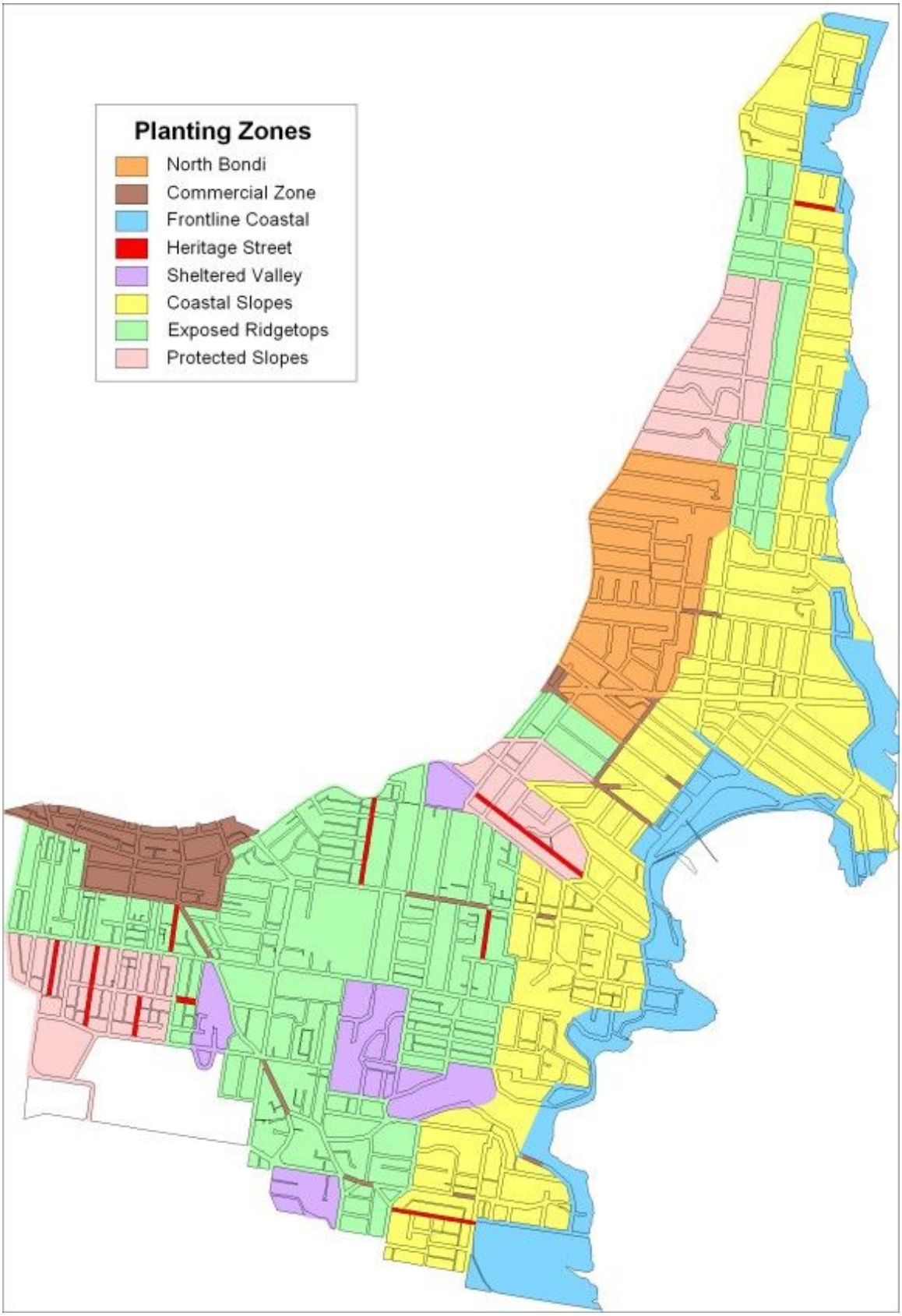
7. **Protected Slopes**: the more protected slopes below the ridge-lines of Rose Bay and Queens Park. Usually sheltered from prevailing winds.

8. **Sheltered Valleys**: the small gullies in Queens Park and behind Bronte Beach and Tamarama.

These planting zones are listed from the most difficult sites for establishing trees i.e. frontline coastal, to those sites with better conditions for tree growth i.e. sheltered valleys. This is also reflected in the wider palette of tree species for planting in the more protected areas.

Within each zone is a short list of preferred species. Tree selection for each street within a zone will be based on factors such as: width of nature-strip; nearby services and utilities; sightlines, heritage values etc.

These lists of trees will be reviewed annually and other tree species may be used or trialled as new varieties become available.


Planting Zones
North Bondi
Commercial Zone
Frontline Coastal
Heritage Street
Sheltered Valley
Coastal Slopes
Exposed Ridgetops
Protected Slopes

2.1 Zone 1 : Frontline Coastal

These areas are directly exposed to strong salt-laden winds. The original vegetation would have consisted of low, wind pruned heath plants. The soils are sandy and skeletal with little or no organic matter and are often only a thin layer over a bedrock of sandstone.

The areas range from the strip of cliff tops from Dover Heights and Vaucluse, down to the North Bondi headlands including Bondi Beach and headlands south to Clovelly. It also includes some streets directly exposed to southerly winds.

Choosing suitable trees for this zone is difficult and the species listed below are recognised as performing moderately well given the extreme conditions.

2.1.1 Streetscape Character

In Dover Heights and Vaucluse the coastal streets are generally wide with expansive grassy naturestrips. This is usually ideal for optimum growth of street trees; however, these wide streets are mostly exposed with little protection from direct salt laden winds. Harsh conditions and occasional poor tree selection have resulted in bare appearances in some streets.

The footpaths in the commercial zones around Bondi are mostly concreted and require specific species selection and robust protection in the form of solid tree guards

New Zealand Christmas Trees in Isabel Avenue Vaucluse

2.1.2 Dominant Trees

Common name	Botanical name
Coastal Banksia	Banksia integrifolia
Bracelet Honey Myrtle	Melaleuca armillaris
Bottlebrush	Callistemon ‘Kings Park Special’
New Zealand Christmas Bush	Metrosideros excelsa
Norfolk Island Pine	Araucaria heterophylla

2.1.3 Issues and Considerations

- Number of declining street trees (mostly New Zealand Christmas Bush -*Metrosideros excelsa*)
- Exposure to coastal winds and poor soil quality limits species selection
- Low number of streets with overhead wires but views to the ocean to be considered with species selection

2.1.4 Strategies

- To improve tree planting and protection conditions to enable a greater percentage of tree survival.
- Create a distinctive local coastal character through the use of coastal tolerant trees

2.1.5 Actions

- Choose trees from the accompanying table of coastal tolerant trees.
- Increase width of planting hole to a minimum of one metre and incorporate quality native soil mix and water crystals
- If planting in areas of concrete footpath, the planting hole must be a minimum size of 1metre x 1 metre. Root barriers to be installed to minimise any potential footpath damage
- Only plant trees that have been 'hardened off' to coastal conditions
- Use tree guards with hessian surrounds to provide extra protection
- In wider nature strips trial planting coastal tolerant shrubs as a barrier around the tree

2.1.6 Preferred Tree Species

Size	Common name	Botanical name
Small (to 6 metres)	Coastal Wattle	Acacia longifolia sub.sophorae
	Beach Birds Eye	*Alectryon coriaceus*
	Silver Banksia	Banksia marginata
	Coastal Tea Tree	Leptospermum laevigatum
Medium (6 to 12 metres)	Coastal Banksia	Banksia integrifolia
	Horsetail Casuarina	*Casuarina equisetifolia*
	Bracelet Honey Myrtle	Melaleuca armillaris
	Moonah	*Melaleuca lanceolata*
	New Zealand Christmas Bush	Metrosideros spp
Large (over 12 metres)	Cook Island Pine	*Araucaria columnaris*
	Norfolk Island Pine	Araucaria heterophylla
	Cotton Palm	Washingtonia robusta
Italicised names may only be available from specialist native nurseries		

2.2 Zone 2 : Coastal Slopes and Basins

This is the general area situated just back from the frontline coastal zone and extending inland towards the ridgetops of Waverley, Bondi and Dover Heights. The coastal conditions of salt laden winds and strong on-shore winds still predominate and influence the growth and success of tree planting. Many taller buildings offer some protection for the smaller and medium sized trees; however, some of the taller growing species show the effects of coastal exposure.

Tuckeroo trees in Lamrock Avenue in Bondi: wide naturestrip but concrete

The areas include the ridgetops and east/south facing slopes from Vaucluse and Dover Heights, Bondi Beach and the Bondi basin, and the streets extending inward from Tamarama and Bronte beaches. The more exposed southern facing slopes are the most affected.

2.2.1 Streetscape Character

The streets in Dover Heights and Vaucluse generally have wide grassy footpaths with no overhead wires – good site conditions for tree planting. Around North Bondi and Bondi the smaller commercial areas also have wide footpaths with no overhead wires but many are concreted or paved with small cut-outs for existing trees. Away from these commercial areas the streets narrow in size with corresponding narrow footpaths and naturestrips; overhead wires are more common restricting the range of suitable trees that can be used.

2.2.2 Dominant Trees

Common name	Botanical name
Coastal Banksia	Banksia integrifolia
Paperbark	Melaleuca quinquenervia
Bottlebrush	Callistemon ‘Kings Park Special’
Bracelet Honey Myrtle	Melaleuca armillaris
Tuckeroo	Cupaniopsis anacardioides
New Zealand Christmas Bush	Metrosideros excelsa
Norfolk Island Hibiscus	Lagunaria patersonia

2.2.3 Issues and Considerations

- Number of declining street trees (mostly New Zealand Christmas Bush *Metrosideros excelsa*)
- Exposure to coastal winds and poor soil quality limits species selection

- Low number of streets with overhead wires but views to the ocean need to be considered with species selection

2.2.4 Strategies

- To create a distinctive local coastal character.
- Improve planting conditions to increase rate of tree survival

2.2.5 Actions

- Choose trees from the accompanying table of coastal tolerant trees.
- Increase width of planting hole to a minimum of one metre and incorporate quality native soil mix and water crystals
- Maximise the width of concrete cut-outs for new trees and incorporate root barriers to minimise any potential footpath damage

2.2.6 Preferred Tree Species

Size	Common name	Botanical name
Small (to 6 metres)	Fringed Wattle	Acacia fimbriata
	Dwarf Apple	Angophora hispida
	Lemon-Scented Bottlebrush	Callistemon citrinus
	Weeping Bottlebrush	Callistemon 'Dawson River'
	Bottlebrush	Callistemon 'Kings Park Special'
	Port Jackson Pine	*Callitris rhomboidea*
	Port Jackson Mallee	*Eucalyptus obstans*
	Coastal Tea Tree	Leptospermum laevigatum
	Bracelet Honey Myrtle	Melaleuca armillaris
	White Feather Honey Myrtle	*Melaleuca decora*
Medium (6 to 12 metres)	*Red Apple*	*Acmena ingens*
	Purple-leafed Willow Myrtle	Agonis flexuosa 'After Dark'
	Forest Oak	Allocasuarina torulosa
	Lemon Myrtle	Backhousia citriodora
	Coastal Banksia	Banksia integrifolia
	Saw Banksia	Banksia serrata
	Illawarra Flame Tree	Brachychiton acerifolius
	Horsetail Casuarina	*Casuarina equisetifolia*
	Tuckeroo	Cupaniopsis anacardioides
	Blueberry Ash	Elaeocarpus reticulatus
	Scribbly Gum	Eucalyptus haemastoma
	Red-leafed Hibiscus tree	*Hibiscus 'Rubra'*
	New Zealand Christmas Bush	Metrosideros spp

Size	Common name	Botanical name
Large (over 12 metres)	Sydney Red Gum	Angophora costata
	Cook Island Pine	*Araucaria columnaris*
	Norfolk Island Pine	Araucaria heterophylla
	Yellow Bloodwood	Corymbia eximia
	Cabbage Tree Palm	Livistona australis
	Fine-leafed Paperbark	*Melaleuca leucadendra*
	Broad-leafed Paperbark	Melaleuca quinquenervia
	Cotton Palm	Washingtonia spp
Italicised names may only be available from specialist native nurseries		

2.3 Zone 3 : Exposed Ridgetops / Shallow Soils Over Sandstone

The exposed ridgetops are the dominant ridge-lines of Charing Cross, Bondi Junction, and Bondi with their exposure to southerly and westerly winds and Dover Heights where the ridgetops experience strong salt laden coastal winds.

The areas of shallow soils over a bedrock of sandstone are found throughout Bondi Junction and the streets of Dover Heights, Waverley and Bronte.

The original vegetation of these areas consisted of low heath plants growing on sandstone.

Both areas have minimal or restricted soil depth for root growth.

Recently Planted Sydney Redgum

2.3.1 Streetscape Character

The streets are extremely varied from the wide grassy nature strips in Dover Heights and parts of Bronte to the concrete or asphalt footpaths in the streets around the commercial zones of Bondi Junction and Charing Cross.

2.3.2 Dominant Trees

Common name	Botanical name
Coastal Banksia	Banksia integrifolia
Bracelet Honey Myrtle	Melaleuca armillaris
Swamp Paperbark	Melaleuca quinquenervia
Bottlebrush	Callistemon viminalis
Watergum	Tristaniopsis laurina
Casuarina	Casuarina glauca

2.3.3 Issues and Considerations

- Medium sized native trees may be more adaptable to soils with minimal water and nutrient retention
- Poor drainage likely in areas of exposed bedrock

2.3.4 Strategies

- To use tree species that are tolerant of periods of drought and restricted root run.
- Generally improve the planting conditions of all new trees to increase the survival rate of tree planting

2.3.5 Actions

- Determine planting locations on the tree database that are exposed to strong winds or known to have poor soil depth
- Investigate the use of improved watering methods by incorporating more water inlets
- Investigate the use of wider planting holes and structural soils in concrete and asphalt footpaths
- Encourage the use of permeable paving and paving surfaces for concrete or asphalt surfaces

2.3.6 Preferred Tree Species

Size	Common name	Botanical name
Small (to 6 metres)	Dwarf Apple	Angophora hispida
	Weeping Bottlebrush	Callistemon 'Dawson River'
	White Feather Honeymyrtle	*Melaleuca decora*
	Prickly Paperbark	Melaleuca styphelioides
Medium (6 to 12 metres)	Purple-leafed Willow Myrtle	Agonis flexuosa 'After Dark'
	Lemon Myrtle	Backhousia citriodora
	Old Man Banksia	Banksia serrata
	NSW Christmas Bush	Ceratopetalum gummiferum
	Tuckeroo	Cupaniopsis anacardioides
	Blueberry Ash	Elaeocarpus reticulatus
	Scribbly Gum	Eucalyptus haemastoma
	Cheese Tree	*Glochidion ferdinandi*
	Riberry	Syzygium luehmannii
	Watergum	Tristaniopsis laurina
	Waterhousea	Waterhousea floribunda
Large (over 12 metres)	Sydney Red Gum	Angophora costata
	Cook Island Pine	*Araucaria columnaris*
	Norfolk Island Pine	Araucaria heterophylla
	Port Jackson Fig	Ficus rubiginosa

Size	Common name	Botanical name
Large (over 12 metres)	Jacaranda	Jacaranda mimosifolia
	Brushbox	Lophostemon confertus
	Fine-leafed Paperbark	*Melaleuca leucadendra*
	Swamp Paperbark	Melaleuca quinquenervia
Italicised names may only be available from specialist native nurseries		

2.4 Zone 4 : Heritage

The following streets are listed as heritage streets due to their historic character or landscape history:

Brisbane Street
Alt Street
Rawson Avenue
Manning Street
Chesterfield Parade
Avoca Street
Flood Street
Francis Street
(Wellington to Denham Sts)
Oceanview Avenue

Hill's Figs, Chesterfield Parade, Bronte

2.4.1 Streetscape Character

Most of the tree plantings date back to the 1930's and are located in wide streets either in the roadways with semi-circular cut-outs e.g. Rawson Avenue or in the middle of wide naturestrips.

2.4.2 Dominant Trees

Common name	Botanical name
Camphor Laurel	Cinnamomum camphora
Hills Fig	Ficus microphylla 'Hillii'
Port Jackson Fig	Ficus rubiginosa
Brushbox	Lophostemon confertus
Poplar	Populus nigra 'Italica'
Paperbark	Melaleuca quinquenervia
New Zealand Christmas Bush	Metrosideros excelsa

2.4.3 Issues and Considerations

- Many of these heritage listed trees were planted during the 1930's and have been assessed on the database as over-mature or senescent
- A number of these over-mature trees could be classified as hazardous due to their poor to fair condition or structural defects. These hazards have been exacerbated by previous poor pruning practices; excessive pruning of roots for road re-surfacing or repairs to kerbs and gutters
- Additional streets with impressive avenues of trees could be nominated for heritage listing to ensure their protection e.g. Onslow Street
- Some existing trees have raised or exposed surface roots that have been damaged by road and footpath construction and repairs

2.4.4 Strategies

- Maintain and enhance the existing stock of heritage trees.
- Increase and expand the number of heritage listed street trees.
- Ensure that plantings are sympathetic to the heritage values of the built environment

2.4.5 Actions

- Use the street tree database to determine the health and condition of each tree listed in heritage streets and their projected lifespan using the SULE method (Safe Useful Life Expectancy)
- Individually assess these trees and prioritise an action plan for each street for renewal/replacement
- Using current replacement costs, estimate projected costs and seek funding
- Assess other streets for planting of potential heritage trees
- Investigate the use of specially constructed tree pits for replacement trees in heritage streets to minimise potential root damage
- Choose trees from the accompanying table of potential heritage trees.

2.4.6 Preferred Tree Species

Size	Common name	Botanical name
Medium (6 to 12 metres)	Coastal Banksia	Banksia integrifolia
	Tuckeroo	Cupaniopsis anacardioides
	Waterhousea	Waterhousea floribunda
Large (over 12 metres)	Sydney Red Gum	Angophora costata
	Cook Island Pine	*Araucaria columnaris*
	Norfolk Island Pine	Araucaria heterophylla
	Port Jackson Fig	Ficus rubiginosa
	Cabbage Tree Palm	Livistona australis
	Brushbox	Lophostemon confertus
	Weeping Paperbark	*Melaleuca leucadendra*
	Paperbark	Melaleuca quinquenervia
	Cotton Palm	Washingtonia robusta
Italicised names may only be available from specialist native nurseries		

2.5 Zone 5 : Commercial

These are the main commercial areas of Bondi Junction, Bondi Beach, Charing Cross and a number of smaller villages as identified in the Local Villages Project.

2.5.1 Streetscape Character

Each of these areas is unique and provides challenging criteria when selecting and preparing for tree planting. The Bondi Junction zone has shallow soil depth usually over a layer of bedrock with a number of streets affected by shadows and wind turbulence from tall buildings. Bondi Beach is less affected by building shadows but is exposed to strong salt laden winds from the south. Many Norfolk Island Pine trees on the beachfront were badly affected from the affects of household detergents borne on the onshore winds prior to the ocean outfall. However, these and other trees are now being re-planted with a greater success rate.

As noted in the Local Villages Project the smaller local villages from Dover Heights to Bronte would benefit from extra tree planting to create a sense of place and identity

Street trees in Bondi Junction

2.5.2 Dominant Trees

Common name	Botanical name
Norfolk Island Pine	Araucaria heterophylla
Coastal Banksia	Banksia integrifolia
Tuckeroo	Cupaniopsis anacardioides
Honey Locust	Gleditsia tricanthos
Brushbox	Lophostemon confertus
Fine-leafed Paperbark	Melaleuca leucadendra
Paperbark	Melaleuca quinquenervia
Plane Tree	Platanus x hybrida
Watergum	Tristaniopsis laurina

2.5.3 Issues and Considerations

- Sturdy protection required for newly planted trees
- Thoroughly assess all the site conditions prior to tree selection
- Use Water Sensitive Urban Design principles where achievable

2.5.4 Strategies

- To plant the most appropriate tree for the constraints of the site.
- Research and evaluate current best practices in tree planting and apply to local conditions where appropriate

2.5.5 Actions

- Discuss tree planting at the concept stage of any landscaping or development project to ensure the best possible outcome for the streetscape
- Assess each site for possible Water Sensitive Urban Design (WSUD) applications
- Evaluate the condition of established plantings
- Research and assess the latest planting methods and apply where possible
- Establish alternative replacement species as existing Plane trees die or are removed

2.5.6 Preferred Tree Species

Size	Common name	Botanical name
Small (to 6 metres)	Ivory Curl Tree	Buckinghamia celsissima
	Weeping Bottlebrush	Callistemon 'Dawson River'
	Eucalyptus Summer Red & cultivars	Eucalyptus 'Summer Red'
Medium (6 to 12 metres)	Coastal Banksia	Banksia integrifolia
	Illawarra Flame Tree	Brachychiton acerifolius
	Tuckeroo	Cupaniopsis anacardioides
	Wilga	*Geijera parviflora*
	Honey Locust	Gleditsia triacanthos
	Golden Rain Tree	Koelreuteria paniculata
	Watergum	Tristaniopsis laurina
	Waterhousea	Waterhousea floribunda
Large (over 12 metres)	Sydney Red Gum	Angophora costata
	Cook Island Pine	*Araucaria columnaris*
	Norfolk Island Pine	Araucaria heterophylla
	Yellow Bloodwood	Corymbia eximia 'Nana'
	Cabbage Tree Palm	Livistona australis
	Brushbox	Lophostemon confertus
	Bull-Bay Magnolia	Magnolia grandiflora
	Weeping Paperbark	*Melaleuca leucadendra*
	Paperbark	Melaleuca quinquenervia
	Firewheel Tree	*Stenocarpus sinuatus*
	Cotton Palm	Washingtonia robusta
Italicised names may only be available from specialist native nurseries		

2.6 Zone 6 : North Bondi / Rose Bay Basin

This zone extends north-west from the Bondi basin of Blair Street to the lower slopes of Rose Bay. The area's original vegetation consisted of sand dunes and low lying swamps. It once supported stands of Eastern Suburbs Banksia Scrub – now listed as a threatened ecological community.

Some of the more significant tree species that were found here include: Wallum Banksia (*Banksia aemula*) and the Broad-leaved Paperbark (*Melaleuca quinquenervia*) in the flooded lagoon areas behind the sand hills.

Other notable species found in pockets of woodland were Scribbly Gum (*Eucalyptus haemastoma*), Red Bloodwood (*Corymbia gummifera*), Sydney Red Gum (*Angophora costata*), and possibly *Eucalyptus oblonga* or *Eucalyptus sparsifolia* (Benson and Howell, 1990).

Paperbark street tree

2.6.1 Streetscape Character

The landscape of this area varies widely from established tree-lined streets such as Chaleyer Street, Murriverie Road and Onslow Avenue to sparsely planted streets such as Gilgandra Road and Niblick Street with wide bare naturestrips. These open expanses can be explained by the recent loss of many mature plantings of New Zealand Christmas Bush (Metrosideros excelsa), a once dominant tree in this area. Generally the majority of streets have wide grassy naturestrips with only a few constrained by overhead wires.

2.6.2 Dominant Trees

A number of well established streets with plantings that date from the 1930's and 1940's, including:

Common name	Botanical name
Brushbox	Lophostemon confertus
Swamp Paperbark	Melaleuca quinquenervia
Hill's Fig	Ficus microphylla 'Hillli'
Eucalyptus varieties	Eucalyptus spp
Tuckeroo	Cupaniopsis anacardioides
Bottlebrush	Callistemon 'Kings Park Special'

2.6.3 Issues and Considerations

- While there is good soil depth there is very little organic matter and the soils have become water repellent
- Over the long-term, planting larger trees may help to ameliorate these affects
- A number of streets such as Onslow Avenue and Liverpool Street should be considered for heritage listing

2.6.4 Strategies

- Re-establish tree species that were once common in this area.
- Provide habitat corridors linking bushland remnant areas to the adjoining open space of Royal Sydney Golf Club.
- Investigate the potential for more avenue planting.

2.6.5 Actions

- Increase the width of planting holes to a minimum of one metre and incorporate quality native soil mix and water crystals
- Use agricultural pipe in planting holes to ensure deep watering and deep rooting
- Encourage residents to adopt newly planted street trees
- Plant tree species that were indigenous to this area and others that will tolerate low fertility sandy soils

2.6.6 Preferred Tree Species

Size	Common name	Botanical name
Small (to 6 metres)	Fringed Wattle	Acacia fimbriata
	Dwarf Apple	Angophora hispida
	Weeping Bottlebrush	Callistemon 'Dawson River'
	Port Jackson Mallee	Eucalyptus obstans
	White Feather Honeymyrtle	*Melaleuca decora*
Medium (6 to 12 metres)	Purple-leafed Willow Myrtle	Agonis flexuosa 'After Dark'
	Lemon Myrtle	Backhousia citriodora
	Coastal Banksia	Banksia integrifolia
	Old Man Banksia	Banksia serrata
	Willow Bottlebrush	Callistemon salignus
	NSW Christmas Bush	Ceratopetalum gummiferum
	Tuckeroo	Cupaniopsis anacardioides
	Scribbly Gum	Eucalyptus haemastoma
	Cheese Tree	Glochidion ferdinandi
Large (over 12 metres)	Sydney Red Gum	Angophora costata
	Yellow Bloodwood	Corymbia eximia
	Red Bloodwood	*Corymbia gummifera*
	Port Jackson Fig	Ficus rubiginosa
	Brushbox	Lophostemon confertus
	Swamp Paperbark	Melaleuca quinquenervia

Italicised names may only be available from specialist native nurseries

2.7 Zone 7 : Protected Slopes

These areas are defined as the streets below the major ridge-lines and sheltered from the extremes of coastal or westerly winds. The soils are generally deeper than the adjacent elevated streets.

In Dover Heights and Vaucluse these are the streets on the western side sloping down to Rose Bay. In Bondi, the north facing slopes around Edward, Francis and Wellington Streets and in Bondi Junction the streets on the southern side of Birrell Street.

Mature Brushbox trees forming a shady canopy

2.7.1 Streetscape Character

The streets in Dover Heights and Vaucluse generally have wide grassy footpaths with no overhead wires – ideal site conditions for establishing an avenue of low broad-domed trees.

In North Bondi and Queens Park the streets vary from wide to narrow often with low overhead wires.

2.7.2 Dominant Trees

Common name	Botanical name
Brushbox	Lophostemon confertus
Paperbark	Melaleuca quinquenervia
Hill's Fig	Ficus microphylla 'Hillli'
Port Jackson Fig	Ficus rubiginosa
Eucalyptus	Eucalyptus spp
Blueberry Ash	Elaeocarpus reticulatus
Tuckeroo	Cupaniopsis anacardioides
Jacaranda	Jacaranda mimosifolia

2.7.3 Issues and Considerations

- Opportunities for establishing large tree planting and avenue planting
- Overhead wires may restrict tree sizes
- Views from residences need to be considered with species selection
- Many mature trees restricted by overhead wires were heavily lopped until the early 1990's. In some instances this lopping has resulted in mature trees with poor branch structure and advanced decay. Subsequent improved pruning techniques were undertaken to establish a tunnel around the wires while still maintaining the necessary electrical clearances.

2.7.4 Strategies

- To investigate the potential for more avenue and shade planting.
- To use tree species appropriate to the scale of the street and the width of the naturestrip.

2.7.5 Actions

- Undertake new plantings to take advantage of the wide nature strips
- Assess the number of streets that would benefit from the replacement of overhead wires with aerial bundle cabling (the bunching of the several strands of electricity wires into one sheathed cable) and prioritise within the aerial bundle replacement program

2.7.6 Preferred Tree Species

Size	Common name	Botanical name
Small (to 6 metres)	Dwarf Apple	Angophora hispida
	Weeping Bottlebrush	Callistemon 'Dawson River'
	White Feather Honeymyrtle	*Melaleuca decora*
	Prickly Paperbark	Melaleuca styphelioides
Medium (6 to 12 metres)	Purple-leafed Willow Myrtle	Agonis flexuosa 'After Dark'
	Lemon Myrtle	Backhousia citriodora
	Old Man Banksia	Banksia serrata
	NSW Christmas Bush	Ceratopetalum gummiferum
	Tuckeroo	Cupaniopsis anacardioides
	Blueberry Ash	Elaeocarpus reticulatus
	Scribbly Gum	Eucalyptus haemastoma
	Cheese Tree	*Glochidion ferdinandi*
	Riberry	Syzygium luehmannii
	Watergum	Tristaniopsis laurina
	Waterhousea	Waterhousea floribunda
Large (over 12 metres)	Smooth-barked Apple	Angophora costata
	Cook Island Pine	Araucaria columnaris
	Norfolk Island Pine	Araucaria heterophylla
	Port Jackson Fig	Ficus rubiginosa
	Jacaranda	Jacaranda mimosifolia
	Brushbox	Lophostemon confertus
	Fine-leafed Paperbark	*Melaleuca leucadendra*
	Swamp Paperbark	Melaleuca quinquenervia
Italicised names may only be available from specialist native nurseries		

2.8 Zone 8 : Sheltered Valley

The hilly landscapes of Bondi and Bronte have a number of areas that could be referred to as small sheltered valleys or gullies. They are protected from the coastal influences that limit the success of tree planting; receive greater water run-off; have deeper soils and are more protected from strong winds.

Some examples are:

- Blandford Avenue Bronte
- Leichhardt Street Bronte
- Cuthbert Street Queens Park

Large Paperbark trees in a sheltered gully near Bronte

2.8.1 Streetscape Character

Many of these streets already benefit from having mature established trees primarily because of these improved growing conditions. The streets vary from wide to very narrow with corresponding widths of naturestrips. A number of the narrower streets have a canopy of trees that covers the width of the street

2.8.2 Dominant Trees

These streets are fortunate to have a high proportion of mature large trees such as:

Common name	Botanical name
Brushbox	Lophostemon confertus
Paperbark	Melaleuca quinquenervia
Hills Fig	Ficus microphylla 'Hillii'
Blueberry Ash	Elaeocarpus reticulatus
Tuckeroo	Cupaniopsis anacardioides
Jacaranda	Jacaranda mimosifolia

2.8.3 Issues and Considerations

- Many of these streets already have successful street tree plantings and only require infill plantings to consolidate the streetscape
- Some streets may benefit from the replacement of overhead wires with aerial bundle cabling to allow for larger trees to be planted
- A high percentage of these trees are classified as over-mature and many are in decline

2.8.4 Strategies

- To further enhance and expand the existing canopy cover in these streets.
- To use tree species appropriate to the scale of the street and the width of the naturestrip planting areas

2.8.5 Actions

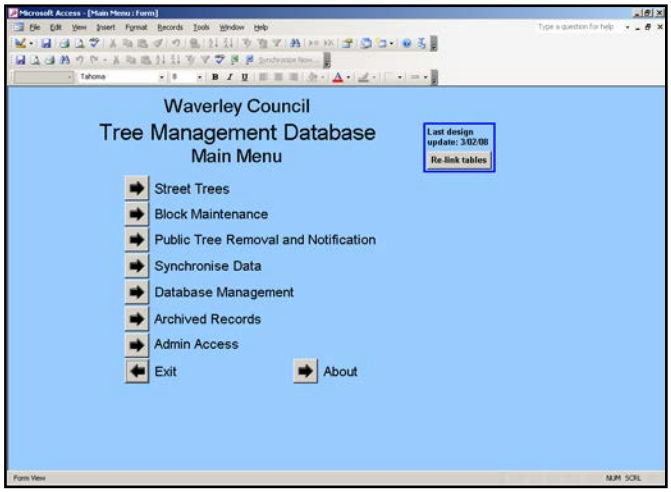
- Choose trees from the accompanying table of trees
- Undertake trial plantings of rainforest species that may be suitable for some streets
- Increase the width of tree planting holes to a minimum of one metre and incorporate quality native soil mix and water crystals
- Determine which streets only require consolidation or infill planting
- Assess the number of streets that would benefit from the replacement of overhead wires with aerial bundle cabling (the bunching of the several strands of electricity wires into one sheathed cable) and prioritise within the aerial bundle replacement program

2.8.6 Preferred Tree Species

Size	Common name	Botanical name
Small (to 6 metres)	Dwarf Apple	Angophora hispida
	Weeping Bottlebrush	Callistemon 'Dawson River'
	White Feather Honeymyrtle	*Melaleuca decora*
	Prickly Paperbark	Melaleuca styphelioides
	James Stirling Pittosporum	Pittosporum 'James Stirling'
Medium (6 to 12 metres)	Purple-leafed Willow Myrtle	Agonis flexuosa 'After Dark'
	Lemon Myrtle	Backhousia citriodora
	Old Man Banksia	Banksia serrata
	NSW Christmas Bush	Ceratopetalum gummiferum
	Tuckeroo	Cupaniopsis anacardioides
	Blueberry Ash	Elaeocarpus reticulatus
	Scribbly Gum	Eucalyptus haemastoma
	Cheese Tree	*Glochidion ferdinandi*
	Riberry	Syzygium luehmannii
	Watergum	Tristaniopsis laurina
	Waterhousea	Waterhousea floribunda
Large (over 12 metres)	Smooth-barked Apple	Angophora costata
	Cook Island Pine	Araucaria columnaris
	White Stringybark	*Eucalyptus globoidea*
	Mugga Ironbark	Eucalyptus sideroxylon
	Port Jackson Fig	Ficus rubiginosa
	Jacaranda	Jacaranda mimosifolia
	Brushbox	Lophostemon confertus
	Fine-leafed Paperbark	*Melaleuca leucadendra*
	Swamp Paperbark	Melaleuca quinquenervia
Italicised names may only be available from specialist native nurseries		

3 Street Tree Database

A survey of Council's ten thousand street trees was undertaken over a two year period from 2004 to 2006. Each tree was assessed and information collected including: age, condition (health and structure), pruning history, site constraints and many other variables.



This information has now been incorporated into a tree database for the Waverley area. From this database we are now able to answer fundamental questions relating to our street trees:

- What species are growing where?
- How are they performing across the different planting zones?
- What is their predicted useful life expectancy in these conditions?
- Are they causing damage to surrounding infrastructure?
- What opportunities are there for increasing urban canopy cover?
- What is the health and condition of a tree or group of trees?

The majority of urban trees have a life span of between 30 to 80 years. Many of our mature trees are reaching the stage where natural attrition due to age, poor soils, pollution stress and tree root conflicts with driveways and footpaths are taking their toll.

By utilising the information from the tree database, tree planting programs for the next ten to twenty years can be planned to help maintain the continuity of planting and offset the loss of some of these larger trees from our urban area.

4 Tree Planning

4.1 Planting Priorities

Each year the majority of our street tree planting is carried out during the cooler months between April and September. The plantings consist of:

- Replacement of trees that are dead or in poor condition hazard or health and safety factors, vandalism or other reasons
- Planting requests from residents
- New trial plantings including 'Adopt a Tree' requests

Throughout the year there are often major projects that involve landscaping and large scale tree planting. This work is undertaken by contractors:

- Programmed street/commercial zone upgrades
- Increased planting along main roads and gateway sites
- Re-planting of heritage listed streets with super advanced trees

In 2006 and 2007, major tree planting was undertaken in Hall Street, Campbell Parade, Lamrock Avenue and Warners Avenue. Further planting will soon take place in the upgrade of Bondi Road and Avoca Street

4.2 Selection of Species

Selecting the most appropriate tree species for planting is very much about "planting the right tree in the right location". Trees that perform well in one situation may perform poorly in others. A number of factors need to be considered before selecting a suitable tree species. These factors include:

A much admired street tree providing shade and beauty to a busy intersection

4.2.1 Environmental Factors

- Climate and topography: some streets are more exposed to strong coastal or westerly winds while others are more protected
- Soils and soil depth. Most of the soils in the Waverley area are thin sandy soils and there are areas of shallow soils overlying sandstone rock.

4.2.2 Site Restrictions

- Footpath width and driveways: the minimum footpath width for pedestrians is 900mm. Trees require a minimum of 600mm but preferably 1000mm for a planting hole
- Underground services: location and direction of stormwater lines, gas or mains water
- Above ground services: overhead wires including: electricity, telephone, house wires, street lighting. Designated safety clearances by Energy Australia for all vegetation limits the range of suitable tree species
- Sightlines: maintaining visibility for pedestrians and cars

4.2.3 Cultural, Historic and Design Factors

- Mature size and canopy spread
- Existing tree species or historic remnants
- Solar access: large trees with dense canopies may limit or block sunlight to properties

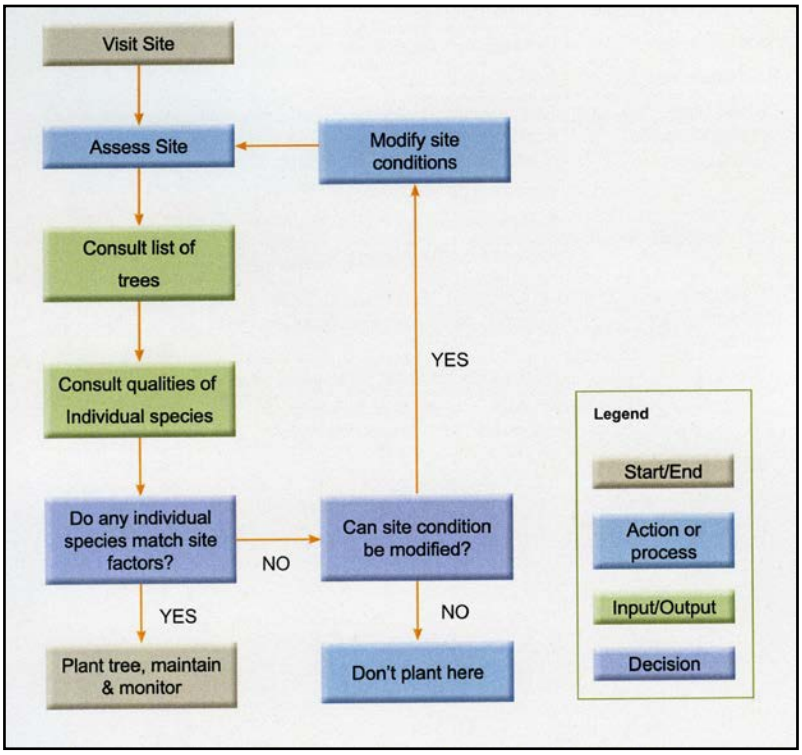
4.2.3 Individual Tree Performance and Function

- Low maintenance requirements: ability to quickly become established; survive periods of drought; require minimal pruning and have minimal leaf and fruit drop
- Availability: must be generally available and in suitable sizes for planting i.e. advanced to super advanced. Most wholesale plant nurseries only stock known performing trees; sourcing particular trees can be difficult if they are relatively unknown or a new cultivar
- Past performance: how they have performed in similar locations over a number of years; their longevity
- Known problems: roots lifting footpaths and or kerbs; branches prone to drop in windy, exposed sites or during prolonged drought periods. Some of these trees may not be excluded from all areas if the proposed planting locations will not be affected.

Overall the main principles of tree selection are that trees should be appropriate to the scale of the street; consistent and unified to re-inforce the character of the street; suit the conditions of each location and preferably be native.

4.2.4 Tree Selection Process

A total of about sixty species have been selected based on their performance and tolerance of the environmental conditions of this predominantly coastal area. They are mostly native species chosen because of their drought tolerance, habitat values and their contribution to establishing a local landscape character. Some exotic trees have been included because of their proven performance and when there may be issues of solar access or replacement of heritage plantings.



4.3 Tree Planting, Establishment and Maintenance

4.3.1 Tree Planting

- All residential street tree planting will be programmed and undertaken during the cooler months of the year between April and September.
- Root barriers will be incorporated into the planting holes where tree roots may potentially cause problems to surrounding infrastructure
- All procedures for tree planting have been updated to improve the success rate of establishment – currently 95% for 2007/2008
- Each new and replacement tree will be entered on the street tree database to ensure continuity
- Council staff are responsible for the planting of the majority of street trees with the exception of larger advanced trees e.g. heritage street plantings where contractors will be used
- Specifications have been written for all tree planting detailing methods of planting, aftercare and maintenance

4.3.2 WSUD Principles (Water Sensitive Urban Design)

Sustainable water management practices are becoming more commonplace in urban planning and design. Their main principle can be summed up as the minimisation and utilisation of surface water normally lost through stormwater or run-off. This can be beneficial for street tree plantings through the use of:

- Permeable or porous paving
- Retention basins or diversion of stormwater run-off for street tree watering

Recently planted palms in Campbell Parade

With bio-retention basins, a small percentage of stormwater run-off is directed into pre-treatment pits where gross pollutants and sediment are captured. The water is directed into air pockets above the tree pits and slowly soaks into the soil. Through a series of soil chemical reactions, pollutants are captured, broken down and absorbed before the cleaner water is discharged into the stormwater system.

A recent example is the use of stormwater channels for irrigating the palm trees in Campbell Parade Bondi Beach and in upcoming footpath and landscaping works in Bondi Road and Avoca Street Bondi.

Further application of WSUD practices will be investigated and incorporated into future landscaping projects.

4.3.3 Tree Protection

Where possible all street trees will be protected with stakes and a mesh tree guard. Wire mesh guards will be used where there is a high probability of vandalism.

For commercial zones, trees will either be planted as super advanced specimens or solid aluminium tree guards will be specified in the planting contracts

Mesh tree guards used on most new plantings

4.3.4 Tree Maintenance

After planting, each street tree is watered and mulched with a follow up maintenance period of two years. Advanced trees and trees in commercial zones have a minimum one year maintenance contract and then added to our maintenance program.

4.4 Performance of Existing Species

The tree database can be used to identify trees that are in poor or fair condition. This could be a result of harsh site conditions, incorrect species selection or a combination of both. Using this information will help to minimise future tree planting losses.

4.5 Trial Species

There are a number of species that have not been used by Council but are likely to be suitable as street trees – depending on particular site conditions.

A list of these appears in Appendix B.

They have been chosen using the same selection criteria as the preferred trees in each of the planting zones. Some of these should perform well but all are worth trialling. Some of the newer cultivars may also warrant planting. Other species may also be suitable and this list is expected to be reviewed annually.

5 Tree Removal and Replacement

The question of why trees need to be removed arises regularly.

The majority of urban trees have a life span of between 30 to 80 years. Many of our mature trees are reaching the stage where they are dying or in decline due to age, poor quality soils, pollution stress, tree root damage or a combination of some or all of these factors.

Aerial photographs from the 1940's (see p.3) show that most of the Waverley area was devoid of trees with only small areas of native low heath plants. Some streets were newly planted and these trees have now become our venerable mature trees. However many of these trees have also passed to the stage of over maturity or senescence. Careful maintenance will be required to prolong their lifespan as well as forward planning to ensure continuity of planting.

5.1 Public Notification/Community Consultation

At times, public trees may need to be removed because of the above reasons or because of damage or vandalism. To keep residents better informed, a process of public notification has been adopted by Council.

If a tree is removed, wherever possible advanced replacement trees will be planted in accordance with our Tree Management Plan and Street Tree Master Plan.

On occasions, most notably after a severe storm, emergency tree removal may sometimes be necessary and may preclude advance notification to nearby residents. Information will be distributed after the works to explain what has happened and what steps will be taken to replace the tree.

5.2 Planting Requests

Residents are encouraged to contact Council if they see an opportunity for street tree planting. Our arborists will inspect the site and, if the location is suitable, will organise planting with an appropriate tree as determined by our Street Tree Masterplan.

If there is scope for further tree planting in the street, or if there is sufficient community interest, Council may select the street for one of our 'Adopt a Tree Programs'

5.3 Planting without Council permission

Any street tree planting carried out by residents without consultation with Council may be well meant but could unintentionally create problems with regard to: sightline difficulties; inconsistency of trees in the streetscape; future damage to Council and/or private property; public liability claims or the added difficulty of ongoing maintenance. Trees planted on Council property become Council responsibility and the legacy of such tree problems may not become evident for up to 10 or 15 years.

When notified of potential problem trees we will consult and discuss with residents to reach a suitable outcome by looking at options such as pruning or transplanting. However, if there are no alternatives we will reserve the right to remove inappropriately planted trees and replant, where possible, with a more suitable tree.

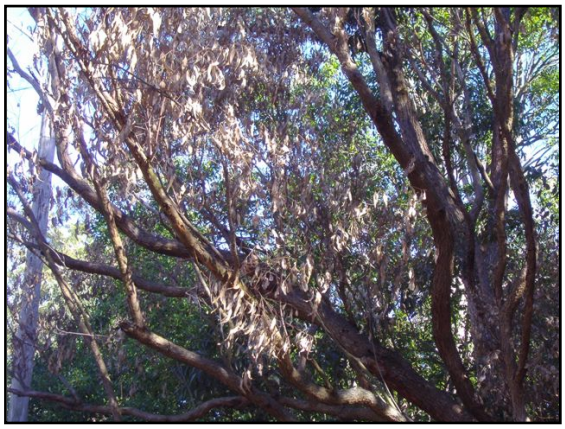
It is important that the selection and maintenance of trees contribute to and support the local character of the site and streetscape.

5.4 Problem Trees

Planting of street trees in Waverley started in the 1930's and 1940's with many of the Fig and Brushbox trees which now define our heritage streets.

Another wave of planting commenced in the 1970's and 1980's with an emphasis on native trees resulting in many fine avenues of Paperbarks, Banksias and Watergums. However as matching tree species to the characteristics of specific locations was not a high priority at the time, Waverley has inherited a small number of problem trees. These need to be managed to contain issues such as damage to infrastructure; poor form and structure; allergenic problems etc.

Trees such as the Norfolk Island Hibiscus (Lagunaria patersonia), though well suited to coastal conditions, can cause allergenic problems, hence its common name of Cow-Itch tree. These are gradually being replaced.



Typical deadwood from Eucalyptus robusta

Casuarinas (Casuarina glauca) have proven very hardy and adaptable but in areas with minimal soil space for example around Bondi Junction, their root system can cause significant trip hazards or damage to buildings and infrastructure.

Golden Robinias (Robinia pseudoacacia) are a very popular street tree but problems with their vigorous root system and brittle trunk and branch structure are becoming evident.

Swamp Mahoghany (Eucalyptus robusta), though indigenous to the eastern suburbs, has proven hazardous as a street tree due to its habit of shedding branches.

These trees have been removed from our planting lists and alternative species are substituted as individual trees die off.

Over time, the new tree selection process combined with the new tree database will greatly improve the matching of species and location characteristics.

6 Greening Masterplan

The Greening Masterplan is the overall strategy and framework for planting in the Waverley LGA. It will inform and integrate with local strategic and development control plans, Residential Character Studies, Plans of Management and key projects such as GreenLinks.

This masterplan will incorporate landscape character zones and habitat corridors for linking remnant bushland areas to other Councils' bushland sites and open space areas.

It will also provide an overall planting matrix of trees for all of Council's streets, parks and reserves.

7 Related Documents

The policies and documents listed below have been considered in the development of this street tree masterplan. This masterplan should be used in conjunction with these policies and documents.

Tree Management Plan

Adopted in October 2006, it provides a framework for the management of all trees within the Waverley LGA for the next ten years

GreenLinks

A policy adopted by Council in 2004 that outlines a series of pedestrian routes to encourage walking by using protected laneways and minor streets. One of the important elements of the policy is to provide as much shade as possible through the planting of more trees along these routes.

Local Villages Project

A guide for the design and integration of the smaller commercial zones consisting of small local shopping strips

Tree Vandalism Policy

Provides a framework for Council's response to incidences of vandalism to trees

Adopt a Tree

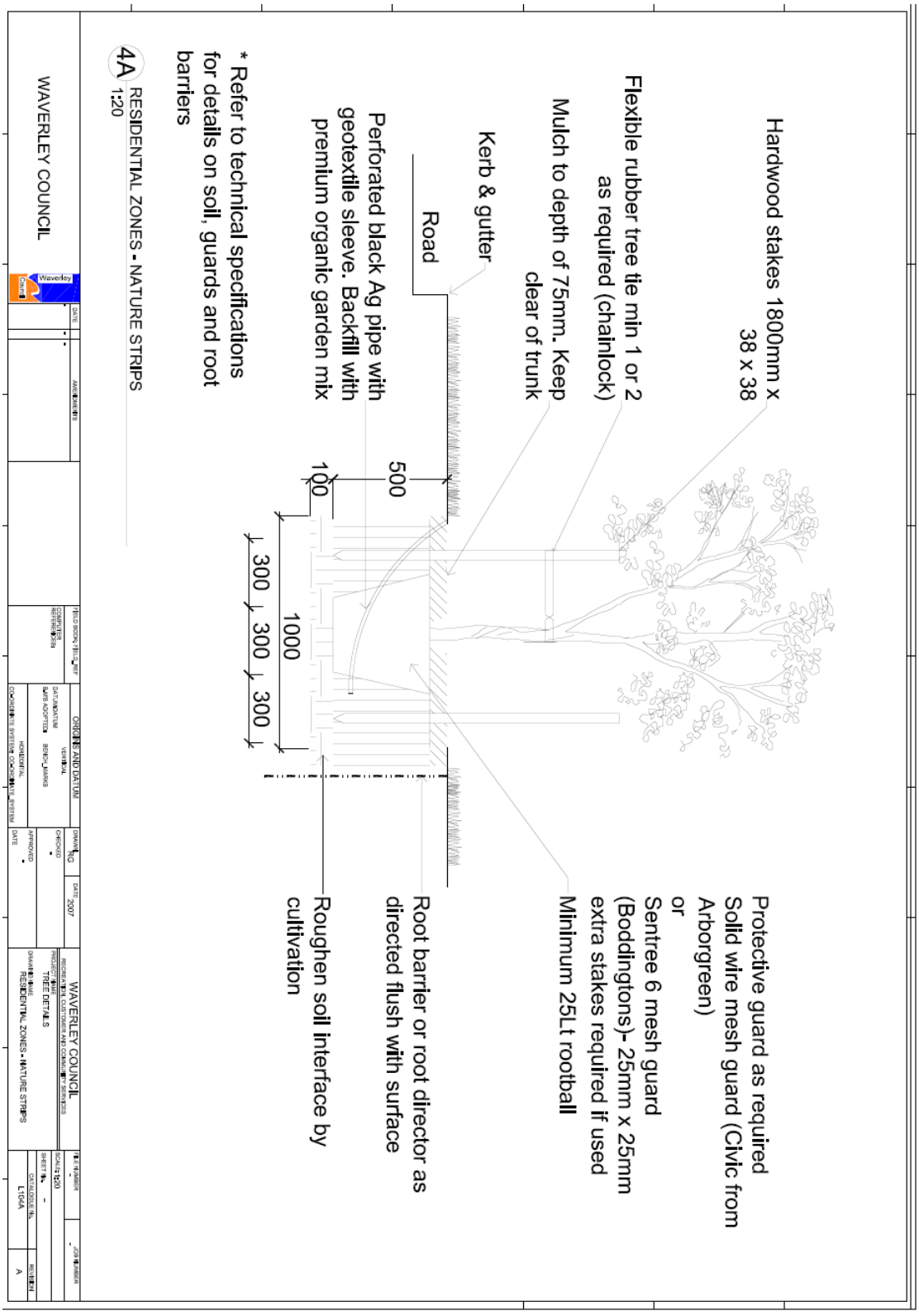
A program to help foster community pride and ownership of trees throughout Waverley. In addition to our regular tree planting, if there is sufficient community interest we will program a street (or a large portion of a street) for planting and ask the residents to become involved and 'Adopt a Tree'

Tree Preservation Order

An order made by Council in Clause 39 of the Waverley Local Environment Plan 1996 and backed by state legislation (Clause 8 of the Environment Planning and Assessment Model Provisions 1980) is designed to protect trees from unregulated pruning, lopping or removal

8 Appendices

Appendix A : Tree planting detail for naturestrips



Appendix B : Trial Street Trees : List of Alternative Tree Species

Size	Common name	Botanical name
Small (to 6 metres)	*Beach Birds Eye*	*Alectryon coriaceus*
	Rose Myrtle *Red Olive Plum*	*Archirhodomyrtus beckleri* *Cassine australis*
	Hairy Lolly Bush *Silk Myrtle* *Native Gardenia* *Sweet Quandong* *Billy Goat Plum* *Queensland Myrtle*	*Clerodendrum tomentosum* *Decaspermum humile* *Randia fitzalanii* *Santalum acuminatum* *Terminalia ferdinandiana* *Thaleropia queenslandica*
	Beach Hibiscus	*Thespesia populneoides*
Medium (6 to 12 metres)	*Yellow Wood* *Brown Laurel* Hard Corkwood Yellow Gum	*Acronychia oblongifolia* *Cryptocarya triplinervis* *Endiandra sieberi* Eucalyptus leucoxylon
	Round Leafed Moort *Macadamia* *Red Kamala*	*Eucalyptus platypus* *Macadamia tetraphylla* *Mallotus discolor*
	Moonah *Golden Penda*	*Melaleuca lanceolata* *Xanthostemon chrysanthus*
Large (over 12 metres)	*Blush Satinash* *Red Ash* *Rough Barked Apple* *Lacebark*	*Acmena hemilampra* *Alphitonia excelsa* *Angophora floribunda* *Brachychiton discolor*
	Spotted Gum *White Stringybark* *Tulip Satinwood*	Corymbia maculata *Eucalyptus globoidea* *Rhodosphaera rhodanthema*
Italicised names may only be available from specialist native nurseries		

Glossary of Terms

ABC (Aerial Bundled Cabling)

The bundling of overhead electricity wires into one insulated sheathed cable

Canopy Cover

The total area of cover provided from the foliage spread of trees in a defined area usually expressed as a percentage

Habitat Corridor

An area of planted land that enables migration, colonisation and interbreeding of plants and animals between two or more larger areas of habitat

Hazardous Tree

Refers to a tree that possesses a structural defect which poses an imminent risk if the tree or part of the tree was to fall. Structural defect is any structural weakness or deformity of a tree or its parts

Heritage Tree

Defined by the Burra Charter as trees “worth keeping because they enrich our lives – by helping us understand the past; by contributing to the richness of the present environment; and because we expect them to be of value to future generations”

Remnant Vegetation

Refers to locally native vegetation occurring naturally, either prior to European development or can be directly traced to pre-European vegetation

Significant Trees

According to the definition form the National Trust: “Trees could be considered significant if they are outstanding and therefore deserving of special protection because of their rarity, appearance, natural or cultural importance. This may be on the basis of outstanding age, size, aesthetic merit, connection to an important historic event, scientific value, Aboriginal importance or occurrence in a unique location or context”

SULE (Safe Useful Life Expectancy)

The life expectancy of a tree is defined is how long is it a safe and useful tree. SULE takes into account the tree’s age; the species type and projected life span; its health and condition; safety aspects and local environment conditions. A SULE assessment estimates whether a tree can be retained with an acceptable level of risk based on the information available at the time of inspection

Urban Forest

Defined as “the totality of trees and shrubs on all public and private land in and around urban areas, including bushland, parkland, garden and street trees and is measured as a canopy cover percentage of the total area” (Local Government Association of NSW, 2003)

Urban Forest Policy

A policy adopted by the Local Government Association in 2003 to encourage Councils to adopt a planned, systematic and integrated management approach to urban trees in their area. The stated goal is to: “improve urban forest planning, management and practices throughout NSW Local Government areas so that communities receive maximum benefit from their urban forest on all land, for an acceptable cost, in a manner based on the principles of Ecologically Sustainable Development”

WSUD (Water Sensitive Urban Design)

Water Sensitive Urban Design is a design approach to efficiently use water run-off and stormwater in urban landscapes. It can be achieved by using concepts such as permeable paving, retention basins and other measures

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