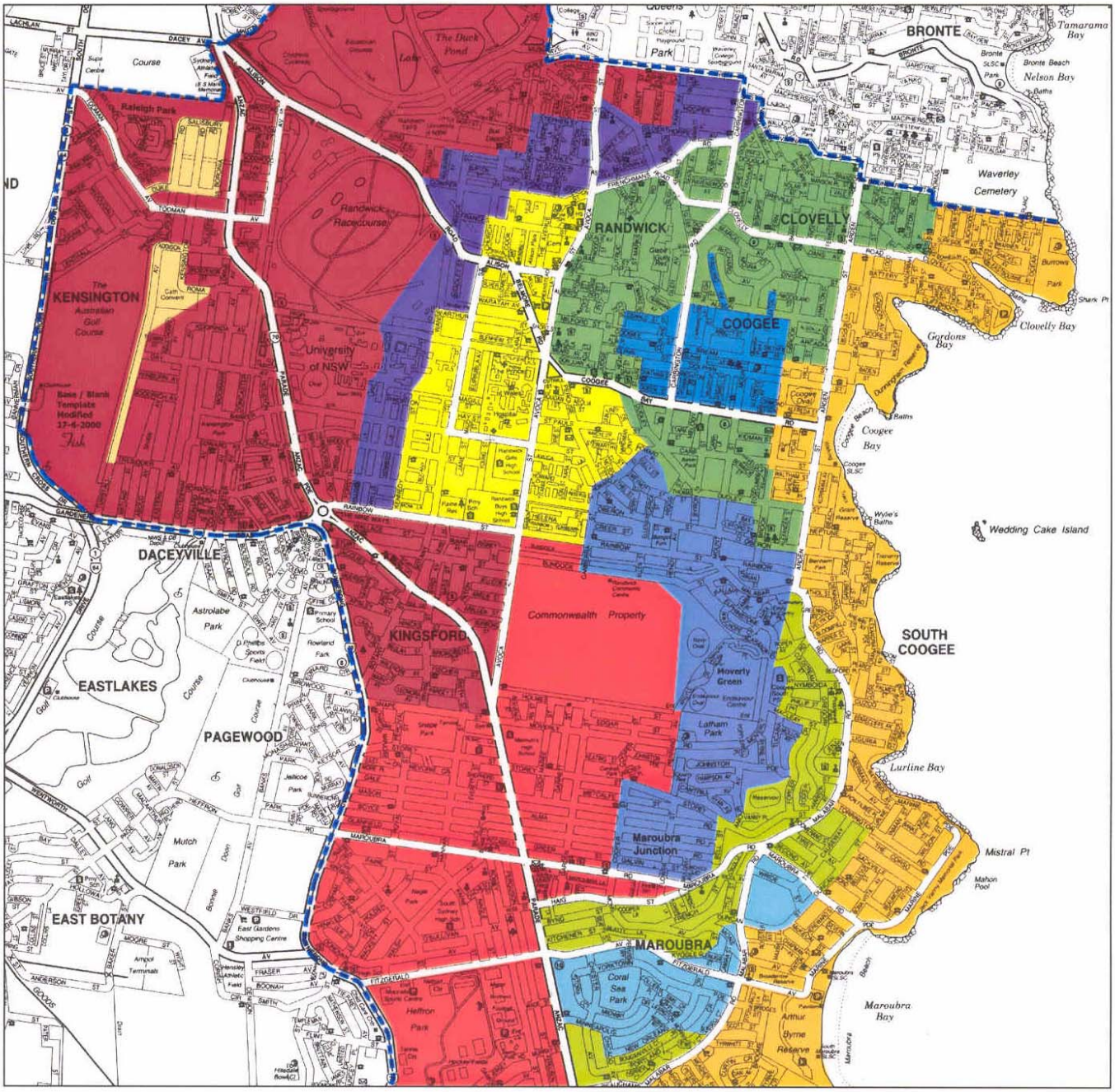
RANDWICK CITY COUNCIL

a sense of community

RANDWICK STREET TREE MASTER PLAN

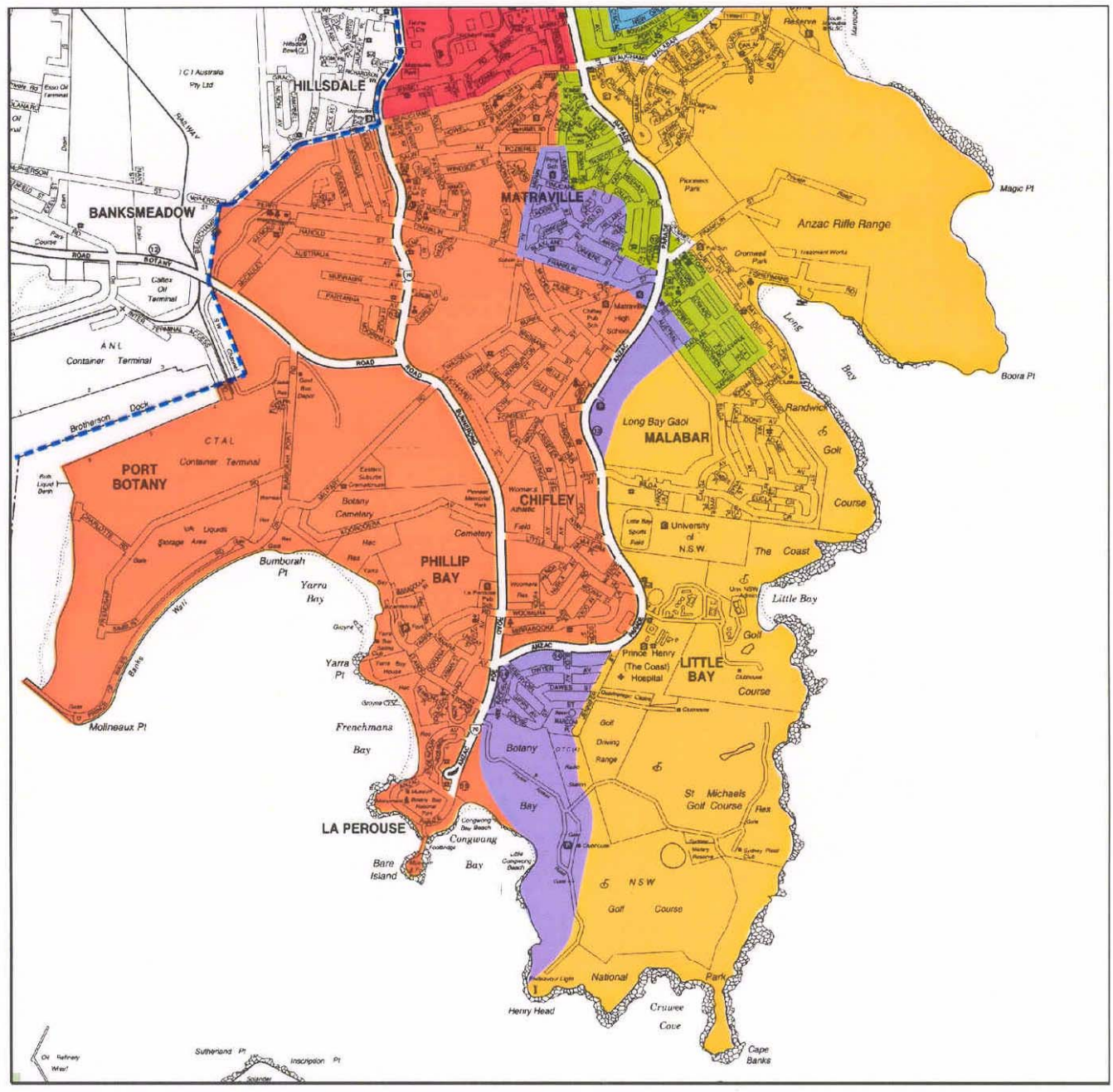
PLATE 1: RANDWICK PRECINCTS



0 1
kilometres

- Remnant Dune Structures
- Northern Swamp Valley Floor
- Central Swamp Valley Floor
- Southern Swamp Valley Floor
- Coogee Bay Valley Floor
- Maroubra Bay Valley Floor
- Plateau
- Coogee Bay Coastal Slopes
- Maroubra Bay Coastal Slopes
- Northern Leeward Slopes
- Central Leeward Slopes
- Southern Leeward Slopes
- Coastal Strip
- Council Boundary

PLATE 1: RANDWICK PRECINCTS



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1.0 BACKGROUND

Randwick City Council has an important resource in its street trees. As with the management of any public resource there are some significant problems associated with this heritage and the management of trees in a coastal environment.

In 1993 the Council prepared a Tree Policy detailing current practices in relation to the management of Council's trees and recommending how any improvements could be implemented to further enhance the environment of Randwick. In this policy Council in part resolved:

- All inspections, as well as maintenance of Council trees, be carried out by persons having appropriate training, qualifications and experience in their respective fields;

- A computer database be set up to provide an inventory of all street trees, other significant trees in public reserves or in private properties, and trees which have been the subject of refused applications under the Tree Preservation Order, as a basis for assessing and monitoring any risks associated with such trees and ensuring sound management practices;

- A City-wide master plan for street tree planting be prepared and exhibited for public comment.

In January, 1995, Council appointed the consultants Spackman and Mossop Pty Ltd (Landscape Architects) to prepare the Street Tree Master plan for the City. In addition, Council requested that the consultants prepare a Street Tree Identification Manual to aid communication of the intent of the master plan amongst residents, and specially identifying the selected tree species.

This report surveys the character of the area, which has been generated by the street patterns, the history of the street planting, the existing street trees, the original plant communities and the current environmental concerns. An investigation of tree management problems and the remaining areas of indigenous bushland has also been undertaken and incorporated into the master plan.

The results of the assessment of the character of the area and the tree management problems has generated a master plan for the street tree planting of the City area. The master plan includes overall design strategies, precinct designs and street design options.

In May, 1994, Council, as part of its *State of the Environment Report*, prepared an outline on the vegetation and wildlife of Randwick City Council, which identified areas of remnant bushland. Council, in its brief to Spackman and Mossop, asked

that where possible, areas of bushland be considered and the possibility of wildlife corridors be evaluated.

This has resulted in reasoned consideration of the promotion of indigenous trees and their management. The report contains a comprehensive set of recommendations for the management of Randwick's street trees as well as an implementation strategy which includes tree planting, principles for tree rehabilitation, and priorities for the conversion of powerlines and tree removal.

The original document drafted by Spackman and Mossop has provided Randwick City Council with an opportunity to develop a comprehensive ecologically based master plan and tree management strategy which seeks to conserve and enrich the environmental heritage of the area, while addressing the important concerns of urban water management, air pollution, environmental amenity and neighbourhood character.

This is an important study addressing a complex issue faced by many local governments in Sydney and provides a prototype for a sensitive environmentally based approach to creating future built environments of high quality.

Eucalyptus leucoxylon - Yellow Gum

2.0 THE MASTERPLAN STRATEGY

2.1 PHILOSOPHY

2.1.1 THE VALUE OF STREETS

While streets are always seen as transportation routes, they are also an important part of a matrix of spaces that together make up the landscape of the public realm. In the City of Randwick this public realm encompasses streets, parks, reserves, beaches, sporting facilities and urban areas associated with commercial and civic zones. These spaces, whilst not often fully recognized, are significant contributors to people's daily experience and their absence or deterioration results in a loss of amenity. When viewed from this perspective, it is the areas other than the carriageway, such as the footpaths and the median, which are most significant in contributing to character and amenity.

2.1.2 THE VALUE OF TREES IN STREETS

Trees are potentially the largest and most significant element in the suburban landscape. As such, they provide the greatest opportunity for the development of city identity and neighbourhood character. Given the importance of streets in people's daily experience, the role of street trees in improving this can be broadly categorized into cultural, environmental, and psychological factors.

Cultural

Street trees have a role in providing a sense of history, place and time. Street tree planting is a result of a combination of factors, both physical and cultural. Contributing factors include the physical determinants of the place - landform, soil, rainfall and coastal influence - and the cultural determinants - time and form of settlement, land use, management practices, and the occurrence of important civic periods, such as the Centenary.

Given these formative factors, past and present street tree planting can be seen, in part, as a reflection of a place and community over a period of time.

Environmental

Air Quality
The value of street trees in ameliorating undesirable climatic conditions is an important consideration. Trees reduce air temperature by filtering sunlight and reducing heat reflected by artificial surfaces such as bitumen, concrete, steel and glass. Street trees are of particular value in Randwick in providing summer shade for pedestrians, vehicles and, to a lesser extent, providing shelter from the wind,

by reducing its speed. Another consideration in locating and selecting street trees is maintaining the access of residents to winter sunlight.

Randwick has many arterial roads carrying high traffic volumes. Street trees can be useful in filtering dust particles and other pollutants from the air as well as providing psychological buffering from traffic noise. Young trees are also net producers of oxygen.

Wildlife
Particularly in the coastal area of the City where there are significant stands of indigenous vegetation, the protection and enhancement of wildlife habitats is essential. Street trees can provide habitats for other fauna such as birds. They can also provide wildlife corridors for the movement of birds and animals.

Psychological

Visual
Within the urban environment street trees play an important role in the establishment of visual amenity and visual quality. They are significant in making urban environments more legible to their users, for example, in the delineation of road hierarchy. They are also important in manipulating the scale of different types of streets, for example, in reducing the scale of residential streets. Trees can be important in providing visual interest and the aesthetic benefits of their beauty in terms of form, colour, foliage, flowers, etc.

Street trees can also provide privacy between streets and houses. Trees can be used to screen undesirable views or activities, as well as providing a unifying element in streets or neighbourhoods.

In many areas of Randwick, views to the ocean often occur. The benefits of maintaining these views need to be balanced with the other benefits of street tree planting. Street tree planting can be designed in these areas to minimize the impact, and even to enhance views by providing scale and enframement.

Perceptual
Street trees provide psychological benefits which are difficult to quantify but which may include the vaguely expressed ‘enjoyment’ or ‘good feelings’ people associate with trees and pleasant surroundings; a sense of perspective, distance and speed for motorists; a sense of safety and security to motorists and pedestrians where dense plantings are used; a reduction in the psychological impact of a hard urban environment by providing privacy, protection and softness; and some reduction in noise by diffusing, absorbing and masking sound.

Despite the overwhelming documentation of the psychological benefits of trees, there are some people who experience a phenomenon known as ‘arborphobia’, which is manifest as an irrational fear of trees. This is most often expressed by the association people make between vegetation and its ability to hide violent criminals. However, there is no definitive evidence that this association exists. This major issue of safety is a complex one that will not find a solution or cause in the planting of street trees.

Economic

Street trees may indirectly increase property values by enhancing the visual appearance of the urban environment. Economic or monetary value can also be assigned to the environmental and climatic benefits trees bring to the community. For example, the careful placing of trees may decrease energy use for summer cooling and winter heating.

2.1.3 PRINCIPLES OF APPROACH

In the initial stages of this project, an approach to street trees for the whole City was developed in conjunction with the consultants. This can be summarized as follows:

Building on what is there already

Understanding the contribution street trees already make to Randwick, this study always begins with an analysis of the existing plantings, and uses them as one basis for determining future plantings.

Ecologically sustainable

This study has employed a number of strategies that can contribute to more ecologically sustainable environments:

- Researching the original plant communities - to identify indigenous species as one basis for determining future plantings;
- Identifying existing remnant vegetation - to acknowledge these areas by creating buffers around them and connections between them;
- Developing precincts determined in part by physical factors - to allow easier selection of a range of trees suitable to that microclimate.

Realising the cultural potential

As major routes to and through places, streets contribute to a sense of place, and street trees can aid that legibility. By identifying main roads, important approach streets, commercial strips and streets adjacent to major public open spaces, this study allows these streets to be designed to signify these places.

Effective use of resources

By identifying opportunities in both design and management, this study suggests ways in which costs related to street trees can be reduced, while acknowledging that some cost is inevitable.

2.2 DESIGN APPROACH

Because roads determine people's movement patterns, both vehicular and pedestrian, they are very significant in shaping people's perception of the place they are moving through. At the broad level, the philosophy of approach is to acknowledge that as roads traverse these places, the landscape of the street should respond to these changes. In this way, roads can be viewed as responsive elements within a larger environment.

The designation of broad precinct types sets up a framework to define these different environments, to enable tree species to be selected that are responsive to the places in which they occur. This study has chosen to use topography and aspect, including maritime influence, as the major determinants for the precincts. This represents an environmental response. As other factors have been influenced by this, too, patterns are revealed. In the development of planting palettes, this approach has the distinct advantage of reducing the number of microclimates within each precinct, allowing the selection of species that will be most successful for the given conditions. Nevertheless, some differences within precincts also emerge, and these result in further differentiation, based on more localized variations in character.

An inventory and assessment of the existing vegetation guides the selection of species for new plantings. It allows Randwick to build on existing successful plantings, and acknowledges the extent to which existing plantings can determine character. The master plan is an opportunity to interpret the accrued history of past planting, in order that an informed strategy for the present and future may be developed.

An inventory and assessment of the original plant communities and their present day remnants has also been undertaken. It should be recognized that however desirable the reconstruction of these original plant associations may be, street tree planting does not provide sufficient scope for this to be done successfully, due to both ecological factors and programmatic issues. Nevertheless, an understanding of the original plant communities, and knowledge of their present day remnants informs this study in a number of ways.

- Firstly, it gives an understanding of the physical environment in which trees once grew. Excepting the subsequent modifications to the physical environment, this can indicate what can successfully grow there now. This will, of course, include many of the original species found in this association, which can be drawn upon as planting options;

- Secondly, it provides an enormous design resource. An understanding of the variety of plant associations and their specific spatial and visual effects reveals the many ways in which different areas can be individualized through a change in plant material. It also implies the use of plants in ways other than

the standard avenue planting. In environments where conditions would dictate a high input of resources to achieve this, this can prove particularly useful. So while not wanting to reconstruct pre-settlement communities in the streets of Randwick, planting designs can respond creatively to them;

- Finally, the use of a limited range of indigenous species will not create true ecological habitats. Strong street tree planting, however, can serve as corridors and buffers for many species as they move between habitats. This mobility is essential for the survival of a diverse range of animals - to search for food sources, escape encroaching development and to maximize the breeding gene pool.

Areas of public open space are also acknowledged in the study process, as they contribute to it in a number of ways:

- They can contribute to a precinct's character, and so influence the selection of a precinct palette;

- For adjacent roads they can provide a larger potential planting zone, thus minimizing management costs and improving growing conditions; and

- The open space may influence the choice of species along roads that serve as routes to these places. The use of specific planting in approach roads can be used to herald arrival at the destination.

Through assessing precinct character, existing vegetation, original vegetation and its remnants and open spaces, the development of palettes for precinct areas gives the opportunity to create coherent precinct palettes. Distinguishable from each other, they will reinforce the differences between adjacent precincts. At the same time, the number of species provided in the palette allows for variety. The use of selection strategies to differentiate types of planting will further illustrate the character components of a precinct, and create a stronger reading of the place.

These palettes can then form the basis of future Precinct Designs.

2.3 ANALYSIS

During the survey stage of this project several factors were mapped in order to describe the existing patterns of the City area. They were:

- Existing street trees
- Landform
- Original vegetation communities
- Remaining bushland
- Street hierarchy
- Public open space; and
- Commercial strips and spots

2.3.1 EXISTING STREET TREES

Existing street trees were mapped using Council's environmental database to plot the relevant information by hand. Random checks were then carried out in the field or by aerial photographs to confirm the validity of the mapping of all trees. Figures 2.1 and 2.2 demonstrate this process

Code	Species Name	Count
18	*Agonis flexuosa*	1189
205	*Metrosideros kermadecensis*	1367
130	*Lophostemon confertus*	924
40	*Callistemon viminalis*	783
137	*Melaleuca armillaris*	676
177	*Callistemon 'Kings Park Special'*	607
148	*Nerium oleander*	540
143	*Melaleuca quinquenervia*	514
216	*Metrosideros excelsa*	504
97	*Ficus microcarpa var. 'Hillii'*	449
114	*Hibiscus rosa-sinensis*	410
207	*Casuarina glauca*	417
34	*Callistemon viminalis*	354
28	*Banksia integrifolia*	330
4	*Pittosporum crassifolium*	287
198	*Tristaniopsis laurina*	251
9	*Hibiscus tiliaceus*	272
72	*Eucalyptus botryoides*	220
122	*Lagunaria patersonii*	240
150	*Olea europa var. communis*	191
152	*Phoenix canariensis*	146
165	*Platanus x hybrida*	166
26	*Syagrus romanzoffianum*	172
88	*Eucalyptus robusta*	168
24	*Araucaria heterophylla*	149
245	*Acacia saligna*	137
14	*Acmena smithii*	119
197	*Erythrina x sykesii*	112
109	*Grevillea 'Robyn Gordon'*	103
116	*Jacaranda mimosifolia*	120
59	*Coprosma repens*	118
183	*Sapium sebiferum*	124
85	*Eucalyptus nicholii*	114
90	*Eucalyptus scoparia*	108
83	*Eucalyptus maculata*	149
169	*Populus nigra 'Italica'*	46
113	*Harpephyllum caffrum*	96
231	*Casuarina glauca*	104
103	*Gleditsia triacanthos 'Sunburst'*	96
70	*Elaeocarpus reticulatus*	103
79	*Eucalyptus ficifolia*	97
75	*Eucalyptus cladocalyx*	86

FIGURE 2.2
Database Sample

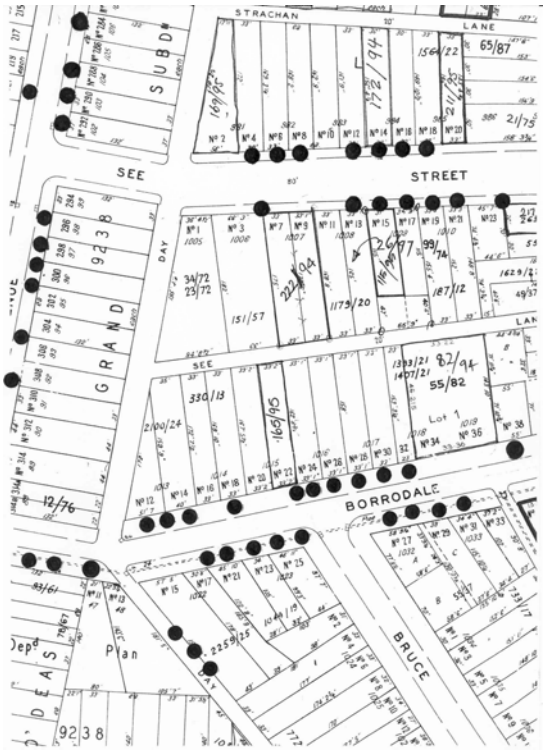


FIGURE 2.1
Mapped information

Randwick's existing street trees fall into two broad categories. There are plantings of largely Australian native trees dating from the 1960s and 1970s and earlier formal plantings of exotic trees in the older settled areas such as Randwick Junction, Kensington and areas near Centennial Park. This has now

been overlaid by a third type of street tree planting: those planted as part of Council's Community Street Tree Planting Programme.

This programme actively encourages residents to develop tree planting schemes for their street and to date has focused on the use of native and indigenous trees. Summaries of the major findings of this analysis process are presented in each precinct master plan (Section 2.6).

2.3.2 LANDFORM

The landform of Randwick City is bounded to the east by a sandstone ridge, with a system of coastal cliffs, slopes, valleys and beaches that form a series of bays along the coast. To the north, this coastal landform is much stronger, with ridges becoming less clearly defined as they move south, and combining with old dune systems. The area west of this major ridge consists of a fairly flat sandy valley floor, with remnant dune structures creating a small north-south ridge. This valley floor was originally dissected by several swamp systems. These have been almost completely drained and filled over the last 200 years. The major topographical formations are shown in Figure 2.3.

2.3.3 ORIGINAL VEGETATION

Randwick lies in Sydney's Eastern suburbs between Port Jackson and Botany Bay. This area is typified by development built up over extensive sand dunes, which, prior to development, drained into a large series of swamps. Until earlier this century, these wind-blown dunes were covered by the Eastern Suburbs Banksia Scrub (Benson & Howell 1990, p90), extending in area from behind the beaches westwards to the estuarine flats of Shea Creek and Cooks River. This vegetation was typified by varied heath, scrub and low forest with a diverse shrub structure. The area was known for extensive wildflower displays at certain times of the year and large numbers of freshwater swamps along drainage lines or in the dune swales.

Historically, it was found there were few areas that carried large stands of timber, except possibly the seaward valleys at Coogee (Benson & Howell 1990, p96). These areas were reported as carrying *Angophora costata*, *Eucalyptus resinifera* or *Eucalyptus botryoides*. Figure 2.4 (adapted from Benson & Howell 1990, p90) is a map of the original vegetation communities.

The main wetlands in the City were the Lachlan Wetlands (now Centennial Park), Long Swamp (now part of Heffron Park in Maroubra) and Birds Gully (now known as Fred Hollows Reserve). Refer Figure 2.4 for the approximate location of these wetland communities. These wetlands were either drained for development and filled or modified for water supply schemes.

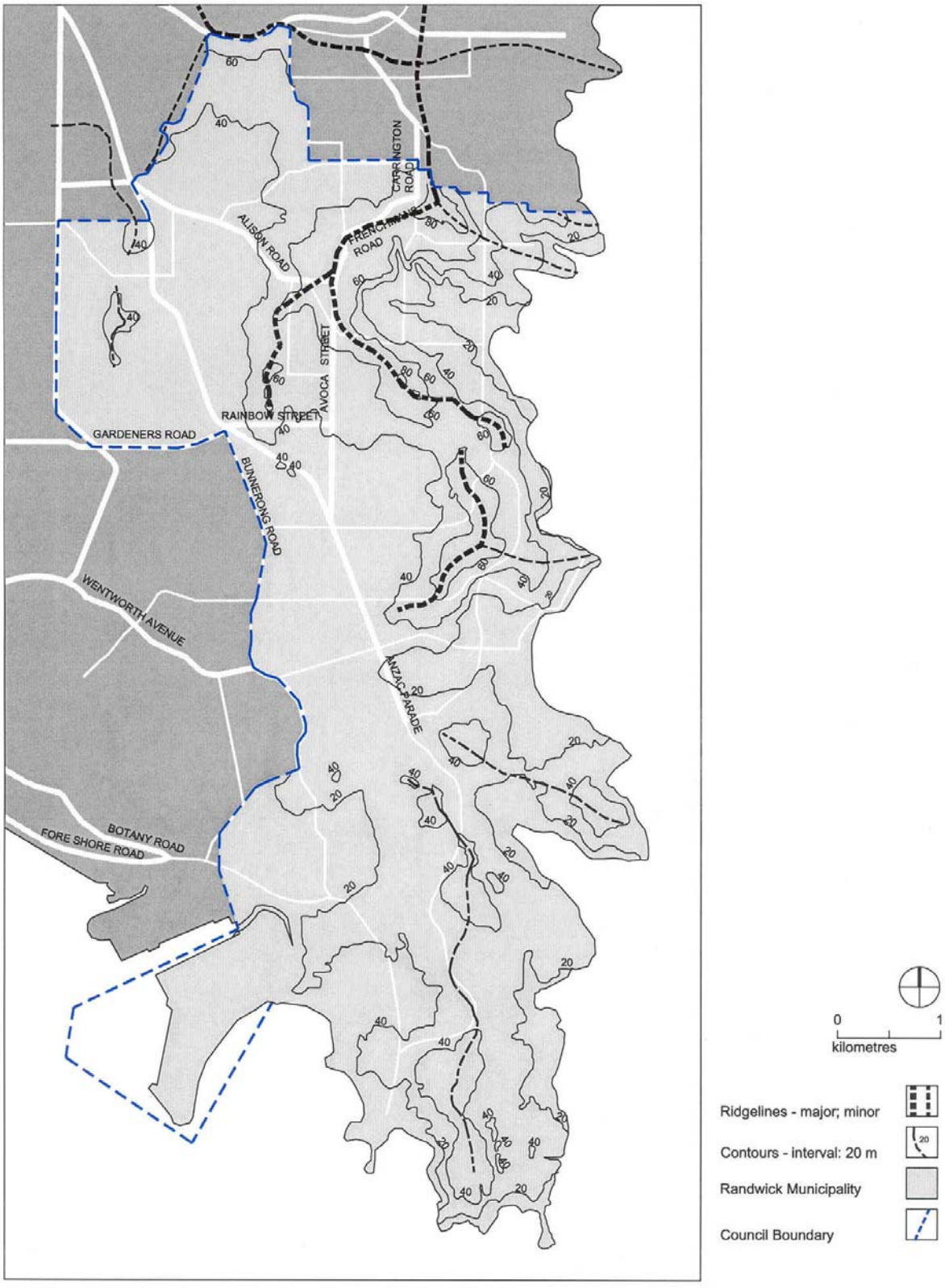


FIGURE 2.3 Topography of Randwick *

* Adapted from Central Mapping Authority of NSW, 1984, Orthophotomap 1:10 000

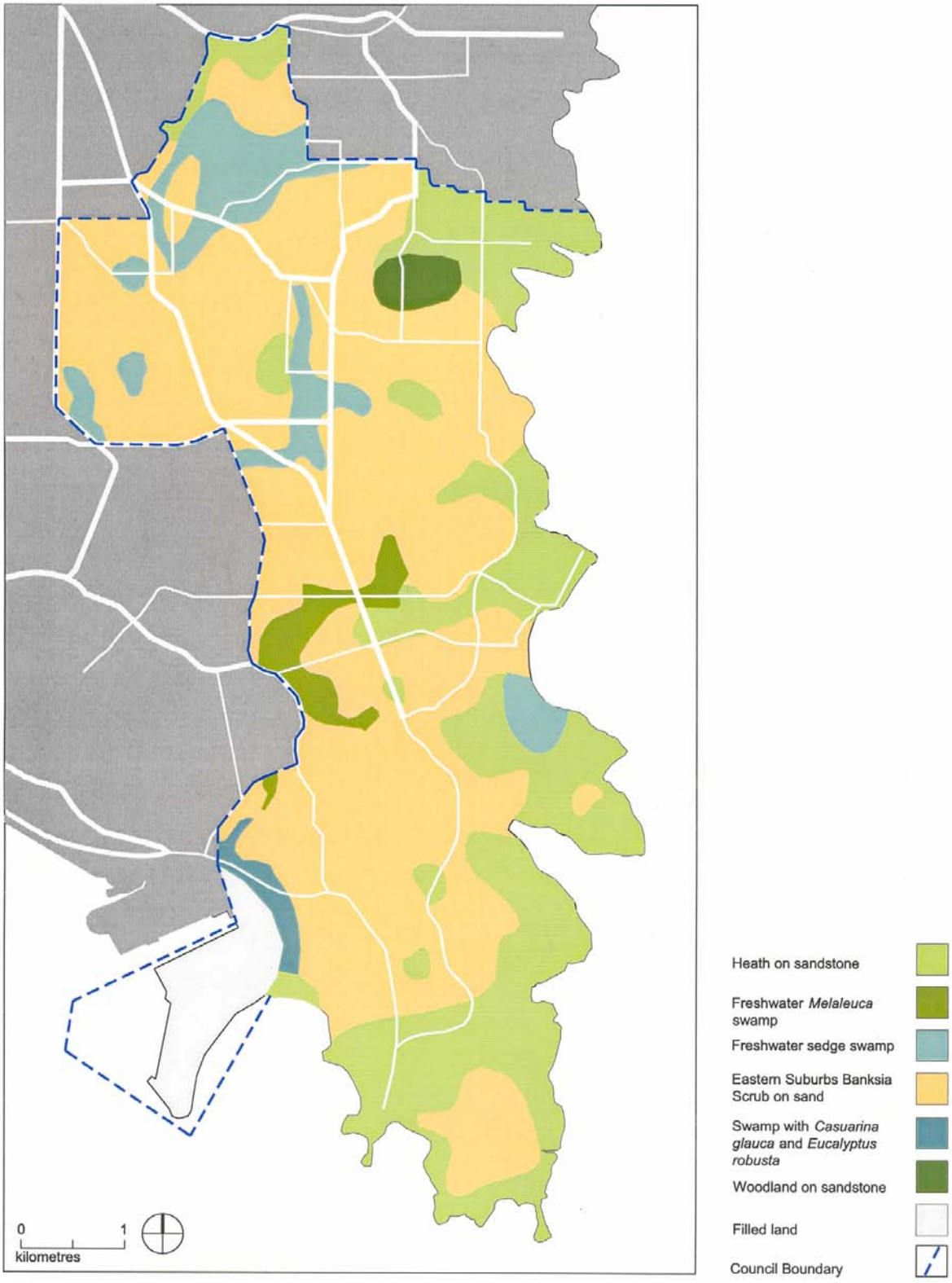


FIGURE 2.4 Pre-settlement Distribution of Plant Communities *

* Adapted from Benson and Howell, 1990, *Taken for Granted: The Bushland of Sydney and its Suburbs*, Kangaroo Press, Sydney

2.3.4 REMAINING REMNANTS

In the late nineteenth century, Randwick developed as a prestigious suburb and many grand houses were built. More intensive sub-division followed in the early twentieth century, with development progressively taking place further from the city through Kensington, Kingsford, Maroubra, Matraville, Malabar and Chifley, over the next twenty years. Almost all this development replaced reasonably undisturbed native vegetation. Many trees were lost in a brief period during the 1960s when large nineteenth century estates and gardens were broken up for medium density housing and, together with recent developments at La Perouse and with developments at Long Bay, this leaves only a fraction of Randwick's original vegetation remaining.

There are, nevertheless, significant areas of natural vegetation within the Randwick City area, including Jennifer Street near La Perouse, Trenerry Reserve in South Coogee and the Botany Bay National Park. In order to protect this important resource, these areas need to be the subject of continuing detailed studies and management programmes.

Figure 2.5 maps the major remaining remnants. An abbreviated description of the plant communities present in the remnants is provided in the relevant precinct master plans in Section 2.6.

2.3.5 COUNCIL-CONTROLLED OPEN SPACE

While Randwick City contains large areas of open space, only a proportion of this is under Council control. The remainder is either in private ownership, or under Federal or State government control. Areas of Council-controlled open space are mapped in Figure 2.5. These open spaces range from major district parks and reserves to neighbourhood and pocket parks.

2.3.6 ROAD LAYOUT AND HIERARCHY

Randwick's road pattern is in part expressive of the rolling topography of the dunes and the more rugged forms of the sandstone country. The major arterial road in the City is Anzac Parade, which follows the gentler terrain out to La Perouse. From this road a series of secondary roads feed down to the coast, utilizing either the gully bottoms (eg, Coogee Bay Road) or the ridge tops (eg, Clovelly Road). A loose grid of local roads fills the gullies and connects to the ridge tops.

The road hierarchy as designated by Council is shown in Figure 2.6.

2.3.7 COMMERCIAL AREAS

At intervals along the road system occur the commercial areas that act as a focus for activity. The larger of these have developed as strips along a major road such as at Kensington, Kingsford and Matraville. Clovelly commercial centre consists of a series of unconnected strips along Clovelly Road. Others have developed at major road junctions, such as Randwick Junction and Maroubra Junction, or at popular destinations, such as Coogee Beach. A series of smaller commercial centres also occur sporadically across the City.

The Eastgardens Shopping Mall is a regional shopping centre and sits on the edge of the City. It contributes very little to the street with regard to form or activity, though it is a destination for many journeys along Randwick's roads.

Typical coastal vegetation – Coogee

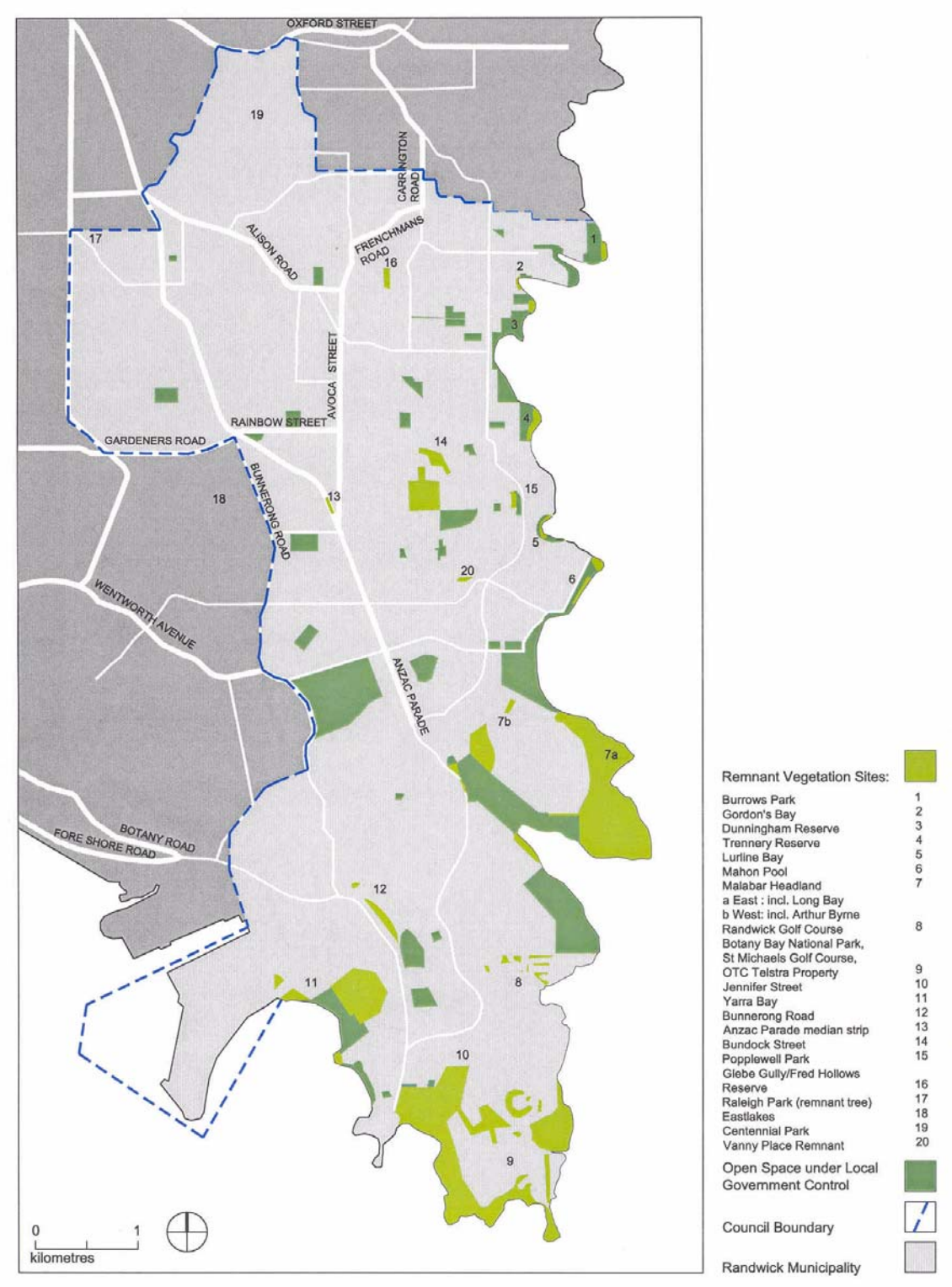


FIGURE 2.5 Council-controlled Open Space and Remnant Vegetation Sites *

* Adapted from – 1. Randwick City Council, 1993, *State of the Environment Report, Chapter 6 – Vegetation and Wildlife*; 2. Randwick Council Planning maps

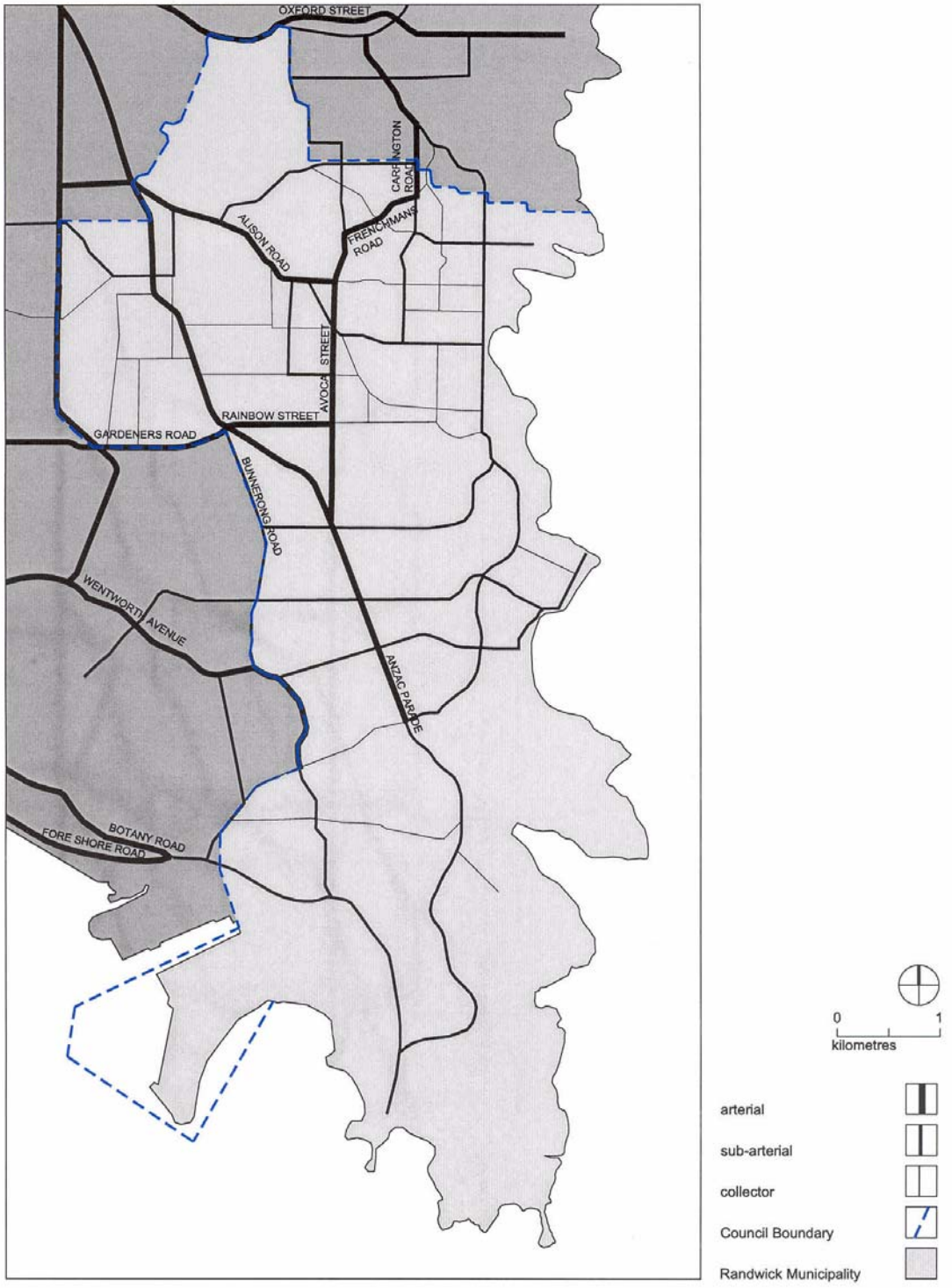


FIGURE 2.6 Road Hierarchy *

* Adapted from *Road Hierarchy Map*, Assets and Infrastructure Dept, Randwick City Council

2.4 OPPORTUNITIES

2.4.1 METHODOLOGY

It is important to consider the strategic opportunities that exist across the City before a more detailed study of individual areas is undertaken. Street tree planting has potential beyond a contribution to the immediate area. It can play a part in protecting and enhancing indigenous vegetation areas and supporting open space strategies. The types of opportunities that have been identified are:

- buffer streets
- corridor streets
- streets adjacent open space, and
- approach streets

For this task, the analysis maps from Section 2.3 were used as a base and then the key streets for each opportunity were identified. This was then verified and adjusted on the basis of site visits. The results of this process are listed street by street where relevant in the appropriate precinct master plans (Section 2.6). It should be noted that the nominated street may only be an opportunity for a portion of its length. It will be the task of the next stage of design development to describe its limits.

2.4.2 OPPORTUNITIES OVERVIEW

The types of opportunities are described and illustrated below. The first two relate to remnant indigenous vegetation. The second two relate to areas of open space.

Buffer Streets

Streets are identified in this category for their potential to provide buffers to existing areas of indigenous vegetation and to protect and enhance these sensitive areas through sympathetic species selection. This would greatly increase the populations of some remnant species, enhancing their long-term survival. It will also act to signal to surrounding streets the unique character of the surviving bushland.

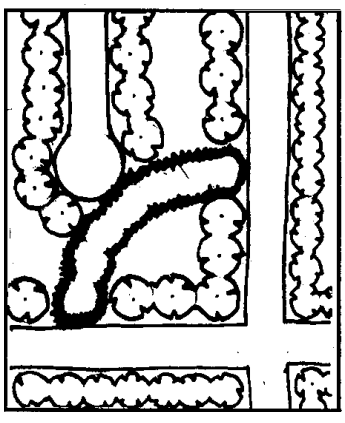


FIGURE 2.7
Buffer Streets

Corridors

Streets are identified in this category for their potential to link areas of existing indigenous vegetation, due to their location between important remnants. The value of corridors is referred to in Section 2.2.

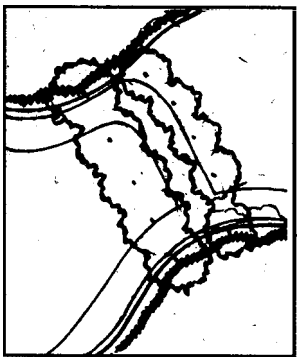


FIGURE 2.8
Corridors

Sites adjacent to Open Space

These streets have been identified for their potential to use adjacent open spaces for street tree planting. Tree planting in these streets could then be implemented with significantly less ongoing management costs, and contribute to both the street and the open space.

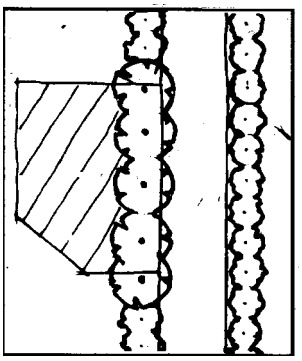


FIGURE 2.9
Open Space Edges

Approach Streets

These streets have been identified for their potential to herald major parks and important areas of open space, by providing landscape cues along the major routes leading from arterial roads.

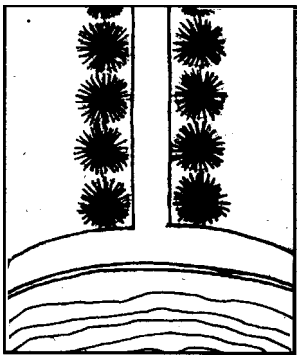


FIGURE 2.10
Approach Streets

2.5 IDENTIFYING PRECINCTS

2.5.1 METHODOLOGY

In order to divide the City into coherent units, the topographical conditions of the City were used, as shown in Figure 2.11. Broadscale precinct types were then plotted through an analysis of slope, aspect and exposure to coastal influence (using Figure 2.3), as shown in Figure 2.12.

These broadscale precinct types were then further divided into sub-precincts. This was based on an analysis of urban form and existing vegetation and other factors that together determined character. To allow for future design development and planting, boundaries have been taken to the nearest cross street, so a change in tree species will not generally occur mid-block.

This further sub-division of precinct areas is shown in Plate 1: Randwick Precincts.

2.5.2 PRECINCTS AND THEIR SUB-PRECINCTS

Precinct	Precinct Sub-divisions
Exposed Coastal Strip – Clovelly, Coogee, South Coogee, Maroubra, Malabar, Little Bay - (Refer 2.6.2)	
Coastal Slopes – Clovelly, Randwick, Coogee, South Coogee, Maroubra, Matraville - (Refer 2.6.3)	1. Coogee Bay Coastal Slopes 2. Maroubra Bay and connecting Slopes
Coastal Valley Floors - Coogee, Randwick, Maroubra - (Refer 2.6.4)	1. Coogee Valley Floor 2. Maroubra Valley Floor
Plateau - Randwick - (Refer 2.6.5)	
Leeward Slopes - Randwick, Coogee, South Coogee, Matraville, Malabar, Little Bay, La Perouse - (Refer 2.6.6)	1. Leeward Slopes - north 2. Leeward Slopes - central 3. Leeward Slopes - south
Swamp Valley Floors - Kensington, Kingsford, Randwick, Maroubra, Matraville, Chifley, Phillip Bay, La Perouse, Port Botany - (Refer 2.6.7)	1. Swamp Valley Floor - north 2. Swamp Valley Floor - central 3. Swamp Valley Floor - south
Remnant Dune Structures - Kensington - (Refer 2.6.8)	1. Remnant Dunes - north and south

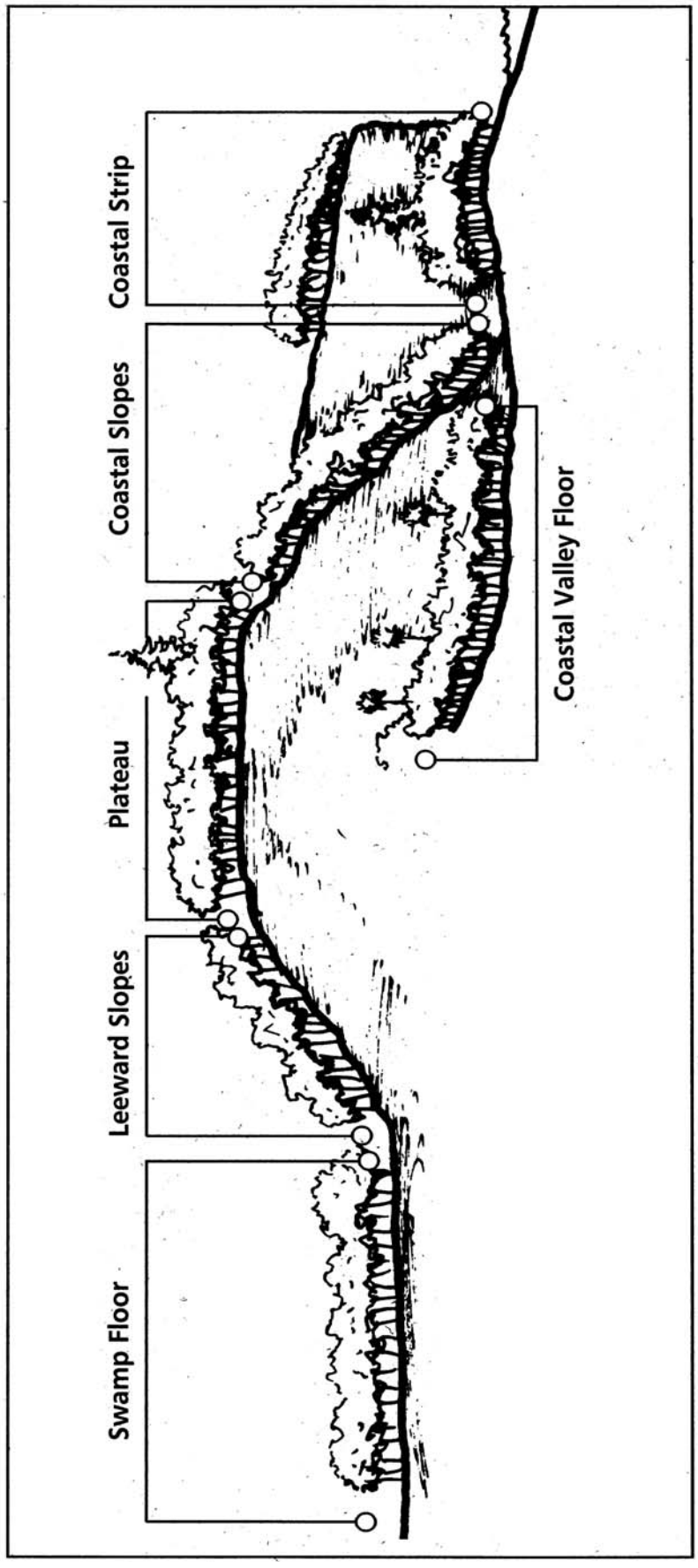


FIGURE 2.11 Diagrammatic section through Randwick showing major topographical features

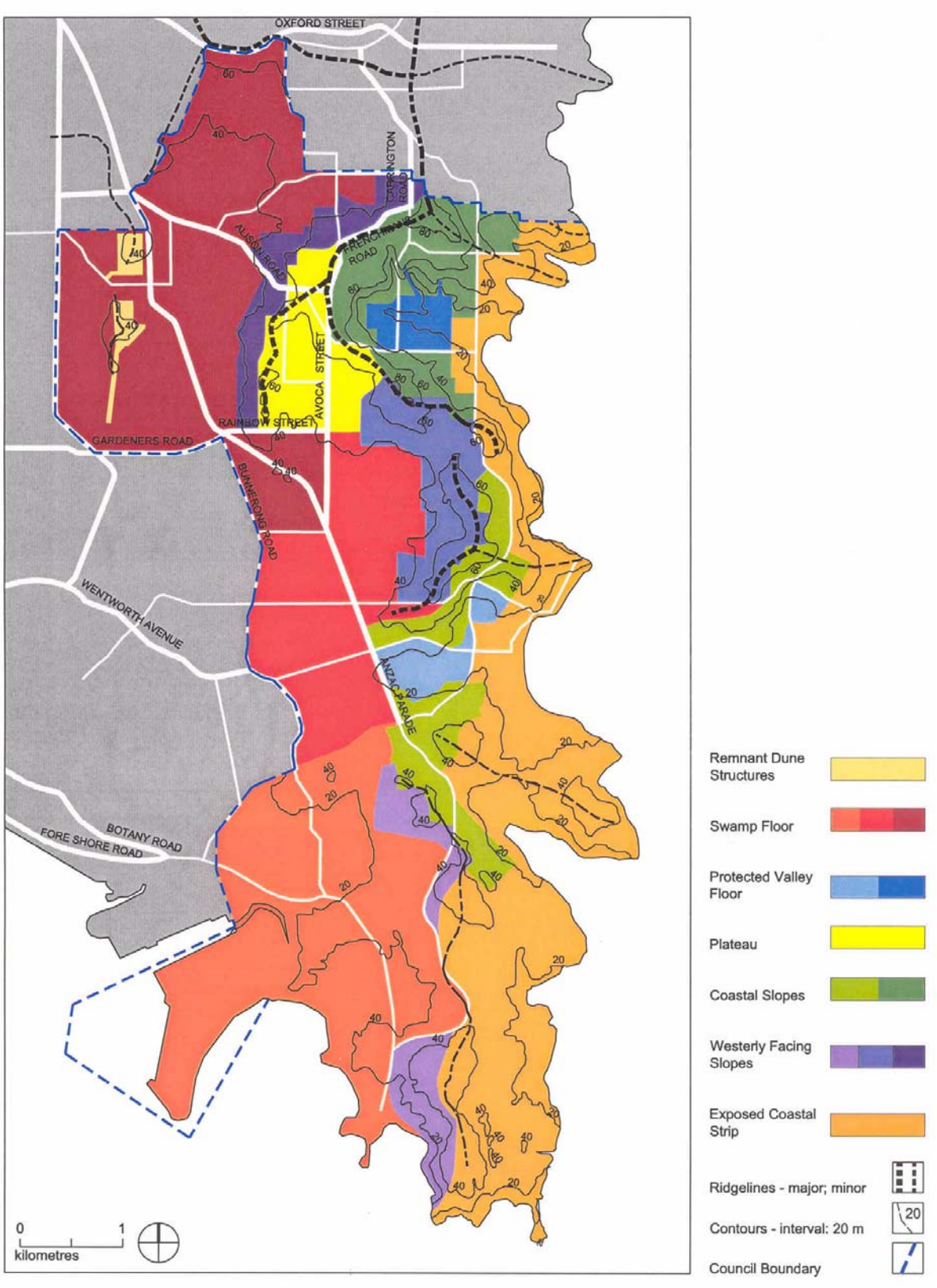


FIGURE 2.12 Broadscale Precinct Types

2.6 A MASTERPLAN FOR EACH PRECINCT

2.6.1 METHODOLOGY

Having defined the major precincts and the sub-precinct divisions, a distinctive palette of plant materials for each precinct was developed. The methodology employed assessed the character of each area in the precinct, and the contributions to this character of the major existing planting. This draws on the survey work carried out in earlier stages of this project.

In looking at each precinct the process was to examine the existing trees and to retain all those of value. If a strong character already existed, or could be developed by reinforcing those streets with the same or similar species, a palette was developed on this basis. In situations where a strong character was not identifiable, the proposal for new plantings attempts to rectify this. The species for these new plantings have been selected for a variety of reasons:

- creating a strong and distinctive character
- compatibility with any existing planting
- environmental suitability (will it grow there?)
- remnant and indigenous vegetation as a potential cue
- vegetation in nearby open spaces as a potential cue, and
- manageability

In order to read as a cohesive planting design, it is important that a diverse palette is implemented consistently within a precinct. Consequently, once the palettes had been selected, they were further categorized in order to identify trees for different situations and specific applications. These selection categories are listed below:

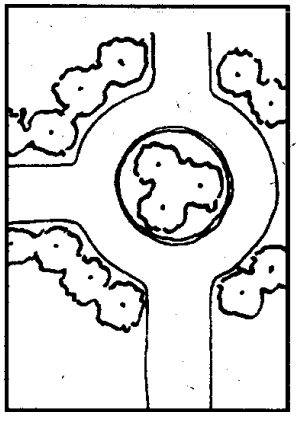
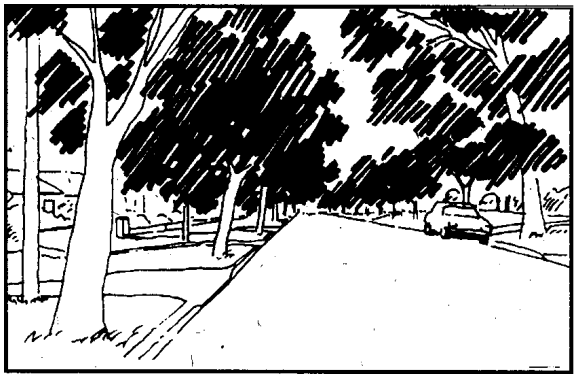


FIGURE 2.13 Special Planting

Special Planting is for specific, designated areas where trees of special character are preferred, clearly distinguishable from the character of General Avenue Planting. Extent is to be limited in order to maintain maximum effect. Urban areas (above left) and major intersections (above right) may be considered for special planting.



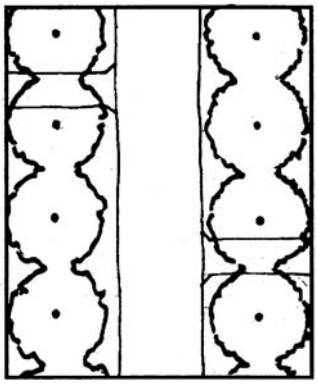


FIGURE 2.14 Formal Avenue Planting

Formal Avenue Planting is for areas where a consistent line of trees is preferred.

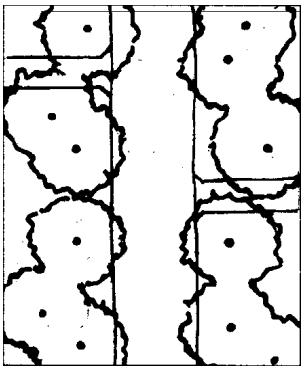
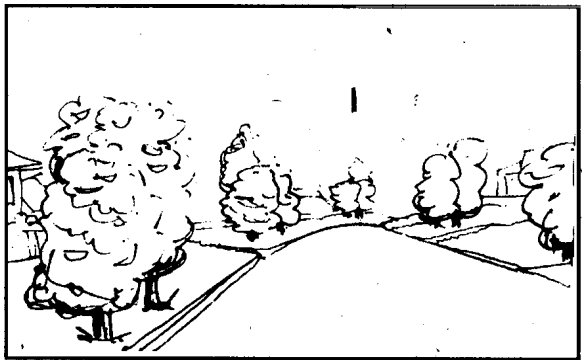


FIGURE 2.15 Informal Avenue Planting

Informal Avenue Planting is for areas where informal groupings are preferred.



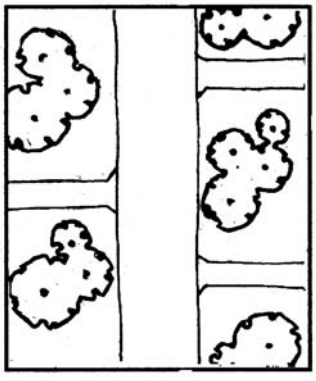


FIGURE 2.16 Shrubland Grove Planting

Shrubland Grove Planting is for areas where dense informal groupings of smaller shrub-like trees are preferred. Canopy trees are unachievable or undesirable.

Reinforced Existing Planting

Reinforced Existing Planting is for streets containing existing species that have been nominated for infill planting. Planting layout will usually be consistent with existing scheme. In order that proposed street tree plantings will read as strong designs, all palette species are recommended as pure stands, avenues or groves. Mixed planting is not recommended unless otherwise stated.

Having established the palette, the opportunities present in this precinct as identified in Section 2.4 are listed. The major arterial roads that traverse the precinct are dealt with in Section 2.7.

An Explanatory Note

The existing vegetation is at times collectively referred to as a proportion of open forest and closed forest species. While these are, strictly speaking, generalizations of more detailed botanical vegetation types, they are useful categories for determining and establishing character, as they group species which share similar visual qualities, such as foliage texture, colour, etc. Closed forest and open forest trees are also noticeably distinctive from one another.

Closed forest in this study refers to those species typical of rainforest or wet forest communities. They are typified by their denser canopy, glossier, greener foliage, and naturally occur in areas of higher moisture (though not swamps). This category includes species such as:

Lophostemon confertus	Brush box
Acmena smithii	Lillypilly
Ficus species	Figs
Elaeocarpus reticulatus	Blueberry ash
Livistona australis	Cabbage tree palm

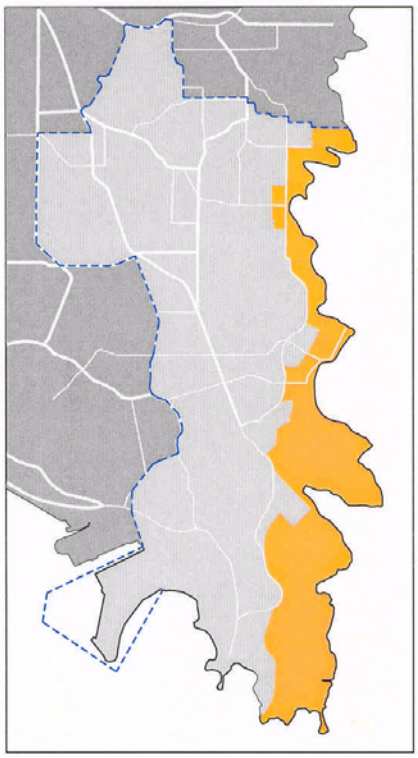
Open forest in this study refers to those species that occur in open forests and woodlands, including forests and woodlands associated with swamp or saline environments. This includes species such as:

Eucalyptus haemastoma	Scribbly Gum
Eucalyptus botryoides	Bangalay
Banksia serrata	Old Man Banksia
Casuarina glauca	She Oak
Eucalyptus robusta	Swamp Mahogany
Angophora costata	Sydney Red Gum
Banksia integrifolia	Coastal Banksia

Note:

Before any street tree species are selected for planting, the restricted species list provided by Council's Bushcare Management Unit is to be consulted and where possible, recommended species are not to be planted in restricted zones.

2.6.2 Exposed Coastal Strip



This precinct is defined by that area most directly exposed to coastal influences. The most significant coastal influence is the prevailing salt-laden winds. Due to this overriding factor, this precinct is distinguished by its topographic range. This range varies from high rugged cliffs, to sandy beaches. A large proportion of the total open space under Council control is located within this precinct. It should also be noted that large areas outside of council jurisdiction also exist within this precinct, and greatly contribute to the total character.

The precinct has generally been considered as a whole. For the listing of the identified opportunities, this precinct has been divided into two sub-precincts: north and south. The division occurs at the southern end of Maroubra Beach. In sub-precinct 1 to the north, the urban development and topography are strong, especially at its northern end. The street patterning is strongly grided. Sub-precinct 2 to the south is mostly open space. The small amount of lower density development occurs on a less regimented grid that warps in response to topography. This precinct includes Clovelly, Coogee, South Coogee, Maroubra, Malabar and Little Bay. Refer to Plate 1: Randwick Precincts for precise locations.

Banksia integrifolia – Coastal Banksia

A ISSUES

Original Vegetation and Remnants

Pre-settlement patterns consisted mainly of heath and with Eastern Suburbs Banksia Scrub. Other communities occurred more locally, such as a small area of woodland within the protection of the southern arm of Maroubra Bay, and an area of gully flora behind Congwong Bay. The majority of remnant vegetation sites within this precinct and plant communities present are mapped in Figure 2.4 and Figure 2.5 and are listed below.

Remnant Vegetation	Plant Communities present
Burrows Park	Coastal heath
Gordons Bay	Coastal heath
Dunningham Reserve	Coastal heath
Trenerry Reserve	Freshwater swamp, wet heath
South Coogee Coast	Sydney sandstone heath, sedgeland
Lurline Bay	Coastal heath, sea cliff
Jack Vanny Memorial Park	Sea cliff
Arthur Byrne Reserve	Coastal heath, ESB scrub
South Maroubra Beach	Coastal dune heath, scrub
Malabar Headland	Heath, woodland, cliff-top swamp, ESB Scrub
Pioneers Park	Sydney sandstone heath, scrub
Long Bay foreshores/Cromwell Park south	Sydney sandstone heath, scrub
Randwick Golf Course	Sydney sandstone heath, scrub
Coast Golf Course	Sydney sandstone heath, scrub
UNSW Little Bay	Sydney sandstone heath, scrub, sedgeland
Ex Prince Henry Hospital site	Coastal heath
OTC Telstra Property	Coastal heath, sedgelands, taller woodlands, gully vegetation
Jennifer Street	ESB Scrub, freshwater swamp
St Michael's Golf Course	Coastal heath, ESB scrub, sedgeland
NSW Golf Course	Coastal heath, ESB scrub, sedgeland
Botany Bay National Park	Coastal heath, ESB scrub, sedgeland

Existing Planting

Street tree plantings are limited in extent and generally sparse in character. Typical precinct species and how they generally occur are listed below.

Typical Precinct species	Occurrence
Banksia integrifolia - Coastal Banksia	Scattered
Casuarina glauca - She Oak	Scattered
Eucalyptus species (incl indigenous) - Gum tree	Scattered
Melaleuca quinquenervia - Swamp Paperbark	Scattered
Metrosideros species - New Zealand Christmas Tree	Avenues and partial avenues

Banksia ericifolia - Heath Banksia

These opportunities are described and illustrated in Section 2.4. In design development, the extent of treatment for each nominated street will need to be determined.

Sub-precinct 1: Exposed Coastal Strip – north

Opportunities	Proposed Sites
Remnant Buffers	
Mahon Pool	Marine Pde
Lurline Bay	Malabar Rd, Edgecliffe Ave, Seaside Pde, Liguria St, Mermaid Ave, Waterside Ave, Lurline St, Ron Filbee Pl
Trenerry Reserve	Crana Ave, Wisdom St, Pearce St, Alexandria Pde, Bloomfield St, Ahearn Ave, Cairo St, Grant St, Dundas St, Wolseley Rd, Oberon St
Dunningham Reserve	Baden St, Beach St, Arcadia St, Major St
Gordons Bay	Moore St, Gordon Ave, Battery St, Tower St, Cliffbrook Pde, Mundurrah St
Burrows Park	Eastbourne Ave, Ocean St, Warner Ave, Northumberland St
Corridors	
Malabar Headland to Jack Vanny Memorial Park	Adjacent Broome St to Marine Pde
Mahon Pool to Lurline Bay	Marine Pde, Wilson St, Banks St, Undine St, Inman St
Lurline Bay to Trenerry Reserve	Cuzco St, Close St, Palmer St, Bunya Pde
Gordons Bay to Burrows Park	Cliffbrook Pde, Melrose Pde, Oak St, Thorpe St, Lowe St, Victory St, Bruce Lane, Shackell Ave, Donnellan Cct, Clovelly Rd

Sub-precinct 1: Exposed Coastal Strip – north (cont)

Opportunities	Proposed Sites
Open Space Edges	
Broadarrow Reserve	Fitzgerald Ave, Marine Pde, Mons Ave
Arthur Byrne Reserve	Fitzgerald Ave, Marine Pde
Mahon Pool	Marine Pde
Blenheim Park	Oberon St, Rainbow St, Arden St
Trenerry Reserve	Wolseley Rd
Grant Reserve	Neptune St, Beach St
Coogee Beach	Arden St, Carr St, Dolphin St
Coogee Oval	Arden St, Dolphin St, Brook St, Alfreda St
Dunningham Reserve	Baden St,
Little Coogee Bay	Victory St, Clovelly Rd, Donellan Cct
Burrows Park	Eastbourne Ave, Ocean St
Approach Streets	
to Maroubra Beach	Fitzgerald Ave, Maroubra Rd
to Maroubra North Headland	Torrington Rd
to Coogee South Headland	Neptune St
to Coogee Beach	Arden St, Coogee Bay Rd
to Waverley Cemetery	Boundary St

Sub-precinct 2: Exposed Coastal Strip – south

Opportunities	Proposed Sites
Remnant Buffers	
Ex Prince Henry Hospital site	Bilga Cres, Eucla Rd, Woli Pl, Wyee Pl
Long Bay	Fishermans Rd, Dacre St, Napier St, Fox St, Raglan St, Ireton St
Malabar Headland	Byrne Cres, Ford Rd, Brown Rd
Corridors	
Little Bay to Prince Henry site	Bilga Cres
Prince Henry site to Long Bay	Prince Edward St, Howe St, Victoria St
Open Space Edges	
Randwick Golf Course	Bilga Cres, Prince Edward St, Howe St
Long Bay (south side)	Bay Pde
Long Bay (north side)	Fishermans Rd
Cromwell Park	Fishermans Rd, Dacre St

Hibiscus tiliaceus - Cottonwood

C OBJECTIVES

- **To create and reinforce a distinctive and unique coastal character**
- **To provide a range of planting types for different palettes and different situations**
- **To realize the identified opportunities, both culturally and environmentally**

D STRATEGIES

The planting palette proposes native/indigenous species appropriate to a harsh, exposed coastal environment. Wherever it specifically complements the objectives and strategies of any particular palette, existing appropriate street tree species will be utilised in streets predominantly planted out with such species.

Precinct Palette Species	**Proposed Areas**
Reinforced Existing Planting	**Determined by -**
Banksia ericifolia - Heath Banksia***	Existing appropriate street plantings
Banksia integrifolia - Coastal Banksia*	Existing appropriate street plantings
Banksia serrata - Old Man Banksia***	Existing appropriate street plantings
Eucalyptus species - Gum tree**	Existing appropriate street plantings
Special Planting	**Major Open Space edges, Approach Streets, Urban Areas**
Araucaria heterophylla - Norfolk Island Pine**	Ridges and valleys (Open Spaces)
Ficus macrophylla - Moreton Bay Fig**	Parks, Open Space
Ficus rubiginosa - Port Jackson Fig**	Parks, Open Space
Ficus superba var. henneana – Deciduous Fig**	Parks, Open Space
Livistona australis - Cabbage-tree Palm**	Coogee Bay commercial strip, Marine Parade commercial strip

Planting key:
* Both sides of street
** Side without wires
*** Under wires and/or confined spaces

Species Legend **E = Evergreen** **D = Deciduous**
N = Native **Ex = Exotic**
***m x *m = average mature dimensions**

Exposed Coastal Strip (cont)

Precinct Palette Species	Proposed Areas
Informal/Formal Avenue Planting	**Nominated Use**
Angophora costata - Smooth-barked Apple* (E – N – 18m x 9m)	Main Roads only
Banksia aemula – Wallum Banksia*** (E – N – 4m x 3m)	General/Under wires
Banksia ericifolia – Heath Banksia*** (E – N – 3m x 2m)	General/Under wires
Banksia integrifolia – Coastal Banksia* (E – N – 9m x 6m)	General planting
Banksia marginata – Silver Banksia*** (E – N – 2m x 2m)	General/Under wires
Banksia robur – Large-leaf Banksia*** (E – N – 2m x 1m)	General/Under wires
Banksia serrata – Old Man Banksia*** (E – N – 7m x 4m)	General planting
Banksia spinulosa – Hairpin Banksia*** (E – N – 2m x 2m)	General/Under wires
Callistemon citrinus - Crimson Bottlebrush*** (E – N – 4m x 3m)	General planting
Callistemon 'Kings Park Special' - Bottlebrush*** (E – N – 5m x 3m)	General planting
Callistemon salignus - Willow Bottlebrush*** (E – N – 6m x 4m)	General planting
Corymbia eximia - Yellow Bloodwood** (E – N – 10m x 5m)	General planting
Eucalyptus botryoides - Bangalay** (E – N – 20m x 10m)	Main Roads only
Eucalyptus haemastoma - Scribbly Gum* (E – N – 8m x 6m)	General planting
Eucalyptus luehmanniana - Yellow-top Ash* (E – N – 4m x 3m)	Sheltered sites
Eucalyptus obtusiflora - Port Jackson Mallee*** (E – N – 3m x 2m)	General planting
Eucalyptus robusta - Swamp Mahogany* (E – N – 18m x 10m)	Main Roads only

Planting key:
- * Both sides of street
- ** Side without wires
- *** Under wires and/or confined spaces

Species Legend
E = Evergreen **D = Deciduous**
N = Native **Ex = Exotic**
***m x *m = average mature dimensions**

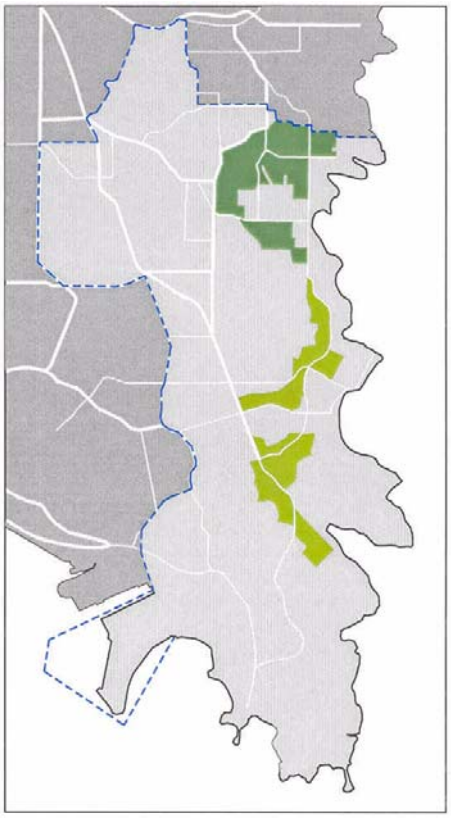
Exposed Coastal Strip (cont)

Precinct Palette Species	Proposed Areas
Informal/Formal Avenue Planting	**Nominated Use**
Hibiscus tiliaceus - Cottonwood* (E – N – 7m x 5m)	General planting
Leptospermum flavescens – Tantoon*** (E – N – 2m x 2m)	General planting
Leptospermum laevigatum - Coastal Tea Tree*** (E – N – 3m x 3m)	General planting
Leptospermum petersonii - Lemon-scented Tea Tree* (E – N – 4m x 3m)	General planting
Leptospermum squarrosum - Tea Tree*** (E – N – 2m x 2m)	General/Under wires
Leptospermum trinervium - Paperbark Tea Tree*** (E – N – 3m x 2m)	General planting
Melaleuca armillaris – Bracelet Honey Myrtle* (E – N – 5m x 4m)	General planting
Melaleuca hypericifolia - Paperbark*** (E – N – 2m x 2m)	General/Under wires
Metrosideros 'Thomasii' - NZ Christmas Tree* (E – Ex – 7m x 4m)	General planting
Shrubland Groves	**General Use**
Angophora hispida - Dwarf Apple*	Very exposed hill sides and ridges
Banksia ericifolia - Heath Banksia*	Exposed hill sides and ridges
Banksia robur - Large-leaf Banksia*	Wet/boggy hill sides
Banksia serrata - Old Man Banksia*	Very exposed hill sides and ridges
Leptospermum laevigatum - Coastal Tea Tree*	Very exposed hill sides and ridges
Melaleuca armillaris - Bracelet Honey Myrtle*	Exposed hill sides and ridges
Westringia fruiticosa - Coastal Rosemary*	Exposed hill sides and ridges

Planting key:
- * Both sides of street
- ** Side without wires
- *** Under wires and/or confined spaces

Species Legend
E = Evergreen **D = Deciduous**
N = Native **Ex = Exotic**
***m x *m = average mature dimensions**

2.6.3 Coastal Slopes



This precinct is defined by the area of hillside behind the coastal strip, extending to the ridgeline. It exists as two sub-precincts. The first is a U-shaped band centred around Coogee Bay. The second is two bands of slopes to the north and south of Maroubra Bay. This precinct includes Clovelly, Randwick, Coogee, South Coogee, Maroubra and Matraville. Refer to Plate 1: Randwick Precincts for precise locations.

Coastal influence is still strong in this precinct, especially on slopes with a south/southeast aspect. This precinct does not exist in the southern portion of the City where, due to the more subtle topography, the Exposed Coastal Strip is extended further inland to the ridgeline.

Street layout patterns vary between the two sub-precincts. The Coogee Slopes maintain a strong grid pattern that transcribes the topography, while the Maroubra Slopes exhibit a street layout with a less regimented grid that warps in response to topography.

Eucalyptus haemastoma – Scribbly Gum

A ISSUES

Original Vegetation and Remnants

Plant communities at the time of settlement for these areas were mainly Eastern Suburbs Banksia Scrub, with smaller areas of Coastal scrub. Apart from the Anzac Rifle Range, which is part of a system of remnants occurring around the Malabar Headland, present day remnants are very restricted and isolated. They include an isolated gully that exhibits very local floristic composition. Sites of remnant vegetation within this precinct and plant communities present are listed below.

Remnant Vegetation	Plant Communities present
Anzac Parade (adj Pioneers Park)	Heath
Fred Hollows Reserve	Gully vegetation
Maroubra Reservoir	ESB scrub
Popplewell Park	Heath

Callistemon salignus - Willow Bottlebrush

Existing Planting

Street tree plantings are relatively diverse. The Coogee Bay slopes have a greater proportion of non-endemic, closed forest species and are generally well vegetated. The vegetation of the Maroubra Bay Slopes is generally sparser, with a greater proportion of open forest species. The existing street planting demonstrates the ability to establish canopy cover. Typical precinct species and how they generally occur are listed below:

Sub-precinct 1: Coogee Bay Coastal slopes

Typical Precinct species	Occurrence
Agonis flexuosa - Willow-leaf Peppermint Myrtle	Scattered
Casuarina glauca - She Oak	Scattered
Eucalyptus species - Gum tree	Partial avenues
Ficus species - Fig tree	Avenues and scattered
Lagunaria patersonii - Norfolk Island Hibiscus	Partial avenues
Lophostemon confertus - Brushbox	Partial avenues
Phoenix canariensis - Canary Island Date Palm	Partial avenues
Various deciduous trees	Scattered

Sub-precinct 2: Maroubra Bay Coastal and connecting Slopes

Typical Precinct species	Occurrence
Agonis flexuosa - Willow-leaf Peppermint Myrtle	Scattered
Banksia integrifolia - Coastal Banksia	Scattered
Casuarina species - She Oak	Partial avenues and scattered
Eucalyptus species (incl indigenous) - Gum tree	Scattered
Lagunaria patersonii - Norfolk Island Hibiscus	Scattered
Metrosideros species - New Zealand Christmas Tree	Partial avenues
Phoenix canariensis - Canary Island Date Palm	Partial avenues

These opportunities are described and illustrated in Section 2.4. In design development, the extent of treatment for each nominated street will need to be determined.

Sub-precinct 1: Coogee Bay Coastal Slopes

Opportunities	Proposed Sites
Remnant Buffers	
Fred Hollows Reserve	Bligh Place, Alison Rd, Glebe St, St Marks Rd, Glen Ave
Open Space Edges	
Burnie Park	Burnie St
Baker Park	Dudley St, Carr St, Byron St
Approach Streets	
to Coogee Beach/commercial strip	Coogee Bay Rd

Sub-precinct 2: Maroubra Bay Coastal Slopes

Opportunities	Proposed Sites
Remnant Buffers	
Popplewell Park	Gregory St, Nymboida St, Malabar Rd
Maroubra Reservoir	Vanny PI, Fowler Cres, Storey St, Johnstone Pde
Anzac Parade Malabar	Anzac Pde, Cromwell St, Hilary Pde
Malabar Headland	Malabar Rd, Beauchamp Rd, Broome St, Thompson Ave, Bowen Place, Manwaring Ave, Hughes Ave, Rodman Ave, Meagher Ave, Curtin Cres
Corridors	
Long Bay to Anzac Pde remnant	Victoria St
Open Space Edges	
Fitzgerald Avenue Road Reserve	Fitzgerald Ave
Popplewell Park	Gregory St, Malabar Rd
Pioneers Park	Anzac Pde

Sub-precinct 2: Maroubra Bay Coastal Slopes (cont)

Opportunities	Proposed Sites
Approach Streets	
to Maroubra Beach	Maroubra Rd, Malabar Rd
to Heffron Park	Fitzgerald Avenue, Murray St, Jersey Rd, Robey St
to Coral Sea Park	Chester Ave, Perkins Way

Glochidion ferdinandi - Cheese tree

C OBJECTIVES

- **To develop two distinct planting palettes, one centred around Coogee Bay and one around Maroubra Bay, based on their individual characters**
- **To reinforce some of the existing species, and incorporate additional species**
- **To improve existing canopy cover as a primary objective, to create a strong character for the precinct, and to contrast these two palettes with exposed coastal strip plantings**
- **To realise the identified opportunities, both culturally and environmentally**

D STRATEGIES

The planting palettes propose species selections that respond to the still strong coastal influence of the more exposed coastal slopes. Wherever it specifically complements the objectives and strategies of any particular palette, existing appropriate street tree species will be utilised in streets predominantly planted out with such species.

Sub-precinct 1: Coogee Bay Coastal Slopes

Precinct Palette Species	**Proposed Areas**
Reinforced Existing Planting	**Determined by -**
Eucalyptus species - Gum tree**	Existing appropriate street plantings
Lophostemon confertus - Brushbox*	Existing appropriate street plantings
Special Planting	**Major Open Space edges, Approach Streets, Urban Areas**
Araucaria heterophylla - Norfolk Island Pine**	
Ficus macrophylla - Moreton Bay Fig**	
Ficus rubiginosa - Port Jackson Fig**	
Jacaranda mimosifolia - Jacaranda*	Limited use only

Planting key:
* Both sides of street
** Side without wires
*** Under wires and/or confined spaces

Species Legend **E = Evergreen** **D = Deciduous**
N = Native **Ex = Exotic**
***m x *m = average mature dimensions**

Sub-precinct 1: Coogee Bay Coastal Slopes (cont)

Precinct Palette Species	Proposed Areas
Informal/Formal Avenue Planting	**Nominated Use**
Angophora costata - Smooth-barked Apple* (E – N – 18m x 10m)	Main Roads only
Banksia ericifolia - Heath Banksia*** (E – N – 3m x 3m)	General/Under wires
Banksia integrifolia - Coastal Banksia* (E – N – 9m x 6m)	General planting
Banksia serrata - Old Man Banksia*** (E – N – 7m x 4m)	General planting
Callistemon pearsonii – Pearson's Bottlebrush*** (E – N - 2m x 2m)	General/Under wires
*Callistemon salignus – Willow Bottlebrush**** (E – N – 6m x 4m)	General planting
Callistemon viminalis - Weeping Bottlebrush* (E – N – 8m x 5m)	General planting
Ceratopetalum apetalum - Coachwood** (E – N – 10m x 5m)	Sheltered sites
Corymbia citriodora - Lemon-scented Gum* (E – N – 20m x 10m)	Main Roads only
Delonix regia – Royal Poinciana* (D – E – 8m x 7m)	General planting
Eucalyptus haemastoma - Scribbly Gum* (E – N – 8m x 6m)	General planting
Eucalyptus piperita - Sydney Peppermint* (E – N – 9m x 5m)	General planting
Fraxinus griffithii – Evergreen Ash*** (E - E – 6m x 4m)	General/Under wires
Glochidion ferdinandi - Cheese Tree* (E – N - 10m x 6m)	General planting
Jacaranda mimosifolia - Jacaranda* (D – Ex – 10m x 8m)	Limited Usage
Lophostemon confertus - Brushbox* (E – N – 10m x 6m)	General planting
Melaleuca decora - White Feather Honey Myrtle** (E – N – 8m x 4m)	Sheltered sites
Michelia champaca - Golden Champa** (E – E – 8m x 4m)	Sheltered sites
Tristaniopsis laurina - Water Gum* (E – N – 8m x 5m)	General planting

Planting key:
- * Both sides of street
- ** Side without wires
- *** Under wires and/or confined spaces

Sub-precinct 2: Maroubra Bay Coastal Slopes

Precinct Palette Species	Proposed Areas
Reinforced Existing Planting	**Determined by -**
Banksia integrifolia - Coastal Banksia*	Existing appropriate street plantings
Eucalyptus species (incl indigenous) - Gum tree**	Existing appropriate street plantings
Special Planting	**Major Open Space edges, Approach Streets, Urban Areas**
Araucaria heterophylla - Norfolk Island Pine**	
Brachychiton acerifolius - Illawarra Flame Tree**	Limited use only
Ficus macrophylla - Moreton Bay Fig**	
Ficus rubiginosa - Port Jackson Fig**	
Jacaranda mimosifolia - Jacaranda*	Limited use only

Callistemon 'Kings Park Special' - Bottlebrush

Planting key:
* Both sides of street
** Side without wires
*** Under wires and/or confined spaces

Species Legend **E = Evergreen** **D = Deciduous**
N = Native **Ex = Exotic**
***m x *m = average mature dimensions**

Sub-precinct 2: Maroubra Bay Coastal Slopes (cont)

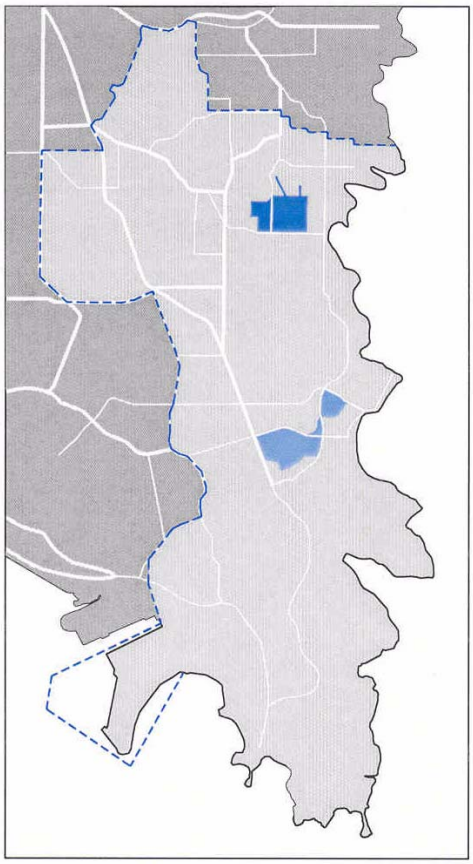
Precinct Palette Species	Proposed Areas
Informal/Formal Avenue Planting	**Nominated Use**
Angophora costata - Smooth-barked Apple* (E – N – 18m x 10m)	Main Roads only
Banksia integrifolia - Coastal Banksia* (E – N – 9m x 6m)	General planting
Banksia serrata - Old Man Banksia*** (E – N – 7m x 4m)	General planting
Brachychiton acerifolius - Illawarra Flame Tree** (E – D – 10m x 5m)	Limited use only
Callistemon citrinus - Crimson Bottlebrush*** (E – N – 4m x 3m)	General planting
Callistemon pearsonii – Pearson's Bottlebrush*** (E – N - 2m x 2m)	General/Under wires
Callistemon salignus - Willow Bottlebrush*** (E – N – 6m x 4m)	General planting
Ceratopetalum apetalum - Coachwood** (E – N – 10m x 5m)	Sheltered sites
Corymbia eximia - Yellow Bloodwood** (E – N – 10m x 5m)	General planting
Corymbia gummifera - Red Bloodwood** (E – N – 9m x 6m)	General planting
Delonix regia – Royal Poinciana* (D – E – 8m x 7m)	General planting
Eucalyptus haemastoma - Scribbly Gum* (E – N – 8m x 6m)	General planting
Eucalyptus sieberi - Silver-top Ash** (E – N – 9m x 5m)	General planting
Fraxinus griffithii – Evergreen Ash* (E – E – 6m x 4m)	General/Under wires
Hibiscus tiliaceus - Cottonwood* (E – N – 7m x 5m)	General planting
Jacaranda mimosifolia - Jacaranda* (D – Ex – 10m x 8m)	Limited use only
Melaleuca decora - White Feather Honey Myrtle** (E – N – 8m x 4m)	Sheltered sites
Melaleuca styphelioides - Prickly-leaf Paperbark* (E – N – 6m x 4m)	General planting

Planting key:
* Both sides of street
** Side without wires
*** Under wires and/or confined spaces

Species Legend **E = Evergreen** **D = Deciduous** **N = Native** **Ex = Exotic**

***m x *m = average mature dimensions**

2.6.4 Coastal Valley Floor



This precinct is defined by the relatively flat ground behind the coastal strip, surrounded by slopes. This typology occurs at Coogee Bay and Maroubra Bay. This precinct includes Coogee, Randwick and Maroubra. Refer to Plate 1: Randwick Precincts for precise locations.

These valley floors are more protected than the surrounding slopes, retaining higher moisture levels, and providing some shelter from coastal winds.

The Coogee Bay Valley Floor is the more protected of the two, with protective slopes to the north, south and west. It was developed earlier with a grid street layout.

The Maroubra Bay Valley Floor is less protected because of the lower height of surrounding slopes. It differs also in the opening to the Swamp Valley Floor in the west. Urban development occurred later, and consequently has a curvilinear street layout that responds more to the topography.

Hibiscus tiliaceus - Cottonwood

A ISSUES

Original Vegetation and Remnants

The original vegetation for the Coogee Valley Floor is described as woodland on sandstone, and is quite a distinct divide from the vegetation of the slopes. The Maroubra Valley Floor is thought not to have been as distinct, described as a continuation of the Eastern Suburbs Banksia Scrub. No remnants in this precinct have been identified.

Existing Planting

Similar to a comparison of the vegetation of the Bay Systems slopes, the two valley floors can also be distinguished. The Coogee Valley Floor has a greater number of street tree plantings, the dominant being historic rainforest and closed forest species, but with significant later plantings of open forest native species. The Maroubra Valley Floor has sparser plantings, with a greater proportion of open forest species.

Sub-precinct 1: Coogee Valley Floor

Typical Precinct species	Occurrence
Casuarina glauca - She Oak	Avenues
Eucalyptus species - Gum tree	Scattered
Ficus species - Fig tree	Avenues
Lophostemon confertus - Brushbox	Partial avenues
Melaleuca quinquenervia - Swamp Paperbark	Scattered
Metrosideros species - New Zealand Christmas Tree	Partial avenues

Sub-precinct 2: Maroubra Valley Floor

Typical Precinct species	Occurrence
Eucalyptus species (incl indigenous) - Gum tree	Avenues and scattered
Lagunaria patersonii - Norfolk Island Hibiscus	Scattered
Lophostemon confertus - Brushbox	Partial avenues
Melaleuca quinquenervia - Swamp Paperbark	Partial avenues
Metrosideros species - New Zealand Christmas Tree	Partial avenues

These opportunities are described and illustrated in Section 2.4. In design development, the extent of treatment for each nominated street will need to be determined.

Sub-precinct 1: Coogee Valley Floor

Opportunities	Proposed Sites
Open Space Edges	
Bardon Park	Bream St, Mount St
John V Dick Reserve	Bream St, Dolphin St

Sub-precinct 2: Maroubra Valley Floor

Opportunities	Proposed Sites
Open Space Edges	
Coral Sea Park	Chester Ave, Yorktown Pde, Midway Dr
Fitzgerald Avenue Rd Reserve	Fitzgerald Ave
Approach Streets	
to Coral Sea Park	Chester Avenue, Perkins Way
to Maroubra Beach	Malabar Rd, Fitzgerald Ave

Callicoma serratifolia – Black Wattle

C OBJECTIVES

- **To develop a palette that emphasises the more sheltered nature of the valley floor**
- **To implement this more strongly in the Coogee Valley Floor where existing historic rainforest and closed forest plantings lend themselves to augmentation**
- **To implement the same objective for the Maroubra Valley Floor using a more subtle palette, to reflect the gentler topography whilst reinforcing existing plantings**

D STRATEGIES

Palettes will, where possible, incorporate rainforest and closed forest species into existing streetscapes. Wherever it specifically complements the objectives and strategies of any particular palette, existing appropriate street tree species will be utilised in streets predominantly planted out with such species.

Sub-precinct 1: Coogee Valley Floor

Precinct Palette Species	Proposed Areas
Reinforced Existing Planting	**Determined by -**
Lophostemon confertus - Brushbox*	Existing appropriate street plantings
Sapium sebiferum - Chinese Tallowwood*	Existing appropriate street plantings
Special Planting	**Major Open Space edges, Approach Streets, Urban Areas**
Ficus macrophylla - Moreton Bay Fig**	Parks, Open Space
Ficus rubiginosa - Port Jackson Fig**	Parks, Open Space
Jacaranda mimosifolia - Jacaranda*	Limited use only
Livistona australis – Cabbage Tree Palm**	Limited use only

Planting key:
* Both sides of street
** Side without wires
*** Under wires and/or confined spaces

Species Legend **E = Evergreen** **D = Deciduous**
N = Native **Ex = Exotic**
***m x *m = average mature dimensions**

Sub-precinct 1: Coogee Valley Floor (cont)

Precinct Palette Species	Proposed Areas
Informal/Formal Avenue Planting	**Nominated Use**
Acmena smithii - Lillypilly** (E – N – 10m x 5m)	General planting
Albizia julibrissin – Silk Tree* (D – E – 5m x 4m)	General/Under wires
Brachychiton discolor - Lacebark** (E – N – 10m x 6m)	Sheltered sites
Callistemon pearsonii – Pearson's Bottlebrush*** (E – N - 2m x 2m)	General/Under wires
Callistemon salignus - Willow Bottlebrush*** (E – N – 6m x 4m)	General planting
Callistemon viminalis - Weeping Bottlebrush* (E – N – 8m x 5m)	General planting
Delonix regia – Royal Poinciana* (D – E – 8m x 7m)	General planting
Fraxinus griffithii – Evergreen Ash* (E – E – 6m x 4m)	General planting
Glochidion ferdinandi - Cheese Tree* (E – N - 10m x 6m)	General planting
Hymenosporum flavum - Native Frangipani* (E – N – 6m x 3m)	Sheltered sites
Jacaranda mimosifolia - Jacaranda* (D – Ex – 10m x 8m)	Limited use only
Koelreutaria paniculata – Golden Rain Tree** (D – E – 7m x 5m)	General planting/Sheltered sites
Lophostemon confertus - Brushbox* (E – N – 10m x 6m)	General planting
Melaleuca linariifolia - Snow-in-Summer** (E – N – 6m x 4m)	General planting
Michelia champaca – (Golden Champa) (E – E – 8m x 4m)	Sheltered sites
Polyscias elegans - Silver Basswood* (E – N – 10m x 5m)	Sheltered sites

Planting key:
- * Both sides of street
- ** Side without wires
- *** Under wires and/or confined spaces

Species Legend **E = Evergreen** **D = Deciduous**
N = Native **Ex = Exotic**
***m x *m = average mature dimensions**

Sub-precinct 1: Coogee Valley Floor (cont)

Precinct Palette Species	Proposed Areas
Informal/Formal Avenue Planting	**Nominated Use**
Sapium sebiferum - Chinese Tallowwood* (D – Ex – 8m x 5m)	General planting
*Synoum glandulosum – Scented Rosewood*** (E – N – 8m x 4m)	Sheltered sites
Syzygium australe - Brush Cherry* (E – N – 10m x 6m)	General planting
Syzygium luehmannii - Small-leaf Lillypilly* (E – N – 8m x 4m)	Sheltered sites
Syzygium paniculatum - Magenta Lillypilly* (E – N – 10m x 5m)	Sheltered sites
*Tibouchina granulosa – Purple Glory Bush**** (E – E – 5m x 3m)	General/Under wires
Tristaniopsis laurina - Water Gum* (E – N – 8m x 5m)	General planting

Xylomelum pyriforme – Woody Pear

Planting key:
- * Both sides of street
- ** Side without wires
- *** Under wires and/or confined spaces

Species Legend **E = Evergreen** **D = Deciduous**
N = Native **Ex = Exotic**
***m x *m = average mature dimensions**

Sub-precinct 2: Maroubra Valley Floor

Precinct Palette Species	Proposed areas
Reinforced Existing Planting	**Determined by -**
Eucalyptus species - Gum tree**	Existing appropriate street plantings
Lophostemon confertus - Brushbox*	Existing appropriate street plantings
Special Planting	**Major Open Space edges, Approach Streets, Urban Areas**
Araucaria heterophylla - Norfolk Island Pine**	Approach to Maroubra Beach
Ficus macrophylla - Moreton Bay Fig**	Fitzgerald Ave (south side)
Ficus rubiginosa - Port Jackson Fig**	Approach to Coral Sea Park, edge of Coral Sea Park
Jacaranda mimosifolia - Jacaranda*	Limited use only

Hymenosporum flavum – Native Frangipani

Planting key:
* Both sides of street
** Side without wires
*** Under wires and/or confined spaces

Species Legend **E = Evergreen** **D = Deciduous**
N = Native **Ex = Exotic**
***m x *m = average mature dimensions**

Sub-precinct 2: Maroubra Valley Floor (cont)

Precinct Palette Species	Proposed areas
Informal/Formal Avenue Planting	**Nominated Use**
Albizia julibrissin – Silk Tree* (D – E – 5m x 4m)	General planting
Banksia integrifolia - Coastal Banksia* (E – N – 9m x 6m)	General planting
Banksia serrata - Old Man Banksia*** (E – N – 7m x 4m)	General planting
Bauhinia x blakeana – Orchard Tree** (D – Ex – 6m x 5m)	General planting/sheltered sites
Callistemon pearsonii – Pearson's Bottlebrush*** (E – N - 2m x 2m)	General/Under wires
Callistemon salignus - Willow Bottlebrush*** (E – N – 6m x 4m)	General planting
Corymbia eximia - Yellow Bloodwood** (E – N – 10m x 6m)	General planting
Cupaniopsis anarcardioides - Tuckeroo* (E – N – 6m x 5m)	General planting
Delonix regia – Royal Poinciana* (D – E – 8m x 7m)	General planting
Eucalyptus botryoides - Bangalay** (E – N – 20m x 9m)	Main Roads only
Eucalyptus haemastoma - Scribbly Gum* (E – N – 8m x 6m)	General planting
Eucalyptus robusta - Swamp Mahogany** (E – N – 18m x 10m)	Main Roads only
Fraxinus griffithii – Evergreen Ash* (E – E – 6m x 4m)	General planting
Hibiscus tiliaceus - Cottonwood* (E – N – 7m x 5m)	General planting
Hymenosporum flavum - Native Frangipani* (E – N – 6m x 3m)	Sheltered sites

Planting key:
- * Both sides of street
- ** Side without wires
- *** Under wires and/or confined spaces

Species Legend
E = Evergreen **D = Deciduous**
N = Native **Ex = Exotic**
***m x *m = average mature dimensions**

Sub-precinct 2: Maroubra Valley Floor (cont)

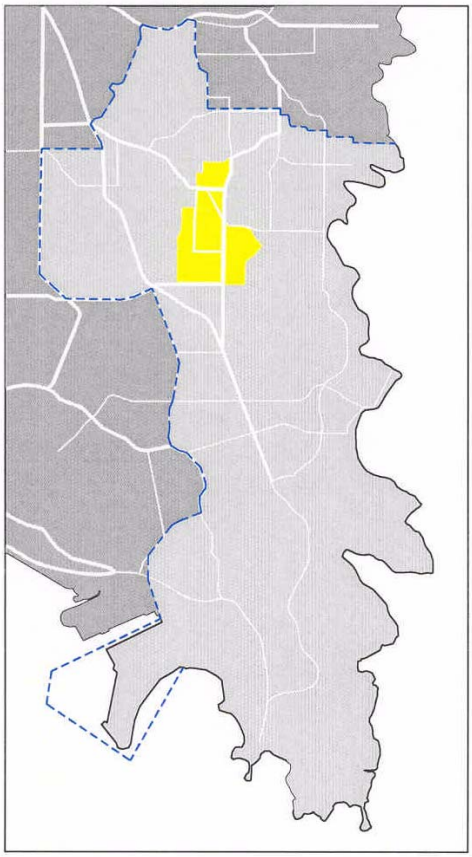
Precinct Palette Species	Proposed areas
Informal/Formal Avenue Planting	**Nominated Use**
Jacaranda mimosifolia - Jacaranda* (D – Ex – 10m x 8m)	Limited use only
Lophostemon confertus - Brushbox* (E – N – 10m x 6m)	General planting
Melaleuca linariifolia - Snow-in-Summer** (E – N – 6m x 4m)	General planting
Polyscias elegans - Silver Basswood* (E – N – 10m x 5m)	Sheltered sites
Synoum glandulosum - Scentless Rosewood* (E – N – 8m x 4m)	Sheltered sites

Eucalyptus sideroxylon - Mugga Mugga Ironbark

Planting key:
* Both sides of street
** Side without wires
*** Under wires and/or confined spaces

Species Legend **E = Evergreen** **D = Deciduous**
N = Native **Ex = Exotic**
***m x *m = average mature dimensions**

2.6.5 Plateau



This precinct is defined by the elevated area of flat to undulating topography that exists between the two major ridgelines, and slopes gently south down to the Swamp Floor. This precinct takes in Randwick. Refer to Plate 1: Randwick Precincts for precise locations.

It is highly developed, including a commercial precinct, hospital, public school, and a portion of the university. As a shallow depression between two ridgelines, the area is, in part, protected from prevailing winds. Importantly, the ridgelines which define this precinct continue beyond its extent, and need to be considered both as a whole and at a precinct scale to ensure a strong connection, as the ridgelines are a highly visible element from many areas in the City.

Platanus x hybrida – London Plane

A ISSUES

Original Vegetation and Remnants

The original vegetation for this precinct is described as being Eastern Suburbs Banksia Scrub, with an area of Freshwater Sedge Swamp contained within the plateau depression that flowed slowly down the gentle slope to the south, continuing through the swamp floor. Small areas of heath on the higher points of the ridgeline are also recorded. No remnants in this precinct of these original communities were recorded.

Existing Planting

The precinct is relatively well vegetated, though a proportion of the existing planting is under-scaled, given the nature of the urban elements within it, and the high visibility of the ridges.

Typical Precinct species	Occurrence
Agonis flexuosa - Willow-leaf Peppermint Myrtle	Partial avenues
Eucalyptus species - Gum tree	Scattered
Lophostemon confertus - Brushbox	Avenues
Melaleuca quinquenervia - Swamp Paperbark	Scattered
Metrosideros species - New Zealand Christmas Tree	Avenues

B OPPORTUNITIES

These opportunities are described and illustrated in Section 2.4. In design development, the extent of treatment for each nominated street will need to be determined.

Opportunities	Proposed Sites
Open Space Edges	
High Cross Reserve	Avoca St, Belmore Rd, Cuthill St
Paine Reserve	Botany St, Rainbow St

C OBJECTIVES

- **To develop a planting palette of a greater scale that is distinct in character to the surrounding slopes, and builds on the existing planting**
- **To implement a planting palette using additional closed forest and rainforest species that exhibit a darker, glossy canopy**
- **To maintain the continuity of ridgeline species as designated in other precincts**

D STRATEGIES

Planting palette will utilise closed forest and rainforest species in an effort to create a dark, glossy street canopy. Wherever it specifically complements the objectives and strategies of any particular palette, existing appropriate street tree species will be utilised in streets predominantly planted out with such species.

Precinct Palette Species	**Proposed Areas**
Reinforced Existing Planting	**Determined by -**
Agonis flexuosa - Willow-leaf Peppermint Myrtle*	Existing appropriate street plantings
Eucalyptus species - Gum tree**	Existing appropriate street plantings
Lophostemon confertus - Brushbox*	Existing appropriate street plantings
Special Planting	**Major Open Space edges, Approach Streets, Urban Areas**
Araucaria heterophylla - Norfolk Island Pine**	Limited use only
Ficus macrophylla - Moreton Bay Fig**	
Ficus rubiginosa - Port Jackson Fig**	
Platanus x hybrida - London Plane*	Limited use only
Podocarpus elatus - Illawarra Pine*	Limited use only

Planting key:
- * Both sides of street
- ** Side without wires
- *** Under wires and/or confined spaces

Species Legend **E = Evergreen** **D = Deciduous** **N = Native** **Ex = Exotic**

***m x *m = average mature dimensions**

Plateau (cont)

Precinct Palette Species	Proposed Areas
Informal/Formal Avenue Planting	**Nominated Use**
Agonis flexuosa - Willow-leaf Peppermint Myrtle* (E – N – 6m x 5m)	General planting
Albizia julibrissin – Silk Tree* (D – E – 5m x 4m)	General planting
Brachychiton populneus - Kurrajong** (E – N – 10m x 6m)	Sheltered sites
Calodendron capense - Cape Chestnut* (D – Ex – 8m x 6m)	General planting
Corymbia citriodora - Lemon-scented Gum* (E – N – 20m x 10m)	Main Roads
Corymbia maculata - Spotted Gum** (E – N – 20m x 10m)	Main Roads
Delonix regia – Royal Poinciana* (D – E – 8m x 7m)	General planting
Flindersia australis - Teak** (E – N – 12m x 5m)	General planting
Glochidion ferdinandi - Cheese Tree* (E – N – 10m x 6m)	General planting
Harpullia pendula - Tulipwood* (E – N – 10m x 6m)	Sheltered sites
Jacaranda mimosifolia - Jacaranda* (D – Ex – 10m x 8m)	General planting
Koelreutaria paniculata – Golden Rain Tree** (D – E – 7m x 5m)	General planting
Lophostemon confertus - Brushbox* (E – N – 10m x 6m)	General planting
Nyssa sylvatica - Tupelo* (D – Ex – 8m x 5m)	Sheltered sites

Planting key:
- * Both sides of street
- ** Side without wires
- *** Under wires and/or confined spaces

Species Legend

E = Evergreen **D = Deciduous**
N = Native **Ex = Exotic**
***m x *m = average mature dimensions**

Plateau (cont)

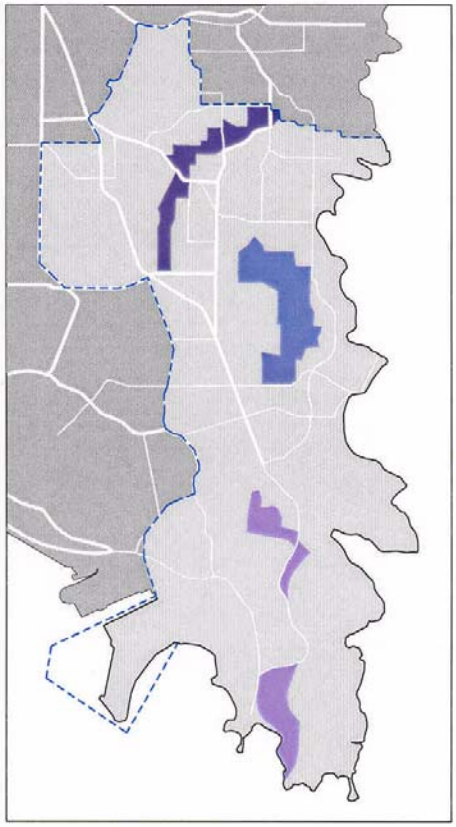
Precinct Palette Species	Proposed Areas
Informal/Formal Avenue Planting	**Nominated Use**
Pistachia chinensis – Chinese Pistachio* (D – Ex – 6m x 3m)	Sheltered sites
Platanus x hybrida - London Plane* (D – Ex – 20m x 15m)	Main Roads
Pyrus calleryana – Callery Pear** (D – E – 6m x 4m)	General planting
Sapium sebiferum - Chinese Tallowwood* (D – Ex – 8m x 5m)	General planting
*Tibouchina granulosa – Purple Glory Bush**** (E – E – 5m x 3m)	General/Under wires
Tristaniopsis laurina - Water Gum* (E – N – 8m x 5m)	General planting

Eucalyptus obtusiflora – Port Jackson Mallee

Planting key:
* Both sides of street
** Side without wires
*** Under wires and/or confined spaces

Species Legend **E = Evergreen** **D = Deciduous**
N = Native **Ex = Exotic**
***m x *m = average mature dimensions**

2.6.6 Leeward Facing Slopes



This precinct is defined as the area behind the major ridgelines, sheltered from the full strength of coastal winds, that slope down to the undulating swamp valley floor. It appears as a broken band, interrupted in the north by the much more gently sloping plateau. This precinct includes Randwick, Coogee, South Coogee, Matraville, Malabar, Little Bay and La Perouse. Refer to Plate 1: Randwick Precincts for precise locations.

Area 1, to the north of the City, contains portions of the significant cultural venues of Randwick commercial precinct, Randwick Racecourse and the University of NSW. Further north in sub-precinct 1, a strongly grided road layout contains largely residential development.

Sub-precinct 2, centrally located in the City, is a mix of older grid street patterning and more recent curved road layouts, primarily residential land use.

Sub-precinct 3, to the south of the City, consists of two small bands. The road patterning reflects the curved layouts of more recent development. Much of this area is open space.

Eucalyptus haemastoma – Scribbly Gum

A ISSUES

Original Vegetation and Remnants

The original communities are described as predominantly Eastern Suburbs Banksia Scrub with areas of heath occurring occasionally on the higher areas of the ridgeline, and more extensively in the southern band of sub-precinct 3, where coastal influences are stronger. Recorded remnants are listed below:

Remnant Vegetation	Plant Communities present
Bundock St remnant	Heath, Eastern Suburbs Banksia Scrub
Botany Bay National Park	Heath, Eastern Suburbs Banksia Scrub
OTC Telstra Property/La Perouse	Coastal heath, sedgelands, taller woodlands, gully vegetation

Agonis flexuosa – Willow-leaf Peppermint Myrtle

Existing Planting

Following the pattern of other precincts, density of planting and number of non-indigenous species is highest to the north and decreases south. Nevertheless, these slopes are characterized generally by their greater proportion of open forest native species.

Sub-precinct 1: Leeward Slopes – north

Typical Precinct species	Occurrence
Agonis flexuosa - Willow-leaf Peppermint Myrtle	Partial avenues
Eucalyptus species - Gum tree	Scattered
Ficus species - Fig tree	Avenues
Lophostemon confertus - Brushbox	Avenues
Melaleuca armillaris - Bracelet Honey Myrtle	Avenues
Melaleuca quinquenervia - Swamp Paperbark	Avenues

Sub-precinct 2: Leeward Slopes – central

Typical Precinct species	Occurrence
Casuarina species - She Oak	Scattered
Eucalyptus species - Gum tree	Partial avenues
Lophostemon confertus - Brushbox	Partial avenues
Melaleuca armillaris - Bracelet Honey Myrtle	Partial avenues
Melaleuca quinquenervia - Swamp Paperbark	Avenues and scattered

Sub-precinct 3: Leeward Slopes – south

Typical Precinct species	Occurrence
Eucalyptus species - Gum tree	Scattered
Melaleuca armillaris - Bracelet Honey Myrtle	Partial avenues

B OPPORTUNITIES

These opportunities are described and illustrated in Section 2.4. In design development, the extent of treatment for each nominated street will need to be determined.

Sub-precinct 1: Leeward Slopes – north

Opportunities	Proposed Sites
Open Space Edges	
Alison Park	Alison Rd, Frances St, Abbey St, The Avenue
Approach Streets	
to Alison Park and Commercial area	Alison Rd

Sub-precinct 2: Leeward Slopes – central

Opportunities	Proposed Sites
Remnant Buffers	
Bundock St Remnant	Bundock St, Elphinstone Rd, Wauchope Cres, Argyle Cres and associated cul-de-sacs
Maroubra Reservoir	Armour Ave, Johnston Pde
Open Space Edges	
Latham Park	Moverly Rd
Quarry Park	Storey St
Randwick Cemetery	Malabar Rd
Approach Streets	
to Latham Park	Moverly Rd

Sub-precinct 3: Leeward Slopes – south

Opportunities	Proposed Sites
Remnant Buffers	
Jennifer St, OTC, Botany Bay National Park	Jennifer St, Dwyer St, Budd Ave, Reservoir St, Dawes St, Gipps St, Grose St, Marconi Ave, Abbe Receveur Place
Corridors	
OTC to ex Prince Henry Hospital site	Anzac Pde

C OBJECTIVES

- **To capitalise on the capacity of this precinct to support a strong canopy in order to reinforce and/or develop a precinct character**
- **To maximize the visual impact of these highly visible slopes on the flatter ground to the west**
- **To distinguish each sub-precinct within the precinct with variations in the palette, that respond to their urban character and existing plantings**

D STRATEGIES

Palettes will generally be open forest species, to reflect the drier conditions of the leeward slopes. Existing shrubland species will not be used, except in some streets of sub-precinct 3, where coastal influence is still strong. Wherever it specifically complements the objectives and strategies of any particular palette, existing appropriate street tree species will be utilised in streets predominantly planted out with such species.

Sub-precinct 1: Leeward Slopes – north

Precinct Palette Species	Proposed Areas
Reinforced Existing Planting	**Determined by -**
Agonis flexuosa - Willow-leaf Peppermint Myrtle*	Existing appropriate street plantings
Eucalyptus species - Gum tree**	Existing appropriate street plantings
Lophostemon confertus - Brushbox*	Existing appropriate street plantings
Special Planting	**Major Open Space Edges, Approach Streets, Urban Areas**
Ficus macrophylla - Moreton Bay Fig**	
Ficus rubiginosa - Port Jackson Fig**	

Planting key:
* Both sides of street
** Side without wires
*** Under wires and/or confined spaces

Species Legend **E = Evergreen** **D = Deciduous**
N = Native **Ex = Exotic**
***m x *m = average mature dimensions**

Sub-precinct 1: Leeward Slopes – north (cont)

Precinct Palette Species	Proposed Areas
Informal/Formal Avenue Planting	**Nominated Use**
Acmena smithii - Lillypilly** (E – N – 10m x 5m)	General planting
Agonis flexuosa - Willow-leaf Peppermint Myrtle* (E – N – 6m x 5m)	General planting
Albizia julibrissin – Silk Tree* (D – E – 5m x 4m)	General planting
Angophora costata - Smooth-barked Apple* (E – N – 18m x 9m)	Main Roads only
Buckinghamia celsissima - Ivory Curl Flower* (E – N – 5m x 3m)	Sheltered sites
Calodendron capense - Cape Chestnut* (D – Ex – 8m x 6m)	General planting
Cupaniopsis anacardioides - Tuckeroo* (E – N – 6m x 5m)	General planting
Eucalyptus globoidea - White Stringybark** (E – N – 10m x 6m)	General planting
Eucalyptus haemastoma - Scribbly Gum* (E – N – 8m x 6m)	General planting
Eucalyptus piperita - Sydney Peppermint** (E – N – 9m x 5m)	General planting
Eucalyptus punctata - Grey Gum** (E – N – 12m x 7m)	General planting
Eucalyptus squamosa - Scaly Bark Gum** (E – N – 9m x 5m)	General planting
Fraxinus griffithii – Evergreen Ash* (E – E – 6m x 4m)	General planting

Planting key:
- * Both sides of street
- ** Side without wires
- *** Under wires and/or confined spaces

Species Legend
E = Evergreen **D = Deciduous**
N = Native **Ex = Exotic**
***m x *m = average mature dimensions**

Sub-precinct 1: Leeward Slopes – north (cont)

Precinct Palette Species	Proposed Areas
Informal/Formal Avenue Planting	**Nominated Use**
Michelia champaca – (Golden Champa) (E – Ex – 8m x 4m)	Sheltered sites
Lophostemon confertus - Brushbox* (E – N – 10m x 6m)	General planting
Pistachia chinensis – Chinese Pistachio* (D – Ex – 6m x 3m)	Sheltered sites
Platanus x hybrida - London Plane* (D – Ex – 20m x 15m)	Main Roads only
Pyrus calleryana – Callery Pear** (D – Ex – 6m x 4m)	General planting
Sapium sebiferum - Chinese Tallowwood* (D – Ex – 8m x 5m)	General planting
*Tibouchina granulosa – Purple Glory Bush**** (E – E – 5m x 3m)	General/Under wires
Tristaniopsis laurina - Water Gum* (E – N – 8m x 5m)	General planting

Leptospermum laevigatum – Coastal Tea tree

Planting key:
* Both sides of street
** Side without wires
*** Under wires and/or confined spaces

Sub-precinct 2: Leeward Slopes – central

Precinct Palette Species	Proposed Areas
Reinforced Existing Planting	**Determined by -**
Eucalyptus species - Gum tree**	Existing appropriate street plantings
Lophostemon confertus - Brushbox*	Existing appropriate street plantings - except in remnant buffers
Special Planting	**Major Open Space edges, Approach Streets, Urban Areas**
Araucaria heterophylla - Norfolk Island Pine**	
Ficus macrophylla - Moreton Bay Fig**	
Ficus rubiginosa - Port Jackson Fig**	

Grevillea cultivar

Planting key:
* Both sides of street
** Side without wires
*** Under wires and/or confined spaces

Species Legend **E = Evergreen** **D = Deciduous**
N = Native **Ex = Exotic**
***m x *m = average mature dimensions**

Sub-precinct 2: Leeward Slopes – central (cont)

Precinct Palette Species	Proposed Areas
Informal/Formal Avenue Planting	**Nominated Use**
Albizia julibrissin – Silk Tree* (D – E – 5m x 4m)	General planting
Angophora costata - Smooth-barked Apple* (E – N – 18m x 9m)	Main Roads
Banksia integrifolia - Coastal Banksia* (E – N – 9m x 6m)	General planting
Banksia serrata - Old Man Banksia*** (E – N – 7m x 4m)	General planting
Callicoma serratifolia – Black Wattle* (E – N – 10m x 4m)	Sheltered sites
Eucalyptus cinerea - Argyle Apple* (E – N – 8m x 6m)	General planting
Eucalyptus haemastoma - Scribbly Gum* (E – N – 8m x 6m)	General planting
Eucalyptus leucoxylon - Yellow Gum** (E – N – 9m x 5m)	Sheltered sites
Eucalyptus sideroxylon - Ironbark** (E – N – 12m x 8m)	Main Roads only
Feijoa sellowiana - Fruit Salad Tree*** (E – Ex – 4m x 3m)	General planting
Fraxinus griffithii – Evergreen Ash* (E – E – 6m x 4m)	
Geijera parvifolia – Wilga* (E – N – 6m x 4m)	General planting
*Grevillea 'Honey Gem'**** (E – N – 3m x 3m)	General/Under wires
*Grevillea 'Misty Pink'**** (E – N – 3m x 3m)	General/Under wires
Hibiscus tiliaceus 'Rubra' - Bronze Hibiscus* (E – N – 5m x 4m)	General planting
Lophostemon confertus - Brushbox* (E – N – 10m x 6m)	General planting
Myoporum acuminatum - Boobialla*** (E – N – 4m x 3m)	Sheltered sites
Polyscias elegans - Silver Basswood* (E – N – 10m x 5m)	Sheltered sites
*Tibouchina granulosa – Purple Glory Bush**** (E – E – 5m x 3m)	General/Under wires
Tristaniopsis laurina - Water Gum* (E – N – 8m x 5m)	General planting

Planting key:
* Both sides of street
** Side without wires
*** Under wires and/or confined spaces

Sub-precinct 3: Leeward Slopes – south

Precinct Palette Species	Proposed Areas
Reinforced Existing Planting	**Determined by -**
Banksia integrifolia - Coastal Banksia*	Existing appropriate street plantings
Banksia serrata - Old Man Banksia***	Existing appropriate street plantings
Eucalyptus species - Gum tree**	Existing appropriate street plantings
Special Planting	**Major Open Space edges, Approach Streets, Urban Areas**
Araucaria heterophylla - Norfolk Island Pine**	
Ficus macrophylla - Moreton Bay Fig**	
Ficus rubiginosa - Port Jackson Fig**	
Schinus areira - Peppercorn*	Except in remnant buffers

Eucalyptus obtusiflora – Port Jackson Mallee

Planting key:
- * Both sides of street
- ** Side without wires
- *** Under wires and/or confined spaces

Species Legend **E = Evergreen** **D = Deciduous** **N = Native** **Ex = Exotic**

***m x *m = average mature dimensions**

Sub-precinct 3: Leeward Slopes – south (cont)

Precinct Palette Species	Proposed Areas
Informal/Formal Avenue Planting	**Nominated Use**
Albizia julibrissin – Silk Tree* (D – E – 5m x 4m)	General planting
Angophora costata - Smooth-barked Apple* (E – N – 18m x 9m)	Main Roads only
Angophora hispida - Dwarf Apple*** (E – N – 4m x 3m)	Sheltered sites
Banksia aemula – Wallum Banksia*** (E – N – 4m x 3m)	General/Under wires
Banksia ericifolia – Heath Banksia*** (E – N – 3m x 3m)	General/Under wires
Banksia marginata – Silver Banksia*** (E – N – 2m x 2m)	General/Under wires
Banksia integrifolia - Coastal Banksia* (E – N – 9m x 6m)	General planting
Banksia serrata - Old Man Banksia*** (E – N – 7m x 4m)	General planting
*Banksia spinulosa – Hairpin Banksia**** (E – N – 2m x 2m)	General/Under wires
Corymbia eximia - Yellow Bloodwood** (E – N – 10m x 5m)	General planting
Corymbia ficifolia (grafted cultivars) - WA Flowering Gum* (E – N – 6m x 4m)	Sheltered sites
Cupaniopsis anacardioides - Tuckeroo* (E – N – 6m x 5m)	General planting
Eucalyptus haemastoma - Scribbly Gum* (E – N – 8m x 6m)	General planting
Eucalyptus obtusiflora - Port Jackson Mallee*** (E – N – 3m x 2m)	General planting
Feijoa sellowiana - Fruit Salad Tree*** (E – Ex – 4m x 3m)	General planting
Fraxinus griffithii – Evergreen Ash* (E – E – 6m x 4m)	General planting
Grevillea banksii – Banks' Grevillea* (E – N – 4m x 3m)	General/Under wires
Grevillea linearifolia - White Spider Flower*** (E – N – 2m x 2m)	General/Under wires
Leptospermum flavescens – Tantoon*** (E – N – 2m x 2m)	General/Under wires
Leptospermum laevigatum - Coastal Tea Tree*** (E – N – 3m x 3m)	General planting

Planting key:
- * Both sides of street
- ** Side without wires
- *** Under wires and/or confined spaces

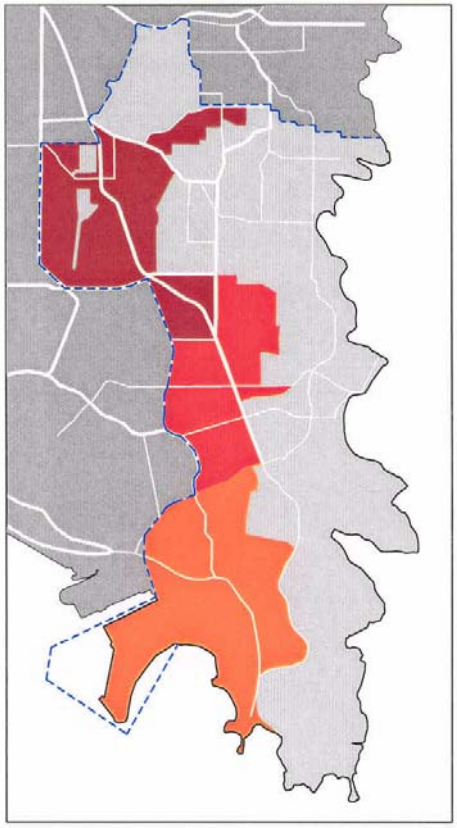
Precinct Palette Species	Proposed Areas
Shrubland Grove Planting	**General Use**
Angophora hispida - Dwarf Apple***	Exposed areas
Banksia ericifolia - Heath Banksia***	Exposed areas
Leptospermum laevigatum - Coastal Tea Tree***	Exposed areas

Grevillea banksii – Banks' Grevillea

Planting key:
* Both sides of street
** Side without wires
*** Under wires and/or confined spaces

Species Legend **E = Evergreen** **D = Deciduous**
N = Native **Ex = Exotic**
***m x *m = average mature dimensions**

2.6.7 Swamp Valley Floor



This precinct is defined as the area of undulating to flat land on the leeward side of the coastal ridgeline, west of the steeper slopes that mark its eastern extent. Character within this precinct is differentiated by the land use and planting. This precinct includes Kensington, Kingsford, Randwick, Maroubra, Matraville, Chifley, La Perouse, Phillip Bay and Port Botany. Refer to Plate 1: Randwick Precincts for precise locations.

Sub-precinct 1 contains older residential areas, Kingsford and Kensington, with large commercial sub-precincts. The street patterns are grided, with many roads skewed in response to the alignment of Anzac Parade. This sub-precinct contains large areas of open space, including the following major venues: Centennial Park, Randwick Racecourse and Kensington Golf Links.

Sub-precinct 2 developed later than Sub-precinct 1, but still exhibits strong grid patterning, with some distortion to the southwest. The major open spaces are Heffron Park to the south and Commonwealth property to the east.

Sub-precinct 3 contains the most recent urban development which is of low density occurring on curvilinear systems. This sub-precinct also has a large portion of heavy industry. Botany Cemetery is a major open space within this precinct. Other open spaces occur along the Bunnerong Road spine and along the land/water edge where this precinct meets Botany Bay.

Acmena smithii - Lillypilly

A ISSUES

Original Vegetation and Remnants

Original vegetation would have consisted of large tracts of Eastern Suburbs Banksia Scrub interspersed with a variety of swamp plant communities associated with the Lachlan and Botany Swamps. Sites of remnant vegetation within this precinct and plant communities present are listed below. Some species identified as remnant species would seem to indicate the presence of woodland communities within the areas designated Eastern Suburbs Banksia Scrub.

Remnant Vegetation	Plant Communities present
Centennial Park	Freshwater sedge swamp
Anzac Parade	1 species only: *Allocasuarina diminuta*
Bunnerong Road	Heath, ESB Scrub
Yarra Bay	Heath, Swamp with *Casuarina glauca* and *Eucalyptus robusta*, some woodland species
Raleigh Park Estate	1 specimen only: *Glochidion ferdinandi*
Australian Golf Course	ESB scrub
Randwick Racecourse	Sydney sandstone heath
Bundock St	ESB scrub, sedgeland
Bumborah Point	Coastal dune heath
Yarra Point	Low estuarine forest
Botany Bay National Park	ESB scrub, sedgeland, heath

Existing Planting

Sub-precinct 1 exhibits relatively strong planting on a grid street pattern. Sub-precinct 2 is largely a continuation of this strong grid with some distortion in the south-west. Vegetation in sub-precinct 2 is sparser because of a similar reduction in the strength of urban development. Sub-precinct 3 has a more organic road layout, and a noticeable absence of closed forest species.

Sub-precinct 1: Swamp Valley Floor – north

Typical Precinct species	Occurrence
Agonis flexuosa - Willow-leaf Peppermint Myrtle	Partial avenues
Casuarina glauca - She Oak	Scattered
Eucalyptus species - Gum tree	Scattered
Ficus species - Fig tree	Avenues, partial avenues
Lophostemon confertus - Brushbox	Avenues, partial avenues
Melaleuca quinquenervia - Swamp Paperbark	Partial avenues
Phoenix canariensis - Canary Island Date Palm	Partial avenues

Sub-precinct 2: Swamp Valley Floor – central

Typical Precinct species	Occurrence
Agonis flexuosa - Willow-leaf Peppermint Myrtle	Partial avenues
Eucalyptus species - Gum tree	Partial avenues, scattered
Ficus species - Fig tree	Scattered
Lophostemon confertus - Brushbox	Scattered
Melaleuca armillaris - Bracelet Honey Myrtle	Partial avenues, scattered
Metrosideros species - New Zealand Christmas Tree	Scattered

Sub-precinct 3: Swamp Valley Floor – south

Typical Precinct species	Occurrence
Agonis flexuosa - Willow-leaf Peppermint Myrtle	Partial avenues, scattered
Casuarina glauca - She Oak	Partial avenues, scattered
Erythrina x sykesii - Coral Tree	Scattered
Eucalyptus species (incl. indigenous) - Gum tree	Partial avenues, scattered
Melaleuca armillaris - Bracelet Honey Myrtle	Partial avenues, scattered
Melaleuca quinquenervia - Swamp Paperbark	Partial avenues, scattered
Metrosideros species - New Zealand Christmas Tree	Scattered

These opportunities are described and illustrated in Section 2.4. In design development, the extent of treatment for each nominated street will need to be determined.

Sub-precinct 1: Swamp Valley Floor – north

Opportunities	Proposed Sites
Remnant Buffers	
Australian Golf Course	Tunstall Ave
Anzac Pde, Kingsford	Anzac Pde
Open Space Edges	
Kensington Park	Barker St, Cottenham Ave, Edward Ave
Approach Streets	
to Kensington Park	Cottenham Ave, Barker St, Edward Ave, Mooramie Ave, Doncaster Ave

Sub-precinct 2: Swamp Valley Floor – central

Opportunities	Proposed Sites
Remnant Buffers	
Bundock Street remnant	Holmes St, Henning Ave
Corridors	
Anzac Pde to Bundock St	Holmes St
Open Space Edges	
Heffron Park	Fitzgerald Avenue, Jersey St, Bunnerong Rd
Nagle Park	Wild St, Holden St, Walsh Ave
Snape Park	Percival St, Storey St, Hannan St, Snape St
Approach Streets	
to Heffron Park	Jersey Rd, Fitzgerald Ave
to Nagle Park	Walsh Ave
to Snape Park	Snape St, Storey St

Sub-precinct 3: Swamp Valley Floor – south

Opportunities	Proposed Sites
Remnant Buffers	
Bunnerong Road remnant	Leichhardt St, Macquarie St, Forrest St, Eyre St, Warburton St, Carnegie Circuit, Wassell St, Wills Ave
Yarra Bay and Bunnerong remnants	Yarra Rd, Military Rd, Botany Rd, Bunnerong Rd, Bumborah Point Rd, Baragoola Ave, Kooringai Ave, Elaroo Ave, Adina Ave, Murrong Pl, Goolagong Pl, Goonda Ave
Botany Bay National Park	Anzac Pde, Endeavour Ave
Corridors	
La Perouse to Bunnerong Rd	Bunnerong Rd
La Perouse to Ex Prince Henry site	Anzac Pde
Open Space Edges	
Botany Cemetery	Bunnerong Rd
Dr Walters Park	Lasseter St, Mawson Pde
Women's Athletic Field	Bunnerong Rd, Little Bay Rd, Hastings Ave
Woomera Reserve	Bunnerong Rd, Woomera Rd
Yarra Bay Bicentennial Park	Yarra Rd
Approach Streets	
to Botany Cemetery	Military Rd
to Women's Athletic Field	Little Bay Rd, Hastings Ave
to Yarra Bay/Yarra House	Yarra Rd

C OBJECTIVES

- **To develop a palette distinctive to this precinct**
- **To provide a much greater proportion of shade than presently exists**
- **To use trees to give a sense of scale and depth to the long sight lines in this precinct**

D STRATEGIES

To develop comprehensive canopy cover using tree species which give a sense of scale and depth to long sight lines within the precinct. Wherever it specifically complements the objectives and strategies of any particular palette, existing appropriate street tree species will be utilised in streets predominantly planted out with such species.

Sub-precinct 1: Swamp Valley Floor – north

Precinct Palette Species	**Proposed Areas**
Reinforced Existing Planting	**Determined by -**
Eucalyptus species - Gum tree**	Existing appropriate street plantings
Lophostemon confertus - Brushbox*	Existing appropriate street plantings – except in remnant buffers
Special Planting	**Major Open Space edges, Approach Streets, Urban Areas**
Ficus macrophylla - Moreton Bay Fig**	Open space edges
Ficus rubiginosa - Port Jackson Fig**	
Livistona australis – Cabbage Tree Palm**	Approach roads
Platanus x hybrida - London Plane*	Limited use only

Planting key:
* Both sides of street
** Side without wires
*** Under wires and/or confined spaces

Species Legend **E = Evergreen** **D = Deciduous**
N = Native **Ex = Exotic**
***m x *m = average mature dimensions**

Sub-precinct 1: Swamp Valley Floor – north (cont)

Precinct Palette Species	Proposed Areas
Informal/Formal Avenue Planting	**Nominated Use**
Acmena smithii - Lillypilly** (E – N – 10m x 5m)	General planting
Ceratonia siliqua – Carob tree* (E – E – 7m x 5m)	General planting
Corymbia citriodora - Lemon-scented Gum* (E – N – 20m x 10m)	Main Roads only
Elaeocarpus reticulatus - Blueberry Ash** (E – N – 7m x 4m)	Sheltered sites
Eucalyptus leucoxylon - Yellow Gum** (E – N – 8m x 5m)	Sheltered sites
Eucalyptus sideroxylon - Ironbark** (E – N – 15m x 8m)	Main Roads only
Fraxinus griffithii – Evergreen Ash* (E – E – 6m x 4m)	General planting
Gleditsia triacanthos 'Sunburst' - Honey Locust* (D – Ex – 8m x 6m)	General planting
Jacaranda mimosifolia - Jacaranda* (D – Ex – 10m x 8m)	Limited Use
Lagerstroemia indica - Crepe Myrtle*** (D – Ex – 5m x 4m)	Sheltered sites
Lophostemon confertus - Brushbox* (E – N – 10m x 6m)	General planting
Magnolia grandiflora - Bull Bay Magnolia* (E – Ex – 10m x 7m)	Sheltered sites
Nyssa sylvatica - Tupelo* (D – Ex – 8m x 5m)	Sheltered sites
Olea europaea var. communis – European Olive* (E – Ex – 5m x 3m)	Limited Use
Pistachia chinensis – Chinese Pistachio* (D – Ex – 6m x 3m)	Sheltered sites
Platanus x hybrida - London Plane* (D – Ex – 20m x 15m)	Main Roads only

Planting key:
- * Both sides of street
- ** Side without wires
- *** Under wires and/or confined spaces

Species Legend
E = Evergreen **D = Deciduous**
N = Native **Ex = Exotic**
***m x *m = average mature dimensions**

Sub-precinct 1: Swamp Valley Floor – north (cont)

Precinct Palette Species	Proposed Areas
Informal/Formal Avenue Planting	**Nominated Use**
Schinus areira - Peppercorn* (E – Ex – 10m x 8m)	Limited Use – wide verges
Stenocarpus sinuatus - Qld Firewheel Tree** (E – N – 8m x 3m)	Sheltered sites
Syzygium luehmannii - Small-leaf Lillypilly* (E – N – 8m x 4m)	Sheltered sites
Tibouchina granulosa – Purple Glory Bush*** (E – E – 5m x 3m)	General/Under wires
Waterhousia floribunda - Weeping Lillypilly* (E – N – 10m x 6m)	General planting

Banksia serrata – Old Man Banksia

Planting key:
- * Both sides of street
- ** Side without wires
- *** Under wires and/or confined spaces

Species Legend

E = Evergreen **D = Deciduous**
N = Native **Ex = Exotic**
***m x *m = average mature dimensions**

Sub-precinct 2: Swamp Valley Floor – central

Precinct Palette Species	Proposed Areas
Reinforced Existing Planting	**Determined by -**
Agonis flexuosa - Willow-leaf Peppermint Myrtle*	Existing appropriate street plantings
Eucalyptus species - Gum tree**	Existing appropriate street plantings
Lophostemon confertus - Brushbox*	Existing appropriate street plantings – except in remnant buffers
Special Planting	**Major Open Space edges, Approach Streets, Urban Areas**
Ficus macrophylla - Moreton Bay Fig**	Open Space edges
Ficus rubiginosa - Port Jackson Fig**	

Eucalyptus leucoxylon – Yellow Gum

Planting key:
- * Both sides of street
- ** Side without wires
- *** Under wires and/or confined spaces

Species Legend

E = Evergreen **D = Deciduous**
N = Native **Ex = Exotic**
***m x *m = average mature dimensions**

Sub-precinct 2: Swamp Valley Floor – central (cont)

Precinct Palette Species	Proposed Areas
Informal/Formal Avenue Planting	**Nominated Use**
Agonis flexuosa - Willow-leaf Peppermint Myrtle* (E – N – 6m x 5m)	General planting
Bauhinia x blakeana - Orchid Tree** (D – Ex – 6m x 5m)	Sheltered sites
Callistemon Harkness - Bottlebrush* (E – N – 6m x 4m)	General planting
Callistemon 'Kings Park Special' – KPS Bottlebrush* (E – N – 5m x 3m)	General planting
Callistemon pinifolius - Bottlebrush*** (E – N – 2m x 1m)	General/Under wires
Corymbia maculata - Spotted Gum** (E – N – 20m x 10m)	Main Roads and Open Spaces only
Eucalyptus haemastoma - Scribbly Gum* (E – N – 8m x 6m)	General planting
Eucalyptus leucoxylon - Yellow Gum** (E – N – 8m x 5m)	Sheltered sites
Eucalyptus sideroxylon - Ironbark** (E – N – 15m x 8m)	Main Roads and Open Spaces only
Fraxinus griffithii – Evergreen Ash* (E – E – 6m x 4m)	General planting
Gleditsia triacanthos 'Sunburst' - Honey Locust* (D – Ex – 8m x 6m)	General planting
Hibiscus tiliaceus - Cottonwood* (E – N – 7m x 5m)	General planting
Hibiscus tiliaceus 'Rubra' – Bronze Hibiscus* (E – N – 5m x 4m)	General planting
Lophostemon confertus - Brushbox* (E – N – 10m x 6m)	General planting
Schinus areira - Peppercorn* (E – Ex – 10m x 8m)	Limited Use – wide verges
Stenocarpus sinuatus - Qld Firewheel Tree** (E – N – 8m x 3m)	Sheltered sites
Ulmus parvifolia - Chinese Elm* (D – Ex – 12m x 8m)	General planting

Planting key:
- * Both sides of street
- ** Side without wires
- *** Under wires and/or confined spaces

Species Legend
E = Evergreen **D = Deciduous**
N = Native **Ex = Exotic**
***m x *m = average mature dimensions**

Sub-precinct 3: Swamp Valley Floor – south

Precinct Palette Species	Proposed Areas
Reinforced Existing Planting	**Determined by -**
Eucalyptus species (incl. indigenous) - Gum tree**	Existing appropriate street plantings
Special Planting	**Major Open Space edges, Approach Streets, Urban Areas**
Araucaria heterophylla - Norfolk Island Pine**	
Ficus macrophylla - Moreton Bay Fig**	
Ficus rubiginosa - Port Jackson Fig**	

Angophora costata – Smooth-barked Apple

Planting key:
- * Both sides of street
- ** Side without wires
- *** Under wires and/or confined spaces

Species Legend

E = Evergreen **D = Deciduous**
N = Native **Ex = Exotic**
***m x *m = average mature dimensions**

Sub-precinct 3: Swamp Valley Floor – south (cont)

Precinct Palette Species	Proposed Areas
Informal/Formal Avenue Planting	**Nominated Use**
Angophora costata - Smooth-barked Apple* (E – N – 18m x 9m)	Main Roads and Open Spaces only
Banksia aemula – Wallum Banksia*** (E – N – 4m x 3m)	General/Under wires
Banksia integrifolia - Coastal Banksia* (E – N – 9m x 6m)	General planting
Banksia serrata - Old Man Banksia*** (E – N – 7m x 4m)	General planting
Banksia spinulosa – Hairpin Banksia*** (E – N – 2m x 2m)	General/Under wires
Ceratonia siliqua – Carob Tree* (E – E – 7m x 5m)	General planting
Corymbia eximia - Yellow Bloodwood** (E – N – 10m x 5m)	General planting
Corymbia maculata - Spotted Gum** (E – N – 20m x 10m)	Main Roads and Open Spaces only
Cupaniopsis anacardioides - Tuckeroo* (E – N – 6m x 5m)	General planting
Decussocarpus falcatus - Yellow Wood* (E – N – 12m x 8m)	Special plantings – limited use
Eucalyptus botryoides - Bangalay** (E – N – 20m x 9m)	Main Roads and Open Spaces only
Eucalyptus robusta - Swamp Mahogany** (E – N – 18m x 10m)	Main Roads and Open Spaces only
Fraxinus griffithii – Evergreen Ash* (E – E – 6m x 4m)	General planting
Gleditsia triacanthos 'Sunburst' - Honey Locust* (D – Ex – 8m x 6m)	General planting
Glochidion ferdinandi - Cheese Tree* (E – N – 10m x 6m)	Sheltered sites
Hibiscus tiliaceus - Cottonwood* (E – N – 7m x 5m)	General planting
Leptospermum flavescens – Tantoon*** (E – N – 2m x 2m)	General/Under wires

Planting key:
- * Both sides of street
- ** Side without wires
- *** Under wires and/or confined spaces

Species Legend **E = Evergreen** **D = Deciduous** **N = Native** **Ex = Exotic**

***m x *m = average mature dimensions**

Sub-precinct 3: Swamp Valley Floor – south (cont)

Precinct Palette Species	Proposed Areas
Informal/Formal Avenue Planting	**Nominated Use**
Leptospermum laevigatum - Coastal Tea Tree*** (E – N – 3m x 3m)	General planting
Melaleuca armillaris – Bracelet Honey Myrtle* (E – N – 5m x 4m)	General planting
Melaleuca ericifolia - Swamp Paperbark*** (E – N – 5m x 3m)	General planting – moist sites
Melaleuca linariifolia – Snow-in-Summer** (E – N – 6m x 4m)	General planting – moist sites
Melaleuca styphelioides – Prickly-leaf Paperbark* (E – N – 6m x 4m)	General planting
Pittosporum rhombifolium – Qld Pittosporum* (E – N - 8m x 3m)	Sheltered sites
Shrubland Grove Planting	**General use**
Leptospermum laevigatum - Coastal Tea Tree***	Areas of strong coastal influence: dry
Melaleuca armillaris - Bracelet Honey Myrtle*	Areas of strong coastal influence: damp

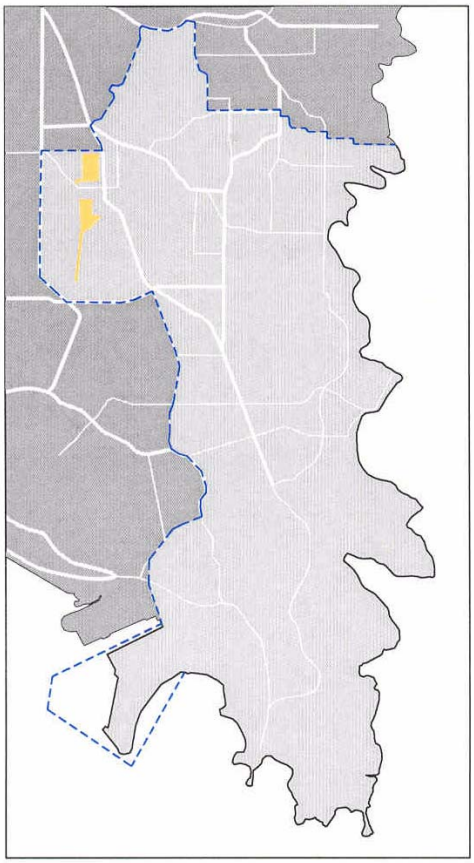
Eucalyptus haemastoma – Scribbly Gum

Planting key:
- * Both sides of street
- ** Side without wires
- *** Under wires and/or confined spaces

Species Legend **E = Evergreen** **D = Deciduous** **N = Native** **Ex = Exotic**

***m x *m = average mature dimensions**

2.6.8 Remnant Dune Structures



This precinct is defined as two hill-like formations that occur within the Swamp Valley Floor. These elevated landforms are quite distinct to the topography which surrounds them. Soils in this precinct would be better drained than those of the lower ground. This small precinct dissects Kensington. Refer to Plate 1: Randwick Precincts for precise locations.

They are identified as a precinct because of their high visibility from surrounding areas. Increased vegetation in these streets will impact on the surrounding areas, contributing to a sense of strong vegetation.

Development on the more northern of the two hills includes some very prominent high-density residential apartments. The other hill is much less developed, with large areas of open space retained as a school site.

Ulmus parvifolia – Chinese Elm

A ISSUES

Original Vegetation and Remnants

The pre-settlement vegetation community of these landforms is described as a continuation of the Eastern Suburbs Banksia Scrub found on the surrounding valley floor. There are no recorded remnants in this precinct at this time.

Existing Planting

This precinct is relatively well vegetated, although a proportion of the existing planting in under-scaled, given the prominence of the surrounding hills, and there is a need to reinforce planting that will help complement large-scale unit development.

Sub-precinct 1: Remnant Dune – north

Typical Precinct species	Occurrence
Agonis flexuosa - Willow-leaf Peppermint Myrtle	Scattered
Eucalyptus species - Gum tree	Scattered
Ficus species - Fig tree	Partial avenues
Lophostemon confertus - Brushbox	Partial avenues

Sub-precinct 2: Remnant Dune – south

Typical Precinct species	Occurrence
Eucalyptus species - Gum tree	Scattered
Ficus species - Fig tree	Partial avenues
Melaleuca quinquenervia - Swamp Paperbark	Scattered

B OPPORTUNITIES

These opportunities are described and illustrated in Section 2.4. However, because the area covered in this palette is so small and it is completely surrounded by Swamp Valley Floor – north, there are no real opportunities to provide buffer planting or to undertake significant corridor planting.

C OBJECTIVES

- **To create planting that exaggerates the size of these hills**
- **To use tree species that complement existing large scale unit development**

D STRATEGIES

To use tree species that complement large scale unit development and which exaggerate the size of surrounding hills. Wherever it specifically complements the objectives and strategies of any particular palette, existing appropriate street tree species will be utilised in streets predominantly planted out with such species.

Sub-precincts 1 and 2: Remnant Dune – north and south

Precinct Palette Species	**Proposed Areas**
Typical Precinct species	**Occurrence**
Eucalyptus species - Gum tree**	Scattered
Ficus species - Fig tree**	Partial avenues
Melaleuca quinquenervia - Swamp Paperbark**	Scattered
Special Planting	**Major Open Space edges, Approach Streets, Urban Areas**
Araucaria heterophylla - Norfolk Island pine**	
Schinus areira - Peppercorn*	Limited use only
Ficus macrophylla - Moreton Bay Fig**	
Ficus rubiginosa - Port Jackson Fig**	
Ficus superba var. henneana - Deciduous Fig**	
Livistona australis – Cabbage Tree palm**	

Planting key:
* Both sides of street
** Side without wires
*** Under wires and/or confined spaces

Species Legend **E = Evergreen** **D = Deciduous**
N = Native **Ex = Exotic**
***m x *m = average mature dimensions**

Sub-precincts 1 and 2: Remnant Dune – north and south (cont)

Precinct Palette Species	Proposed Areas
Informal/Formal Avenue Planting	**Nominated Use**
Acmena smithii - Lillypilly** (E – N – 10m x 5m)	General planting
Agonis flexuosa - Willow-leaf Peppermint Myrtle* (E – N – 6m x 5m)	General planting
Albizia julibrissin - Silk Tree* (D – E – 5m x 4m)	General planting
Backhousia citriodora - Lemon Myrtle* (E – N – 10m x 4m)	Sheltered sites
Elaeocarpus reticulatus - Blueberry Ash** (E – N – 8m x 3m)	Sheltered sites
Eucalyptus mannifera – Red Spotted Gum** (E – N – 10m x 6m)	General planting – wider verges
Fraxinus griffithii - Evergreen Ash*** (E – E – 6m x 4m)	General planting
Glochidion ferdinandi - Cheese Tree* (E – N – 10m x 6m)	General planting
Koelreutaria paniculata – Golden Rain Tree* (D – E – 7m x 5m)	Sheltered sites
Lagerstroemia indica - Crepe Myrtle*** (D – Ex – 5m x 4m)	Sheltered sites
Lophostemon confertus - Brushbox* (E – N – 10m x 6m)	General planting
Stenocarpus sinuatus - Qld Firewheel Tree** (E – N – 8m x 3m)	Sheltered sites
Syzygium luehmannii - Small-leaf Lillypilly* (E – N – 8m x 4m)	Sheltered sites
Syzygium paniculatum - Magenta Lillypilly* (E – N – 10m x 5m)	Sheltered sites
Ulmus parvifolia - Chinese Elm* (D – Ex – 12m x 8m)	General planting
Waterhousia floribunda - Weeping Lillypilly* (E – N – 10m x 6m)	General planting

Planting key:
- * Both sides of street
- ** Side without wires
- *** Under wires and/or confined spaces

Species Legend **E = Evergreen** **D = Deciduous** **N = Native** **Ex = Exotic**

***m x *m = average mature dimensions**

2.7 MAIN ROADS

2.7.1 METHODOLOGY

Roads chosen for specific species nomination were those shown on the road hierarchy map (Figure 2.6) as arterial and sub-arterial. After careful consideration, Clovelly Road was added to this section.

To determine a species for main road planting the following steps were undertaken:

1. Using the precincts already determined, each road was divided into portions as it crossed various precinct boundaries.

2. The mapped database was then consulted to determine existing planting.

3. The existing planting was then compared to the palette of proposed species for that precinct. If the existing planting was listed to be continued, the same species was nominated. Otherwise, a selection was made from the palette of proposed species.

This study only nominates a preferred tree species for each road. Design development as indicated in the Action Plan (Section 4.2) will be required to enable many of these species to be planted.

Jacaranda mimosifolia – Jacaranda

2.7.2 PROPOSED SPECIES*

Street Portions	Proposed Principal Species
Alison Road	
Anzac Parade - Avoca Street	*Platanus x hybrida* - London Plane
Anzac Pde	
Alison Road – Gardeners Road	*Platanus x hybrida* - London Plane
	Magnolia 'Little Gem' – Little Gem Magnolia (awnings)
Gardeners Road – Snape Street	*Corymbia citriodora* - Lemon-scented Gum
Snape Street – Gale Road	*Eucalyptus sideroxylon* - Ironbark
Gale Road – Haig Street	*Eucalyptus leucoxylon* - Yellow Gum
Haig Street – Minneapolis Crescent	*Eucalyptus sideroxylon* - Ironbark
Minneapolis Cres – Lawson Street	*Banksia integrifolia* - Coastal Banksia
Lawson Street – Forrest Street	*Eucalyptus haemastoma* - Scribbly Gum
Forrest Street – Jennifer Street	*Banksia integrifolia* - Coastal Banksia
Jennifer Street – Little Bay Rd	*Angophora costata* - Smooth-barked Apple
Little Bay Rd – Bunnerong Road	*Banksia integrifolia* - Coastal Banksia
Bunnerong Road – La Perouse	*Angophora costata* - Smooth-barked Apple
Arden Street	
Malabar Road – Carr Street	*Eucalyptus haemastoma* - Scribbly Gum
	Banksia serrata - Old Man Banksia (under wires)
Dolphin Street – Alison Road	*Livistona australis* – Cabbage Tree Palm
	Banksia serrata - Old Man Banksia (under wires)
Alison Road – Clovelly Road	*Eucalyptus haemastoma* - Scribbly Gum
Clovelly Road – Varna Street	*Banksia serrata* - Old Man Banksia
Avoca Street	
Anzac Parade – Rainbow Street	*Corymbia maculata* - Spotted Gum
Rainbow Street – Frenchmans Rd	*Corymbia citriodora* - Lemon-scented Gum
	Eucalyptus haemastoma - Scribbly Gum (under wires)
Frenchmans Rd – Clovelly Road	*Eucalyptus deanei* – Round-leaf Blue Gum
	Tristaniopsis laurina - Water Gum (under wires)
Clovelly Road – Darley Road	*Angophora costata* - Smooth-barked Apple
Barker Street	
Botany Street – Avoca Street	*Jacaranda mimosifolia* - Jacaranda

* Unless otherwise stated, nominated tree species can be planted on both sides of the street

2.7.2 PROPOSED SPECIES (CONT)*

Street Portions	Proposed Principal Species
Beauchamp Rd	
Anzac Pde – Malabar Road	*Eucalyptus haemastoma* - Scribbly Gum
Belmore Road	
Avoca Street – Alison Road	*Magnolia 'Little Gem'* – Little Gem Magnolia
Botany Road	
Beauchamp Rd – Bunnerong Rd	*Angophora costata* - Smooth-barked Apple
Bunnerong Road	
Anzac Pde – Snape Street	*Eucalyptus botryoides* - Bangalay
Snape Street – Beauchamp Rd	*Ficus superba var henneana* – Deciduous Fig
Beauchamp Rd – Botany Rd	*Eucalyptus robusta* - Swamp Mahogany
	Corymbia eximia - Yellow Bloodwood (under wires)
Carrington Road	
Coogee Bay Rd – Frenchmans Rd	*Glochidion ferdinandi* - Cheese Tree
Frenchmans Rd – Darley Road	*Angophora costata* - Smooth-barked Apple
Clovelly Road	
Frenchmans Rd – Donnellan Cct	*Banksia integrifolia* - Coastal Banksia
	Banksia serrata - Old Man Banksia (under wires)
Coogee Bay Road	
Avoca Street – Brook Street	*Livistona australis* – Cabbage Tree Palm
	Awnings – no trees
Darley Road	
Alison Road – Carrington Rd	*Angophora costata* - Smooth-barked Apple
Doncaster Avenue	
Alison Road – Todman Ave	*Schinus areira* - Peppercorn
Fitzgerald Avenue	
Bunnerong Rd – Anzac Pde	*Ficus macrophylla* - Moreton Bay Fig
	Cupaniopsis anacardioides – Tuckeroo (under wires)
Anzac Pde – Malabar Road	*Ficus macrophylla* - Moreton Bay Fig
	Cupaniopsis anacardioides - Tuckeroo (under wires)
Malabar Road – Marine Pde	*Araucaria heterophylla* - Norfolk Island Pine

* Unless otherwise stated, nominated tree species can be planted on both sides of the street

2.7.2 PROPOSED SPECIES (CONT)*

Street Portions	Proposed Principal Species
Frenchmans Road	
Avoca Street – Carrington Rd	*Angophora costata* - Smooth-barked Apple
Gardeners Road	
Bunnerong Road – Tunstall Ave	*Corymbia citriodora* - Lemon-scented Gum
Malabar Road	
Arden Street – Maroubra Rd	*Banksia integrifolia* - Coastal Banksia
	Banksia serrata - Old Man Banksia (under wires)
Maroubra Rd – Beauchamp Rd	*Angophora costata* - Smooth-barked Apple
Marine Parade	
Fitzgerald Ave – Wilson Street	*Araucaria heterophylla* - Norfolk Island Pine
	Banksia serrata - Old Man Banksia (western side of street)
Maroubra Road	
Bunnerong Rd – Cooper Street	*Eucalyptus haemastoma* - Scribbly Gum
Cooper Street – Malabar Road	*Angophora costata* - Smooth-barked Apple
Malabar Road – Marine Parade	*Banksia integrifolia* - Coastal Banksia
	Banksia serrata - Old Man Banksia (under wires)
Rainbow Street	
Anzac Pde – Kennedy Street	*Calodendron capense* - Cape Chestnut
Kennedy St – Avoca Street	*Corymbia maculata* - Spotted Gum
	Eucalyptus leucoxylon - Yellow Gum (under wires)
Todman Avenue	
Dowling St – Lenthal Street	*Lophostemon confertus* - Brushbox
Lenthall Street – Doncaster Ave	*Jacaranda mimosifolia* - Jacaranda

* Unless otherwise stated, nominated tree species can be planted on both sides of the street

3.0 RECOMMENDATIONS FOR DESIGN AND MANAGEMENT

3.1 THE REQUIREMENTS OF STREET TREES

To obtain the benefits of street trees, the needs of trees must be considered. For trees to function, the following requirements must be met.

- **Suitable temperature range**

Trees must be climatically suited to the site. Because the general climatic conditions of any given site are largely pre-determined, suitable species need to be selected.

- **Air**

Oxygen is required for all cells, carbon dioxide by the leaves. Oxygen for tree roots is one of the most limiting factors for tree growth. The root space available in most streets is generally limited and consists of poorly constructed soils.

- **Water**

Water is another limiting factor. Growth can be limited by its scarcity, or by too much water preventing adequate oxygen supply to the roots.

- **Support**

An adequate growing media in which the tree's roots can develop an anchorage system.

- **Nutrients**

While proportions are variable between species, all trees require an adequate supply for growth and maintenance.

- **Light**

Light is essential for photosynthesis. This may be a limiting factor depending on overshadowing by other trees or tall buildings.

Overall, the tree must have enough room in which to grow. Trees in streets rarely have the opportunity to reach their full potential of size and/or lifespan. There are two main reasons for this:

  - compared to the tree's natural environment, the stressful environment and the limited access to essential requirements reduce plant vigour, and

- the physical space in which the tree has to grow is limited by pavements, kerbs, driveways, fences, buildings, roads, utilities and powerlines.

Trees in streets should be considered to have a definite life span and their replacement planned for.

Because of the many roles and functions of the street and the many services that are located there, it is inevitable that there is conflict between services and the needs of the tree.

Gleditsia triacanthos "Sunburst' – Honey Locust

3.2 MANAGING EXISTING TREES

3.2.1 PRUNING

Pruning is a necessary maintenance task for the ongoing management of Randwick's trees. However, past pruning practices have resulted in some undesirable effects. The following paragraphs discuss various pruning techniques, and their applicability or otherwise to Randwick's street trees.

Lopping

The problems associated with the selection of tall-growing species have been exacerbated by lopping practices employed to reduce the height of trees growing under powerlines. Lopping is the practice of reducing a branch by a particular distance rather than to a growing point. The resultant growth is vigorous, vertical in habit, weakly attached and dense. This is shown in Figure 3.1. Lopping destroys the natural habit of trees and predisposes branches to decay and storm damage. It is not uncommon for regrowth from lopped branches to be 10-20 times more vigorous than natural growth from unpruned branches.

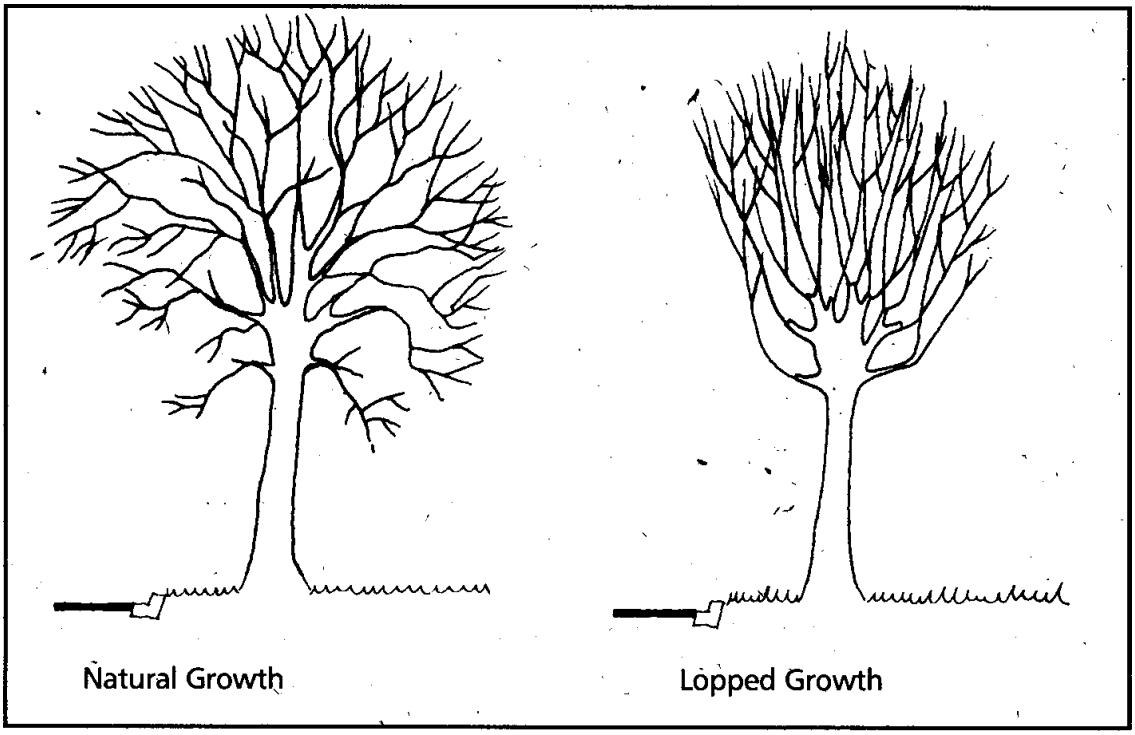


FIGURE 3.1
Natural growth and Lopped growth

While it is a common belief that the harder a tree is pruned, the slower the regrowth, in reality the regrowth is rapid. This belief has often resulted in tree trimming gangs cutting below the position of the previous season's growth and hence encouraging very rapid regrowth. The result is a lopping 'treadmill', with trees being pruned from wires on an annual basis. The practice represents a huge cost to the community.

Lateral or horizontal branches on street trees are perhaps the most functional in terms of shading and visual screening. However, when the tops of trees are lopped, the tree is often also ‘neatened up’ by removing the ends of the horizontals. Lateral branches may also be removed for vehicular clearance or from property alignments. It is extremely difficult to re-work a tree which consists of a trunk and several upright branches.

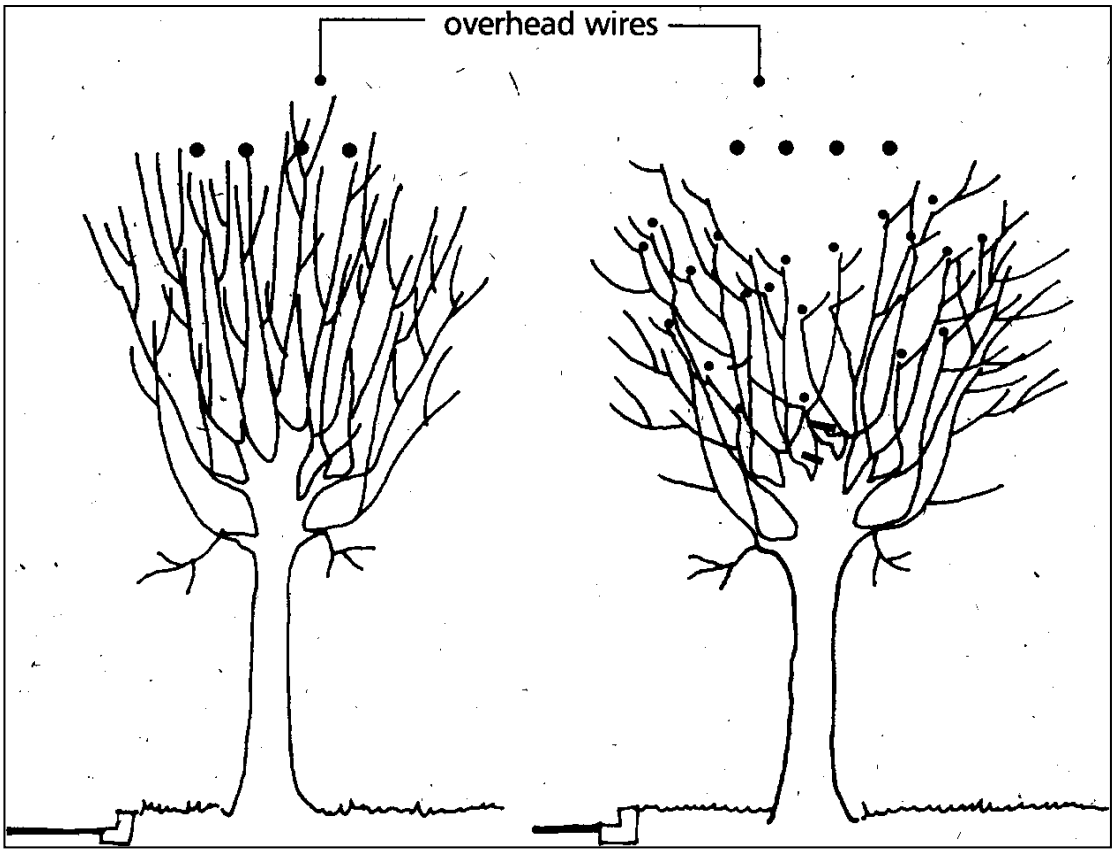


FIGURE 3.2
Principles of re-working a previously lopped tree

Given all these reasons, the cessation of lopping as a management technique is standard practise. The re-working of previously lopped trees may be possible in accordance with the techniques illustrated in Figure 3.2 above.

Directional Pruning

Over-pruning has several detrimental effects, including: sunburn of internal branches, a very bare and unnatural appearance, and the encouragement of suckering on exposed branches. Directional pruning is an alternative pruning method that prevents these undesirable effects.

Directional pruning is the removal of selected branches to branch collars or to a growing point. The branch collar is the point at which branches are naturally shed. It contains chemicals which inhibit the development of decay-causing organisms and is part of the tree's protection system. It is essential that pruning cuts be made to this point. This is shown in Figure 3.3.

The purpose of directional pruning is to remove only the branch or branches causing the problem, be it growing into powerlines or a low branch across a pathway.

This method, resulting in a more natural appearance to the tree, has several advantages over lopping:

- Minimal removal of branches
- Little or no increase in growth rate, and
- Minimal suckering from cut branches

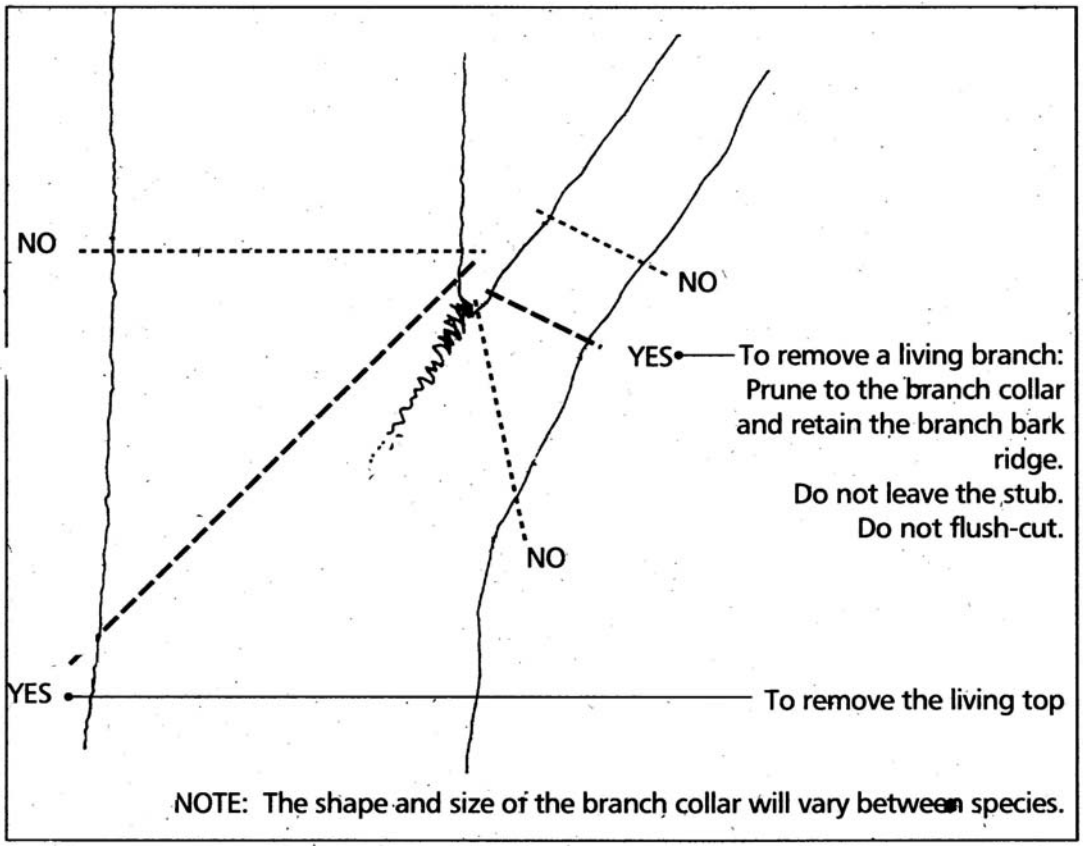


FIGURE 3.3 Positioning of pruning cuts

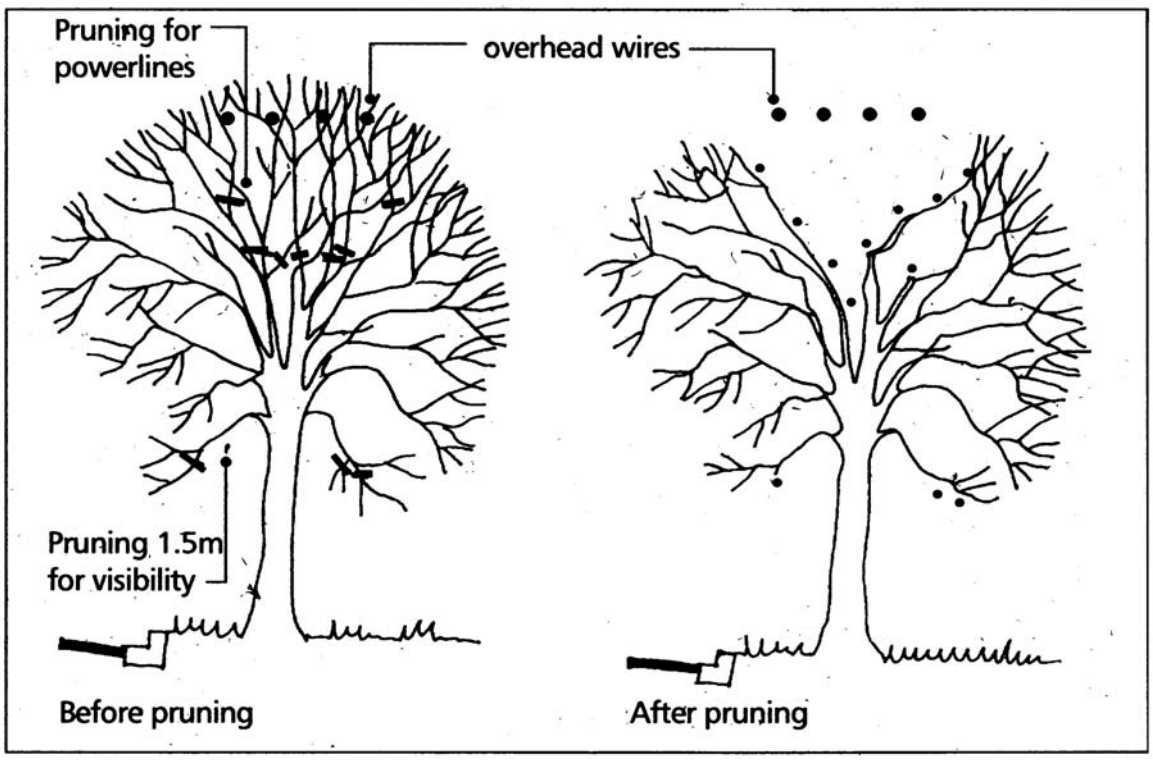


FIGURE 3.4 Directional Pruning and Crown lifting

Directional pruning is best achieved when the tree species is of a broad-dome shape with reasonably closely spaced branches and when the pruning commences at an early stage (Figure 3.4).

Directional pruning, tip pruning or re-working can only be recommended for those trees where there is sufficient depth of crown and/or suitable horizontal branches. Re-working a crown under powerlines usually involves the removal of old unproductive stubs from the centre of the tree, selective removal of vigorous, upright branches and the pruning back of remaining problem branches. No precise instructions can be given for pruning, as all trees must be treated on an individual basis.

Experience with pruning such trees has shown that minimal pruning results in fewer problems for the tree in the long term. Tip pruning is directional pruning where the tips of branches are reduced to lower lateral branches. This procedure is useful for re-working trees consisting almost entirely of vertical shoots if a reasonable depth of crown remains between the required clearances for both wires and pedestrian access. This technique reduces the apical dominance of the branches, hence slowing the growth rate or at least not invigorating the tree.

Adequate foliage is retained, benefiting both the tree and the landscape. The technique is shown in Figure 3.5. Many tree species respond better to minimal tip pruning than to the practice of creating a bare framework.

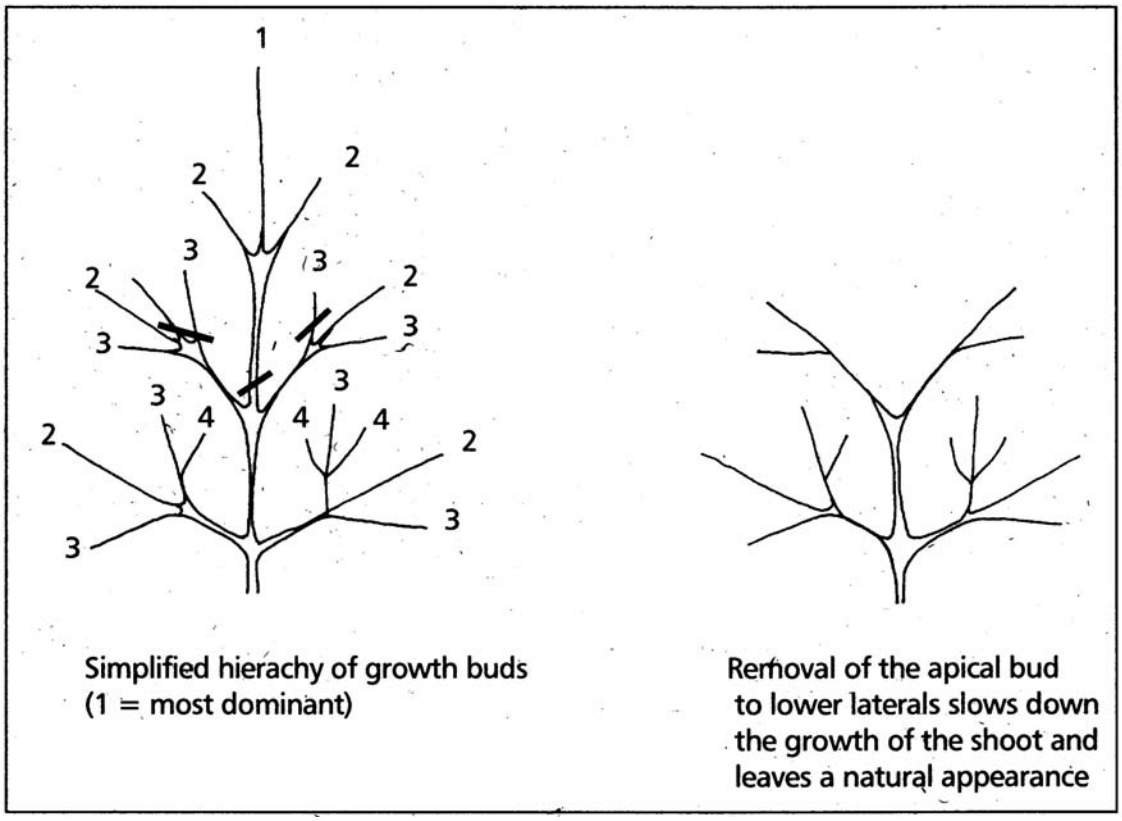


FIGURE 3.5 The principles of tip pruning

Other Pruning Practices

Thinning techniques for unpruned trees

The practice of tree height reduction has been curtailed in favour of a process of sympathetic thinning to allow more light penetration and wind movement. Thinning involves the removal of secondary branches back to the branch collar whilst retaining the main structural branches and hence the overall shape of the tree. This is illustrated in Figure 3.6.

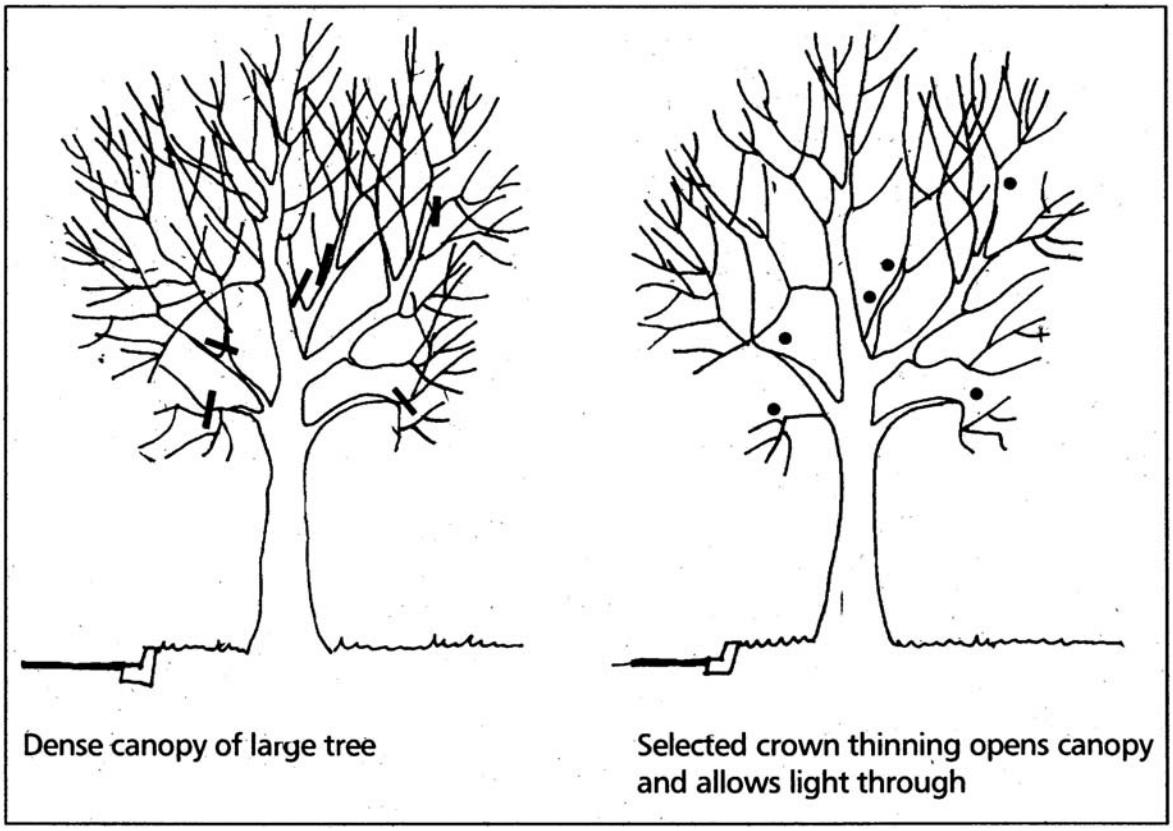


FIGURE 3.6 Crown Thinning

Crown lifting

Crown lifting is the removal of low branches over footpaths and roadways to ensure adequate clearance and visibility. Removal of low branches forces growth toward the top of the tree. If these trees are also under powerlines, the net result is a crown that is too small to work with.

Excessive removal of horizontal branches also reduces the functional value of the tree by removing the branches which shade and screen. On young trees, low branches feed the trunk and develop trunk strength. It is recommended that crown lifting be done on a gradual basis and that clearances be kept to the minimum requirement.

Early Training of Trees

In many areas of the City there have been new or relatively recent plantings of trees. Some of these trees have been planted under powerlines. Even though many of these trees are not yet interfering with the wires, directional pruning of these trees should commence as soon as possible so as to minimise the impact of future growth. Minimal pruning now will represent significant savings in the future. The same procedure applies for crown lifting.

3.2.2 POWERLINES AND CABLE SERVICES

The present method of distributing electricity is via bare overhead line conductors. These wires must be kept free of interference by trees. There are several problems associated with powerlines and trees in the Randwick City area. Bare overhead wires, poles and wires on both sides of some streets, and low clearances from some low voltage spans, particularly mid span, mean that trees require regular pruning to maintain clearances.

There are various alternatives that may be appropriate and some of these are detailed below.

Aerial Bundled Cabling (ABC)

This is an overhead line construction where individual conductors are insulated and bundled together as a single cable. The use of low voltage aerial bundled cabling (ABC) is now commonplace among many Australian energy distribution authorities.

ABC offers significant economic and operational advantages over the traditional individual bare conductors whilst also reducing the need for tree trimming (Electricity Supply Association of Australia, 1990). EnergyAustralia's policy on ABC is that from July, 1991, ABC will be used for all new low voltage overhead supply. ABC will also be used where low voltage mains replacement is required for routine development of the electricity distribution system.

In most streets in the Randwick City area, ABC would certainly minimise the impact of pruning on the street trees. Contact with leaves and twigs is tolerated, but branches thicker than 20mm in constant contact with the cable should be removed to avoid abrasion.

The main factor inhibiting the use of ABC in the Randwick City area is cost. Existing powerlines can be converted to ABC at a cost to Council of approximately $2000 per span. This is to replace the four-wire low voltage plus one- or two-wire street lighting aerials with twin ABC, provided that no extra poles are required.

Randwick has already begun an annual programme of aerial bundling. It is recommended that this be continued (Refer to Action Plan in Section 4.2).

Underground power

The undergrounding of powerlines is often suggested as the best means of avoiding conflict between trees and powerlines. However, due to the materials required, the amount of trenching along both sides of the street and across roads, as well as the cost of dismantling services, the overall cost of undergrounding power in established areas is usually prohibitive. Technical advice from EnergyAustralia suggests costs of 10-15 times that of conventional construction for undergrounding.

Other problems with underground power are the creation of new trenches in often narrow strips between the property line and kerb, as well as the resulting damage to the roots of existing trees.

Installation of wires on facades

This approach would be limited to shop front facades in the commercial areas where the urban form provides a continuous line of built form. Similar installations have recently been carried out on King Street, Newtown, and along part of Parramatta Road, Leichhardt.

Rationalising of wires

In some streets where presently overhead wires exist on both sides of the street, a substantial reduction in the maintenance regime can be achieved through the rationalising of these wires on to one line of power poles only.

3.2.3 TREE ROOTS

In understanding why root problems occur, it is useful to consider the nature and functioning of tree roots. Roots anchor the tree in the ground, take up water and nutrients, store food reserves and produce some growth hormones. Root growth of trees is opportunistic and takes place wherever the environment is favourable: that is, where there is sufficient water, nutrients, warmth and above all, air.

Because of the requirement for oxygen, most tree roots will be located near the surface (certainly within the top 500mm of most soils) and will often extend for distances greater than twice the height of the tree (Figure 3.7). Surface roots will grow along cracks and crevices in pavements (Clarkson, 1991).

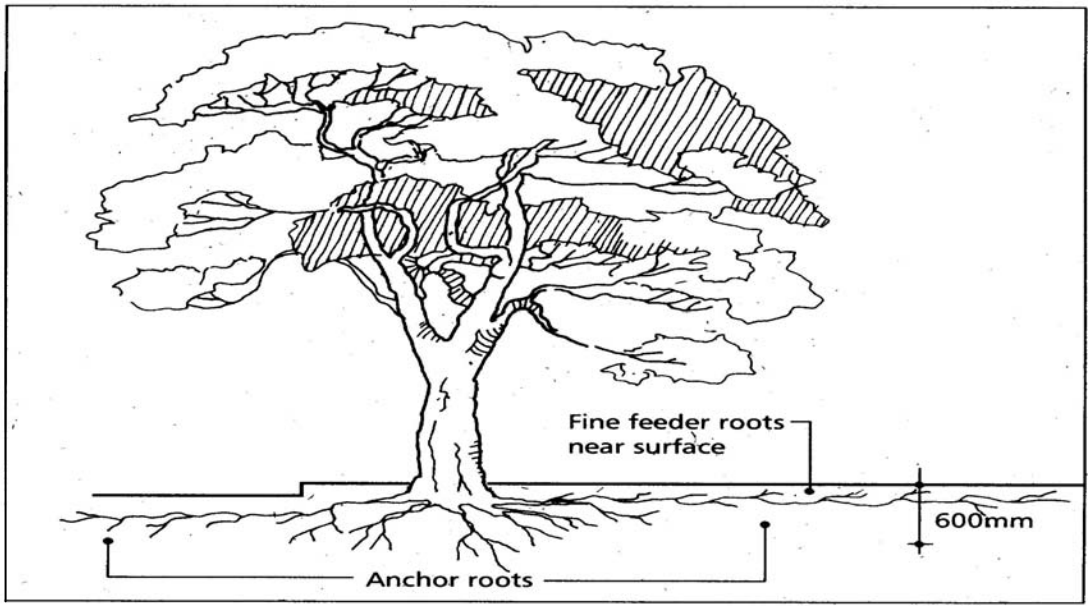


FIGURE 3.7 Typical extent of roots

The problem and costs

Primary damage to pavements generally occurs close to the base of the tree due to secondary expansion of structural roots. This rate of expansion increases as the roots are exposed to light. Further from the tree, roots divide and become finer. Less damage occurs further from the base of the tree.

Several problems associated with root growth frequently occur in the Randwick City area. The most common problems are the cracking and lifting of footpath slabs and kerbing and guttering, as well as damage to private property. This often impedes the run-off of storm water, resulting in water ponding and stagnating. Where cracking and lifting is severe, the road pavement may also be damaged.

Other problems occur where large surface roots or the basal flaring of the trunk causes mounding and uplift of the nature strip. This presents a potential hazard to pedestrians, particularly in narrow nature strips.

The blocking of sewers is an ongoing problem. Plumbing repairs range from electric eel treatment of blocked sewers to more permanent repairs. Concrete encasement of pipes or total replacement with solvent sealed PVC are effective but very expensive.

The cause of root problems

- ***Mis-matching species selection to site***

The selection of large growing trees with surface roots and/or basal flaring of the trunk is a significant cause of damage to street infrastructure. *Melaleuca quinquenervia* is found naturally in poorly aerated soils along creek and estuary banks. This makes an ideal specimen for survival in poorly aerated, compacted and generally hostile soils common in nature strips. Its method of surviving in poorly aerated conditions is to produce many large surface roots.

Ficus microcarpa var. 'Hillii' grow to significant dimensions and produce a broad bole at the base of the tree for support. Hence the inherent characteristics of this species create problems in nature strips not designed to accommodate them.

Planting in narrow nature strips exacerbates the problems of poor species selection. Quite simply, there is not enough room for the roots to function without causing problems. Many trees have been planted within a metre of the kerb, which clearly does not allow for the nominal increase in trunk diameter of these species.

- ***Poorly aerated soils***

The soil in nature strips is often variable and may not be representative of the natural soil of the area. Subsoil and other spoil from paving, trenching and road construction can create an inhospitable rooting environment. The usual planting procedure involves digging a hole approximately 400 to 600mm wide and 200mm deeper than the container size and then backfilling with an improved potting mix. A 200mm containerised plant is then placed into this mix. This would present limited 'ideal' conditions for root growth.

Surface compaction, as a result of poor soil structure, pedestrian and mower traffic, also decreases water infiltration. For these reasons, tree roots tend to develop near the surface for air and water.

In a survey of street tree root problems in twenty-two Californian cities, it was observed that trees planted in deep, non-compacted soils ten years or more before the installation of kerbs and footpaths created fewer concrete breakage problems than the same species planted in a compacted soil after kerbs and footpaths were in place. It should be noted that some root damage would have been inevitable when these structures were installed but careful species selection could minimize the risk. The main implication of this observation for existing trees are the benefits of appropriate species selection and the use of de-compacted soils. (Armstrong et al, 1991, p105).

- ***Lopping of trees***

In some instances, the repeated lopping of the tops of trees can worsen tree root problems. When the top is removed, sugars moving to the roots are reduced and some roots will die back. When the tree 'recovers' via epicormic shoots and more sugars are produced, growth of new roots will occur, usually in the favourable positions above the older roots. This is particularly the case with the species *Ficus microcarpa var. 'Hillii'*.

Solutions to root problems

In developing solutions to the problems caused by roots it is necessary to address the causes of these problems. The best and least expensive alternative for new areas is to design planting and paving configurations that include larger planting areas (see Section 3.3 and Section 3.4). However, for existing situations where alternative street designs will not be installed, the following

recommendations are based on the existing design of roads, kerbs, gutters and footpaths.

- ***Root pruning***

Root pruning should take place where trees are in good health, where there is opportunity to widen nature strips and the crowns are in good or manageable condition. When the roots are pruned they should be cut as far away from the tree's zone of rapid root taper as possible and cuts should be made cleanly. This may be done by hand, with concrete cutters or with specially designed root pruners.

Whilst trenching is a possible means of controlling problem roots it has problems of its own. It may destabilize trees, leading to crown dieback and susceptibility to other stresses and secondary problems. It may also stimulate new root growth, necessitating ongoing treatment, unless permanent barriers are installed within the trench, if appropriate.

- ***Soil aeration***

One technique to aerate soils in existing planting situations involves the use of a 'Terra-Lift'. This machine uses compressed air to force air through a probe inserted into the soil. The effect is to shatter and decompact the soil for an area of 2-4 square metres wide and up to one metre deep. This device can also be used to place fertilizers and soil conditioners into the soil. It can be used around established trees or prior to planting. It is reported not to damage underground services unless the probe actually penetrates the pipe.

3.3 PLANTING PRINCIPLES

3.3.1 SELECTING PLANTING LOCATIONS

The following guidelines have been prepared to help determine appropriate planting sites for commonly used planting locations. These are general principles only and each planting project will require individual assessment. In addition to observing these guidelines, the following points should be made:

- No trees should be planned for sites with recognized established accident histories;
- The planting of large specimens in parks, or other pockets of public open space such as schools, adjacent to road reserves where there is little opportunity for planting trees on the nature strip, should be exploited;
- Non-powerline sides of streets should be exploited first for potential tree sites;
- Always consider the position of street lighting when positioning street trees.

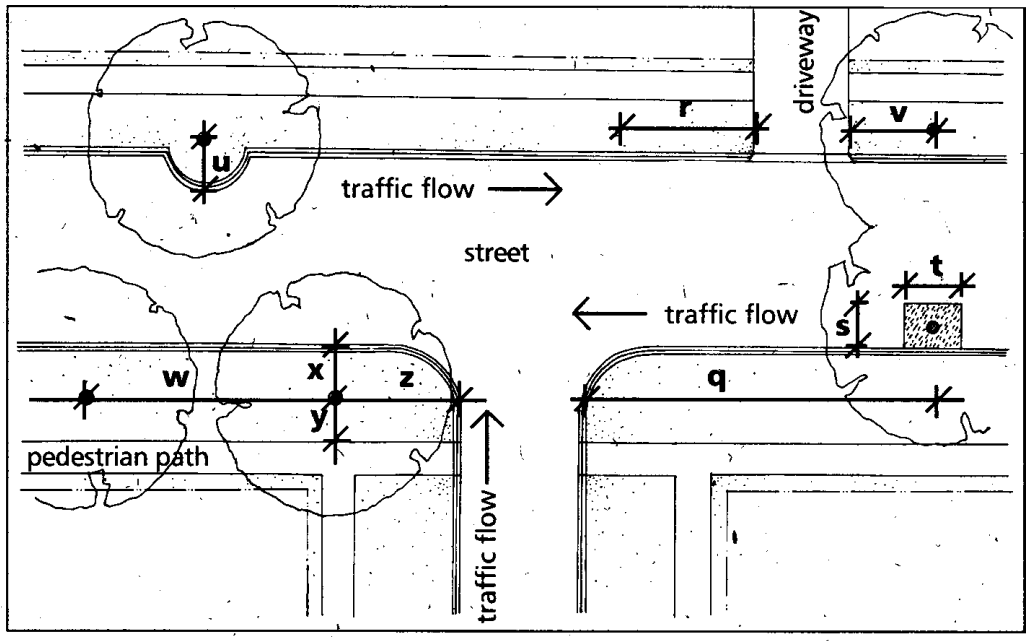


FIGURE 3.8 Code for Table of Distances

q = distance from road intersection (approaching traffic flow)
r = distance from driveway (approaching traffic flow)
s = width of carriageway planting area
t = length of carriageway planting area
u = radius of kerb extension
v = distance from driveway (passenger preferred side)
w = distance between trees
x = distance from kerb
y = distance from footpath
z = distance from road intersection
(i) arterial and sub-arterial roads
(ii) collector roads
(iii) local roads

TABLE 1 Planting Distances for Roads

TREE TYPE	q	r	s	t	u	v	w	x	y	z(i)	z(ii)	z(iii)
Shrubs	10	7	2	2.5	2	4	3	1	1	10	7	7
Small Trees	10	7	2	2.5	2	4	5	1	1	10	7	7
Medium Trees	10	7	2	2.5	2	4	7.5	1	1	10	7	7
Large Trees	10	7	2	2.5	2	4	10	1.5	1.5	10	7	7

3.3.2 SPECIFICATIONS FOR PLANTING

While planting Specifications will vary depending on the location, plant size, and species, etc, Figure 3.9 shows a typical guide to planting.

It is the intention to minimise or delay root disturbance to pavements by new planting, by taking advantage of the way in which roots are known to grow. The following methods are recommended for adoption.

- ***Soil Preparation***

Provide a greater volume of aerated soil to encourage deeper root development from the base of the tree. To avoid surface rooting and its associated problems, well-aerated planting holes or strips should be prepared prior to re-planting. As roots follow the path of least resistance and favour the most aerated parts of the soil, planting holes should be dug as large as possible with drainage provided if necessary.

An elongated planting hole will encourage roots to travel parallel with the roadway. Alternatively, a method worth trialing is the aeration of a well-prepared planting strip between the kerb and other service trenches. The aim of this is to encourage root growth along the nature strip and to minimise the problems of surface rooting and kerb damage. This could be achieved by single tyned ripping of the soil in new plantings, particularly if kerb and turf are to be reinstated. The main limitation of this method is the presence and location of underground services.

Deeper root development can be encouraged by installing aeration pipes at the bottom of planting holes and running them away from the base of the tree. This can also encourage growth parallel to the road.

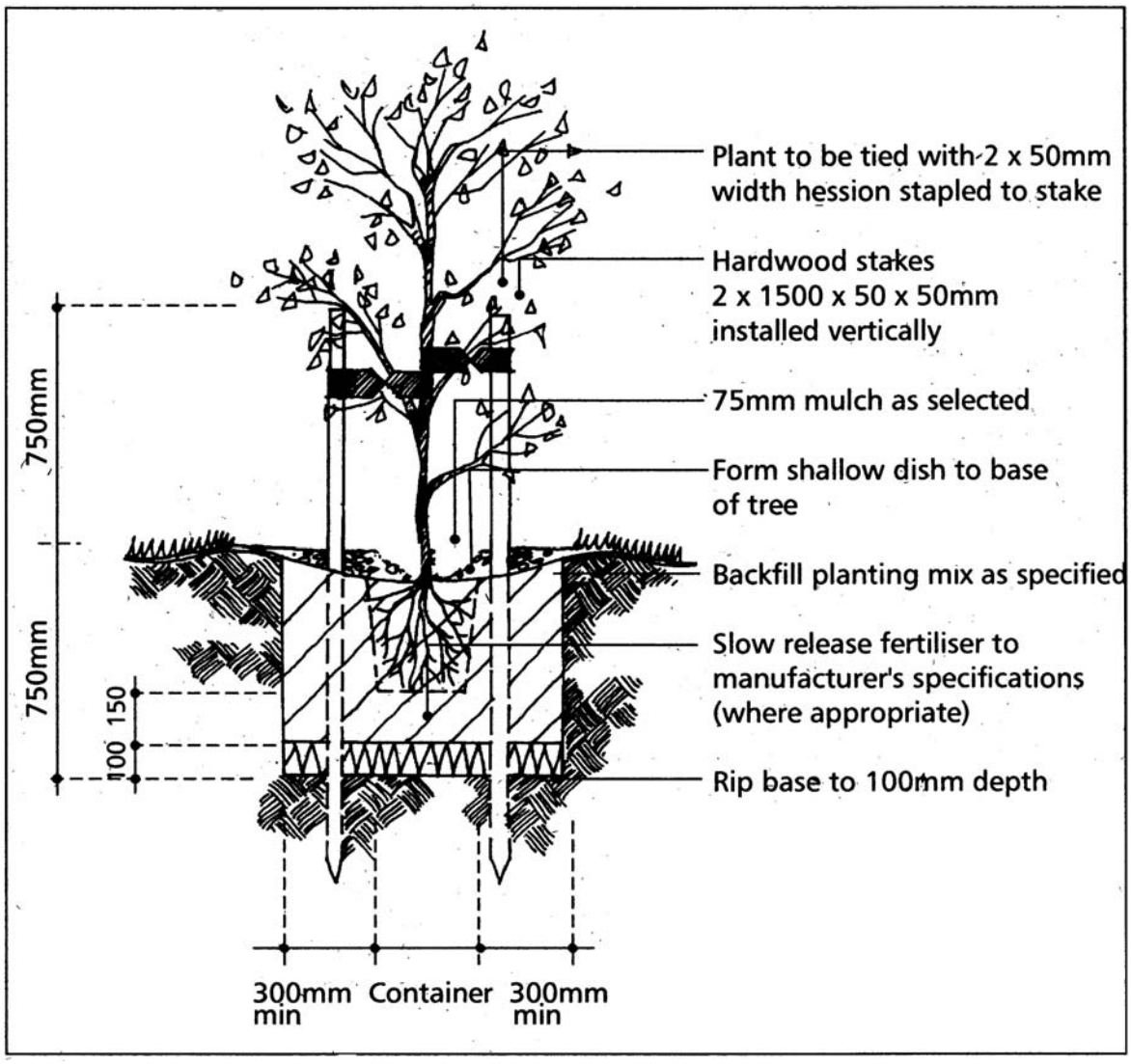


FIGURE 3.9 Typical planting detail

3.4 STREET DESIGN OPTIONS

In some areas there may be scope for redesigning the street, in order to reduce the conflict of trees with other services. The problems which the new street design options are selected to address are:

- the problem of urban water management
- the conflict between tree roots and kerb and guttering and footpaths
- the conflict with overhead powerlines

All options have been developed with consideration to the maintenance of clear ground plane visibility for pedestrian and traffic safety.

The measures specific for street redesigns should be viewed in concert with other management techniques that address the same issues from a management perspective.

Due to the pressures of traffic management, the street character in many places has been altered by roundabouts, crash control barriers, median strip traffic control, and other traffic control measures. As well, the development of major shopping complexes often results in quite dramatic impacts on existing streets. Another change which is evident in streets is streetscape improvements. Many of these improvement schemes result in significant change to the street character, particularly where garden beds are installed or ‘blister gardens’ have been created.

In order to compensate for such changes in the character of Randwick’s streets, the street design options are selected to maintain the simplicity of the street form while addressing the particular problems of Randwick.

On wide streets without heavy traffic, bitumen road shoulders may be replaced with gravel (stabilized decomposed granite) and tree planting which is well protected by strong tree guards, as illustrated in Figure 3.10. This is also shown in the perspective drawing, Figure 3.16.

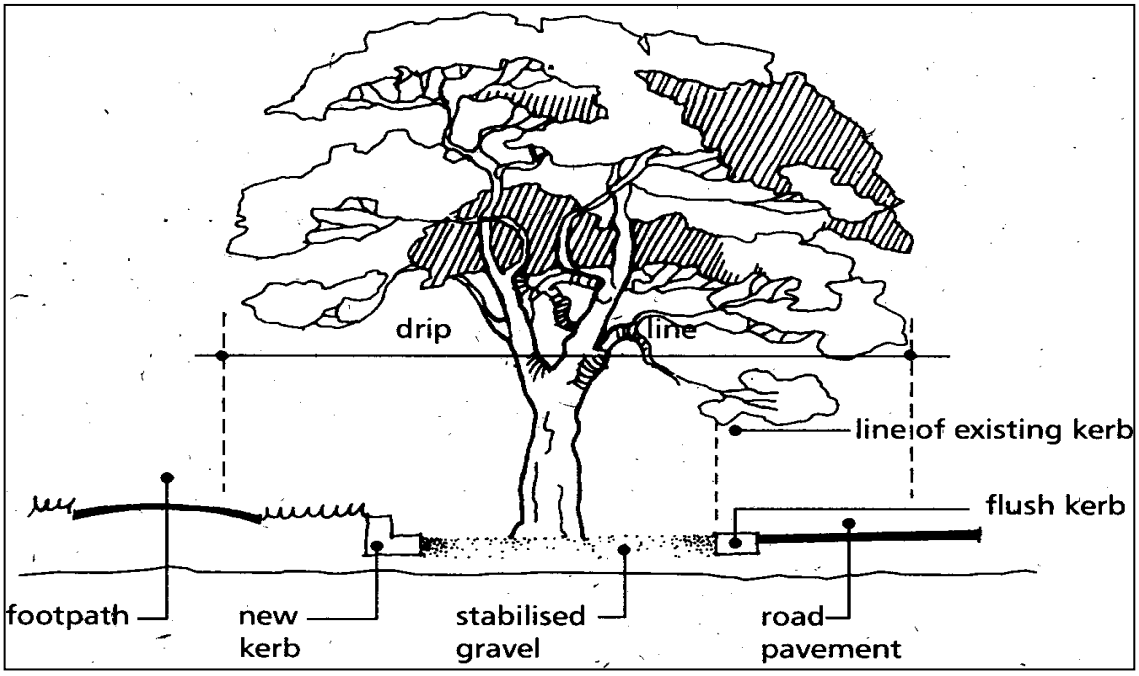


FIGURE 3.10 Gravel Road Shoulder

On narrower residential streets, the grass nature strips can be extended out into the parking lane with rolled edging of flush paving units where the grass meets the bitumen. Trees may then be planted in grassed areas where they don't already exist.

In particular, narrow streets where cars are likely to park on grass, a stabilized grass material such as 'Grass Cell' may be considered for installation to allow for parking, as shown in Figure 3.11.

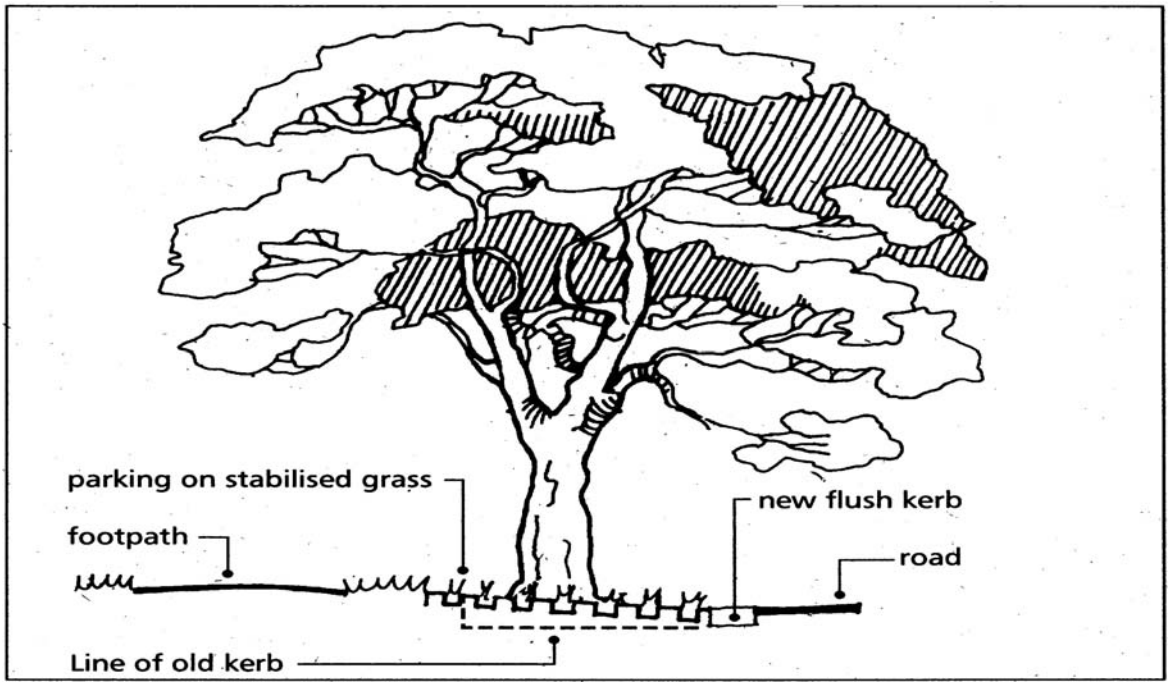


FIGURE 3.11 Stabilised Grass Road Shoulder

In areas without kerb and guttering, rapid water removal as occurs with conventional kerb and guttering can still be achieved. Suggested alternatives are grass swales or paving units set in sand to form dish drains, as shown in Figure 3.12.

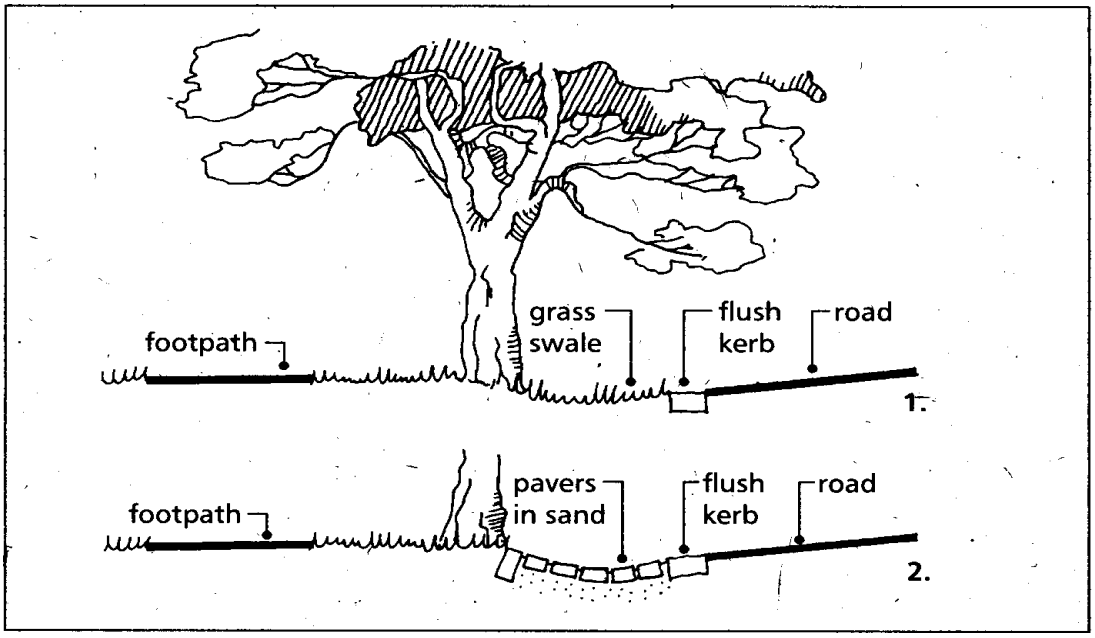


FIGURE 3.12 Alternatives to Kerb and Guttering

In streets where existing large trees are disturbing the kerb and guttering, the kerb may be pulled back to the footpath or realigned, as shown in Figure 3.13.

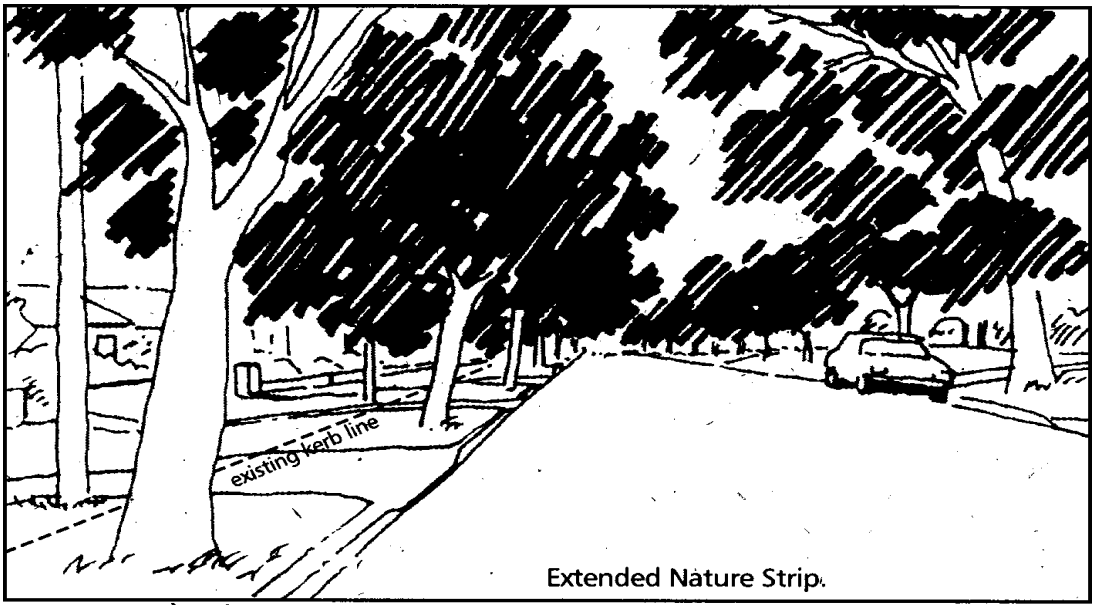


FIGURE 3.13 Kerb Extension

Alternatively, the nature strip may be brought around the tree in a wide curve, as shown in Figure 3.14.

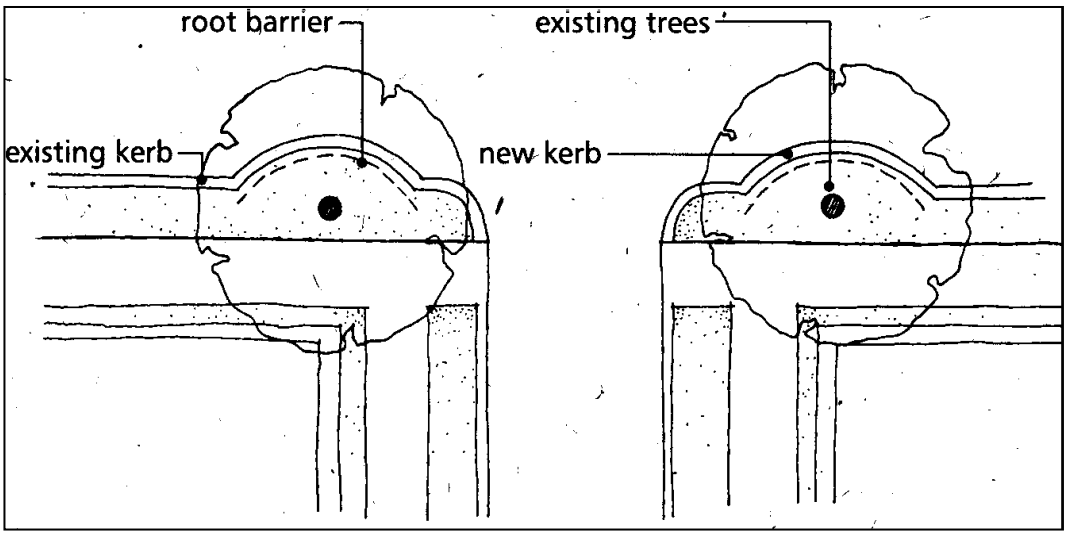


FIGURE 3.14 Kerb Extension around Existing Trees

By maintaining hard pavements as far away from the base of the tree as possible, it is less likely to be lifted when root expansion does occur later in the tree's life. At one and a half metres from the base of most trees, root expansion will not be sufficient to damage pavements for many more years than occurs with existing planting techniques. Providing flexible pavements closer to the base of the tree will further accommodate the secondary expansion of roots.

In areas with front yard set backs, realigning pedestrian pavement to be next to the kerb will allow tree placement away from the road, and where root growth can utilize the adjacent property. The relocating of the pathway to the property line will give a more limited benefit, maximizing the space between the path and the road, but retaining the tree relatively close to the road. Figure 3.15 illustrates these proposals.

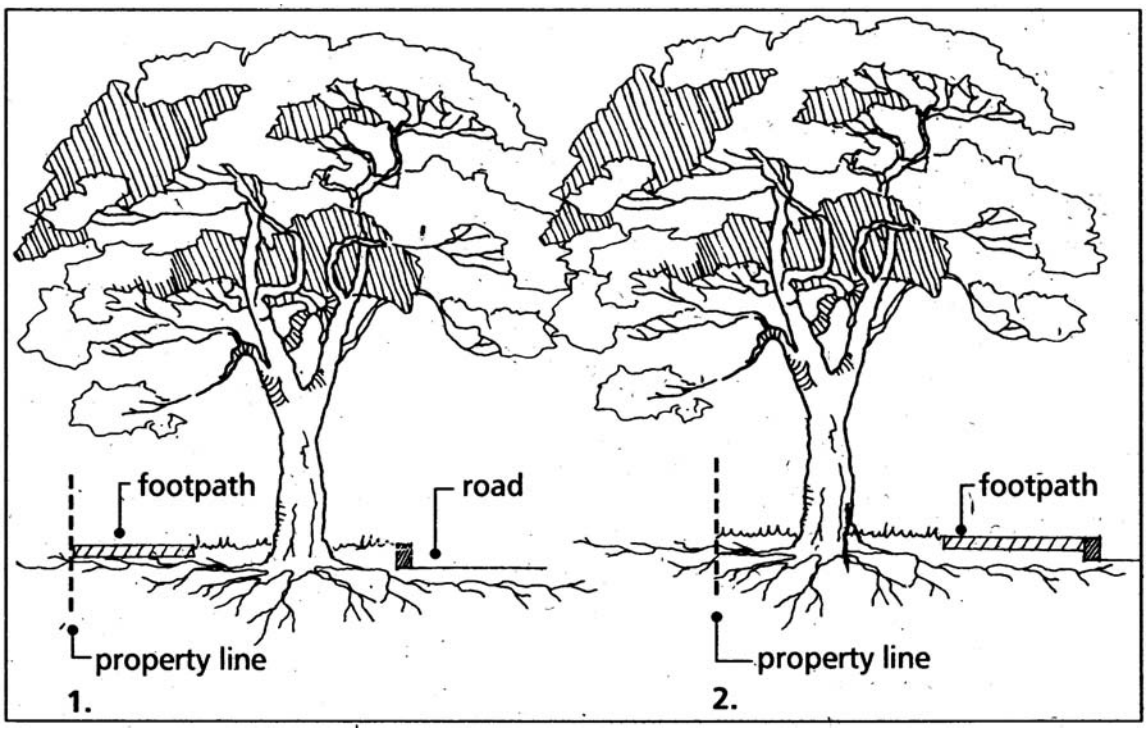


FIGURE 3.15 Path Relocation within Nature Strip

The problem of overhead wires can be addressed in a number of ways using tree management and alternative power options. The trees can be placed on widened nature strips or within road shoulders, as illustrated earlier. It should be noted that regular arrangement of trees is recommended in the older grid streets. The following guidelines should be adopted to resolve these conflicts.

- Where there is no future conflict with powerlines the selected species should be used;
- Where the species can be pruned to grow around the powerlines the same species has been used;
- Where the species cannot co-exist with the powerlines, a compatible second species should be selected from the palette; OR
- Where the species is incompatible with powerlines, planting in the road carriageway should be considered where the road width is sufficient. This could be in the road shoulder as shown in Figure 3.16 or in a median strip.

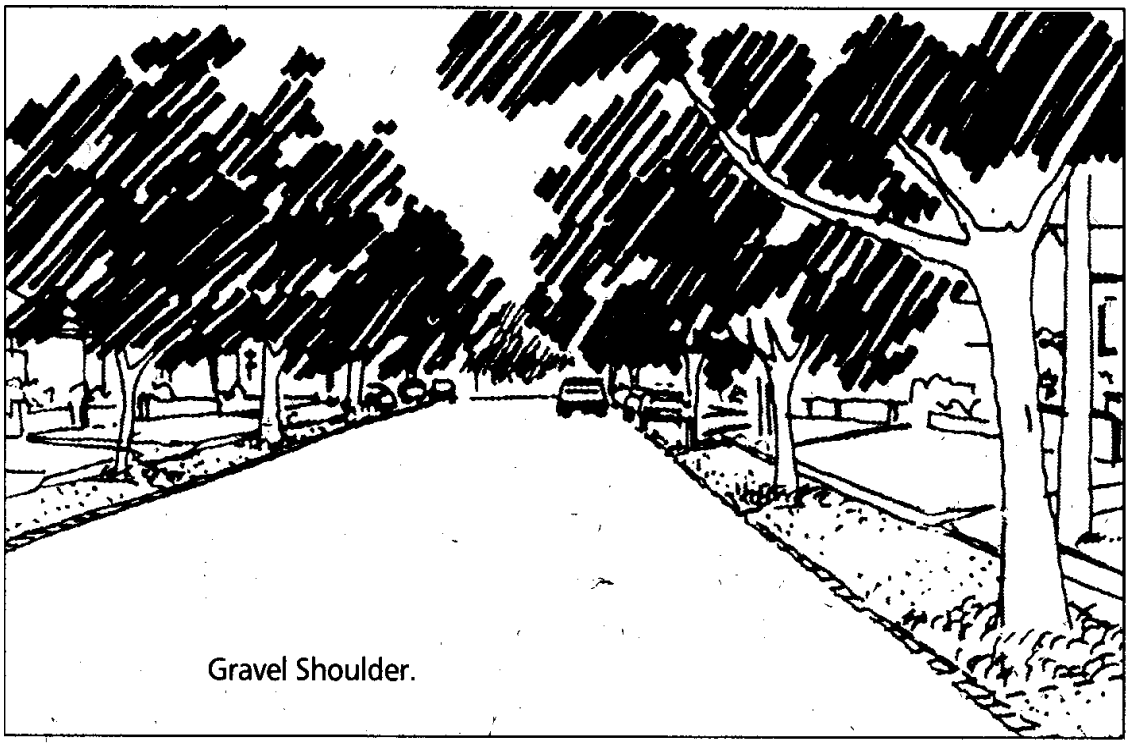


FIGURE 3.16 Street Planting in Gravel Shoulder

4.0 IMPLEMENTATION

4.1 INTRODUCTION

This section describes a series of strategies and courses of action to implement the major recommendations of the master plan. It is a guideline only and will require adjustment and refinement as it is developed, and subsequent factors come to light.

It is recommended that Council:

- Adopt the policies and objectives of the master plan and in doing so sets a target date for their implementation.
- Sets a time frame of seven (7) years to implement that plan. The following strategies and actions outline what will be required to bring this about.

Calodendron capense – Cape Chestnut

4.2 ACTION PLAN

The overall objective recommended in the Action Plan is that every street receives street tree planting in accordance with the master plan. In order to achieve this objective the following actions would need to be implemented.

Strategy	Action	Priority/Time
INVENTORY OF PHYSICAL INFORMATION		
	Street Tree Inventory	
	Database of street trees to be implemented, reviewed and regularly updated.	High – 1 to 2 years
	Database to be extended to include a photograph of significant trees and record resource expenditure for every tree.	Medium - 2 to 3 years
	Database to be linked to GIS system for accurate spatial mapping of all trees.	Low - within 7 years
	Services and Infrastructure	
	Prepare inventory of conflicting services such as overhead wires.	Medium - within 2 to 3 years
DESIGN DEVELOPMENT		
	Precinct Designs	
	Develop detailed design plans for every street in each precinct, based on the master plan guidelines, that show: - species selection and style of planting - planting priority - spatial configuration - street redesigns where applicable - formulate phased removal plan - co-ordinate design with services inventory	Medium - within 3 to 5 years

Strategy	Action	Priority/Time
	Main Road Design	
	Develop detailed design plans for designated main roads, based on the master plan guidelines, that show: - species selection and style of planting - spatial configuration - planting priority - street redesigns where applicable - formulate phased removal plan - co-ordinate design with services inventory	Medium - within 3 to 5 years
INTEGRATION WITH OTHER STUDIES		
	Environmental Strategies	
	Integrate and develop strategies for buffers and corridors with Council's other environmental/conservation strategies.	High - within 1 to 2 years Ongoing
	Plans of Management	
	Integrate and develop strategies for approach streets and open space edge planting with Council's Open Space Plans of Management.	High - within 1 to 2 years Ongoing
RESOURCE ALLOCATION		
	Annual Budget	
	Commit ongoing financial resources to development and implementation.	High - within 1 year
	Prepare an annual budget allocation for design development and implementation.	Medium – within 3 to 5 years
IMPLEMENTATION		
	Planting Program	
	Devise yearly planting programs that will list all nominated planting in accordance with Main Street Planting and Community Street Tree Planting Programme objectives (Section 4.3).	Ongoing

Strategy	Action	Priority/Time
IMPLEMENTATION		
	Planting	
	Main Streets and Coastal Areas.	High - within 1 to 3 years
	Other Precincts.	Medium- within 5 to 7 years Ongoing
	Phased Removal	
	Implement phased removal to be identified in each Precinct Plan.	Low - within 10 to 20 years
	Implement phased removal to be identified in each Main Roads Design.	Low - within 7 years Ongoing
COMMUNICATION		
	Education	
	Implement education programme for Council staff on management recommendations.	High - within one year Ongoing
	Review	
	Build in review procedures for all Action Plans.	Ongoing

4.3 PLANTING PROCESS

It is obvious that extensive tree planting is required and recommended throughout the City of Randwick. However, to ensure that the street tree policy is carried out effectively, street tree planting must be implemented in accordance with a pre-determined programme. A basis of prioritisation is provided to aid in determining a programme of works and management practices to best begin implementation.

Planting Areas	Priority
Main arterial and sub-arterial roads	High
Commercial shopping strips	High
Approach streets	Medium
Major Open Space edges	Medium
Buffers and Corridors	Medium
Collector and Local roads	Low

As a general rule this plan recommends that it is better to partially implement planting of the preferred species than more extensive planting of a less preferable species.

4.3.1 COMMUNITY STREET TREE PLANTING PROGRAMME

The aim of the Community Street Tree Planting Programme is to give residents the option to plant their own street trees if they wish to do so, with the guidance of Council's officers, to ensure that the most desirable species and site are chosen. The programme is intended to form the basis of a large percentage of future residential area street tree planting.

A Brief Description

Following application to Council for street tree planting, the applicant is encouraged to obtain the names of at least five other residents in his or her street who would also be interested in participating in street tree planting. A volunteer Street Co-ordinator is nominated by the applicants in order to oversee the works as directed by Council officers.

The residents are not required to make the decisions regarding species or site selection, although some degree of consultation is encouraged. It is then the responsibility of the relevant Council officer to undertake the underground service checks, and to nominate the most suitable street tree species, based on the relevant Precinct Design. The standards and policies for species and site selection are adhered to, as well as standard planting techniques.

The fundamental difference of this programme is that the work is initiated by the interested residents, and the actual physical planting and ongoing maintenance of the street trees are, likewise, undertaken by them.

The benefits to Council of utilizing this programme of community street tree planting include a reduction in planting and maintenance costs usually borne by Council. A much greater survival rate has been observed, due to the fact that the residents who are willing to plant their own street trees are generally more committed to the necessary follow up maintenance of their own trees.

This plan recommends:

- This programme does not apply to the main roads designated in the master plan

- This programme should be periodically reviewed to monitor its performance and to assess its ability to form the basis of future residential street tree planting

4.3.2 COUNCIL'S MAIN STREET TREE PLANTING PROGRAMME

The benefits of utilizing enthusiastic local residents for the planting and long-term care of their own street trees allows the freeing up of Council's tree planting contractors for the more significant main road planting, as well as increasing the ability of Council to successfully undertake the necessary street tree management practices recommended elsewhere in this document.

Council in the past has carried out tree planting in a variety of situations either as 'one off' at the request of residents, or in a more co-ordinated fashion, such as the ongoing planting of trees along Randwick's main roads. Commercial centres, park developments and building works often have street tree planting associated with them.

The majority of street tree planting is carried out in the autumn/winter season, so that essential summer park maintenance work is not affected. During the autumn/winter period plants have a greater rate of survival than they would if planted during the summer.

Every year, the Main Street Planting Programme will indicate the streets to be planted, in accordance with the detailed design for that street, and the proposed times of such planting. Tree planting contractors will regularly inspect the newly planted trees, water them and carry out any maintenance or replacements which may be necessary. With reference to community residential street tree planting, it is recommended that at the beginning of each year, the lists of resident street tree requests be examined and co-ordinated for inclusion into the planting programme at the appropriate priority rating. It should be scheduled so that each ward receives a relatively equal number of street trees each year.

4.4 PHASED REMOVAL

As new planting schemes are phased in, various trees will be identified as non-viable for design or management considerations. Removal of these trees will be planned to occur over a short, medium or long term. Following is a basis for determining the phasing of any tree removal.

Short-term Removal

Trees in this group would be recommended for removal over the next 3-5 years. These trees will require removal due to:

- Location – where changes in management techniques could not reduce or remove the necessity for regular maintenance;
- Species – where the species is causing severe and ongoing damage and effective long-term management of the problems is not a cost-effective option;
- Health – trees exhibiting poor health and vigour where changes in cultural conditions are unlikely to improve the short to medium term viability of the tree;
- Condition – trees that have been excessively lopped and have little crown left for re-working, or few horizontal branches.

Medium-term Removal

Trees in this group tend to include those approaching senescence (based on the anticipated age for the species in Sydney and the growing conditions of the site). These trees are exhibiting signs of declining health and vigour but do not represent a significant hazard or do not require immediate attention by Council to repair pavements or other structures.

Some trees that are part of a more recent planting period may be included in this group if they exhibit poor vigour due to site conditions or mechanical damage. In a few cases, very young trees are included in this group because their placement is inappropriate or their removal is necessary for establishing a consistent tree population and to avoid future root problems.

Long-term Removal

Trees identified as requiring removal over the longer term generally exhibit an acceptable level of health and vigour and are considered to be viable for the next 10-20 years. It is essential that these trees be periodically assessed for any changes in their condition. Where work around the tree is likely to require significant root cutting, the trees should be assessed by an arborist and removal should be considered as part of a replacement programme.

Interplanting

An important aspect to the proposal for phased removal is the establishment of a programme of interplanting. This can occur where the existing tree spacing is significantly wider than the proposed planting interval. By incorporating interplanting into the broader programme of tree removal the effect is to copy nature by providing new trees to take over before old trees become senescent and die. By allowing new trees to grow between existing trees for 5-10 years, the visual impact of tree removal will be greatly reduced. This technique will be utilized in avenues of existing trees that have not been nominated for reinforced planting.

Where trees have been removed it is recommended that, where possible, replacement trees should be planted in approximately the same location as the removed tree following excavation of roots and amendments to the planting hole. Where existing trees have been known to interfere with utilities, access or lines of sight the replacement tree should be located in the nearest appropriate location.

Banksia serrata – Old Man Banksia

Acknowledgements: Original Masterplan document compiled by Spackman and Mossop Pty Ltd
Revised and re-formatted text compiled by RCC Tree Management staff
Revised maps by RCC Landscape Technicians