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**Woollahra Council Team**
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Paul Goyoaga

**External Advisors**
Robert Smart - Arterra Design Pty Ltd
Street trees are one of Woollahra’s most important natural assets. The Street Tree Master Plan 2014 recognises the collective ecological, environmental, economic, cultural and social contributions of our street trees.

This Master Plan is a guide to aid in the maintenance and provision of street trees across the entire municipality. The objective of this Master Plan is to provide a sustainable and strategic framework that is used for the management of Woollahra’s street tree canopy. The Plan will contribute to the collective urban forest for the benefit of all through good planning, maintenance, enhancement and reinforcing our ongoing commitment to the protection of trees.

With this Master Plan, Woollahra will continue to provide a population of healthy street trees which will beautify and define our urban environment today and will become an important legacy for future generations.

"Friendship is a sheltering tree."

Samuel Taylor Coleridge
1.0 Introduction

1.1 How to Use This Plan

This document is one part of Woollahra’s suite of documents used to proactively manage its tree resources. Trees like all living things, grow, age and eventually die. It is therefore important that we have a strategy and a plan to deal with our street trees. The Plan will outline where trees are planted and what species are to be used to replace trees when they eventually reach the end of their useful life. In short, this document is intended to guide the future of all street tree planting throughout Woollahra.

The general rule the Council has followed in developing this plan is to continue the existing street characters and tree planting as much as possible, unless there are specific problems to address or clear opportunities for improvement. Council will seldom remove a healthy street tree. If a certain type of tree is proposed for a street, it does not mean that Council will remove the existing street trees in the short term to implement any proposed new species. This will only happen over time, as trees need replacing or if an opportunity exists to plant a new tree in an otherwise vacant area.

Existing street trees will typically be left to grow for their natural life and will only be removed once they become a safety issue and an unacceptable hazard. The exception to this may be when major street improvements or upgrade works are required or it is planned to revitalise a specific area, but even then tree removal will be avoided where possible.

As a member of the community, the way you might use this plan is outlined below.

1. Read Part 2 & 3 on tree species selection to understand the many complex considerations involved in selecting any street tree and its placement.
2. Refer to Part 4 which has a map of the entire Woollahra Local Government Area (LGA) area and identify the precinct that your street lies within.
3. Once you have located the precinct in which your street lies, you should then refer to that precinct’s summary page and the proposed Tree Species listings for each street. The list shows what species of trees are proposed for each street within the precinct.
4. If you are unfamiliar with the tree species, you may want to refer to Part 5 at the end of the document where a brief Tree Data Sheet is provided for all the tree species proposed, giving a photograph, a brief description of the trees and outlining their key features.

We hope you find this document useful and share our passion in making Woollahra a green, sustainable and beautiful area.

1.2 Our Core Values

As custodians of street trees, Woollahra Council bases its street tree management and planning around its core values which include:

- Providing outstanding customer service and a safe and beautiful area in which to live, work and visit;
- Encouraging public participation and education through appropriate community consultation and engagement;
- Selecting the most appropriate planting, based on current knowledge, that respects the needs of the wider community and the environment while minimising undesirable impacts on individual residents and businesses;
- Providing high quality tree care by ensuring that appropriately qualified tree management officers and consultants undertake the assessment of tree related issues and;
- Utilising professional and best-practice industry standards, together with the latest technology, to ensure the highest quality tree planting and ongoing management is undertaken.

Figure 1.1- Bay Street, Double Bay - The great streets of the future are dependent on how we plan our street planting today. (Photo Arterra)
1.3 Context & History

The Woollahra LGA has a rich heritage of street trees planted since the early development of the area. These trees provide a backdrop to the area and form part of the beauty, character and history that continue to make the area such a desirable place to live and work.

It is located on a peninsula of land immediately east of the City of Sydney, with the beautiful Sydney Harbour to the north and western side and the Pacific Ocean to the east. It is home to the southern side of the prominent headlands which define the entry to Port Jackson, otherwise known as Sydney Harbour. It is bound by The City of Sydney LGA to the west, Waverley LGA to the east and south and a small area near Bondi Junction bounded by the Randwick LGA.

Originally, much of the area was dominated by low and windswept native heathlands with some taller open forests in the more protected areas. The indigenous inhabitants were the ‘Cadigal’ people and their territory stretched along the southern sides of Sydney Harbour from South Head through to what is now known as Petersham. They were a part of the wider ‘Eora’ group of aborigines. They had a close affinity with the Harbour and a strong affinity with the land that they were tied to by ancestral and religious feelings. The fine balance and way of life of the indigenous community was soon lost with the arrival of the first European settlers.

The development of the area began in the early 1800’s. Being so close to the fledgling colonial township of Sydney it was one of the early areas of wider Sydney to be developed. Initially this was through relatively large areas of land being granted to prominent colonial figures to build extensive mansions and villas. Some scattered outposts and fishing villages also occurred in the various sheltered bays and coves, together with market gardens and dairying on the deeper soils by the Harbour. By the mid 1800’s Sydney was expanding rapidly and pressures to house the growing population close to the City saw the development of the suburb of Paddington and the beginning of redevelopment and subdivision of the early land grants for more intensive residential development. Towards the later part of the 1800’s expansion became very rapid with the expansion of tram services and the Woollahra LGA became a very desirable residential location.

The area was seen as a ‘dress circle’ position given its relation to the Harbour, and quickly gained prestige as a desirable area in which to reside. The character of the developing suburbs was typified by the allotments ranging from the 20 feet terrace frontages of the workers cottages of West Woollahra and Paddington to villas and mansion sites of 1 acre or more, seen in such locations as Woollahra, Bellevue Hill and Darling Point. Factories and industrial uses in the area were rare which added to the desirability of the area.

Figure 1.2 Woollahra - Local Government Area and Context Plan
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Figure 1.3- O’Sullivan Road, Rose Bay (Photo Arterra)

Figure 1.4- View over Bellevue Hill from Kulgoa Road illustrating what a significant contribution trees and gardens make to the municipality (Photo Arterra)
Figure 1.5- View over Double Bay circa 1874 with New South Head Road in the foreground and the then wooded hills of Bellevue Hill and Point Piper in the background. (Source: State Library of NSW: a08950h.jpg)

Figure 1.6- View over Vaucluse and Watsons Bay circa 1929 with the reservoir at the end of Black Street in the foreground and the newly developed and rather treeless suburbs towards Watsons Bay in the background. (Source: Pictorial History of the Eastern Suburbs, Sharpe 1999)
A steady increase in generously proportioned suburban-style housing spread from the southern areas such as Woollahra and Darling Point towards the areas of Double Bay, Rose Bay and Bellevue Hill. By the early 1900's intensive subdivision and residential development had occurred throughout the remainder of the municipality with Watsons Bay and Vaucluse built out by the early 1930's with housing similar to what we see today.

Some areas such as Edgecliff, Double Bay and Darling Point have seen more intensive development occur past these initial periods, with commercial expansion and numerous apartments being built from the mid 1960's through to the 1980's. Now days, most development in the municipality is restricted to redevelopment of aging individual residences and replacement with ever-more impressive modern dwellings. Some relatively small-scale urban infill apartment construction is also occurring.

The Woollahra LGA is physically characterised as a broad sandstone plateau cut in two by a low lying sand filled valley between Bondi to the south-east and Rose Bay to the north-west. The sand was an extensive deposit of naturally unstable dunes. Extensive heath and scrub covered the more exposed sandstone plateaus. As late as 1909 a considerable amount of heath and woodland vegetation still remained in Vaucluse and Watsons Bay. As housing spread, little thought was given to retaining or replanting any of the original vegetation and today most has gone, except for areas around The Gap and South Head (Benson & Howell 1990).

On the more sheltered Harbour hillsides and gullies taller woodland and forest was more common and would have been dominated by Scribbly Gum (Eucalyptus haemastoma), Forest Red Gum (Eucalyptus tereticornis), Blackbutt (Eucalyptus pilularis) and Smooth-barked Apple (Angophora costata). A substantial swampy and sandy area behind Rose Bay was dominated by Broadleaf Paperbark (Melaleuca quinquenervia) (Benson & Howell 1990).

The important endemic species that occurred in Woollahra and are relevant to this Master Plan include the following:-

<table>
<thead>
<tr>
<th>Botanic Name</th>
<th>Common Name</th>
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<tbody>
<tr>
<td>Angophora costata</td>
<td>Smooth-barked Apple</td>
</tr>
<tr>
<td>Angophora hispida</td>
<td>Dwarf Apple</td>
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<tr>
<td>Banksia integrifolia</td>
<td>Coastal Banksia</td>
</tr>
<tr>
<td>Banksia serrata</td>
<td>Old Man Banksia</td>
</tr>
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<td>Eucalyptus tereticornis</td>
<td>Forest Red Gum</td>
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<tr>
<td>Corymbia gummifera</td>
<td>Red Bloodwood</td>
</tr>
<tr>
<td>Eucalyptus piperita</td>
<td>Sydney Peppermint</td>
</tr>
<tr>
<td>Eucalyptus pilularis</td>
<td>Blackbutt</td>
</tr>
<tr>
<td>Eucalyptus botryoides</td>
<td>Bangalay</td>
</tr>
<tr>
<td>Eucalyptus robusta</td>
<td>Swamp Mahogany</td>
</tr>
<tr>
<td>Eucalyptus resinifera</td>
<td>Red Mahogany</td>
</tr>
<tr>
<td>Eucalyptus haemastoma</td>
<td>Scribbly Gum</td>
</tr>
<tr>
<td>Livisitona australis</td>
<td>Cabbage Tree Palm</td>
</tr>
<tr>
<td>Melaleuca quinquenervia</td>
<td>Broadleaf Paperbark</td>
</tr>
<tr>
<td>Acmena smithii</td>
<td>Creek Lilly Pilly</td>
</tr>
<tr>
<td>Glochidion ferdinandi</td>
<td>Cheese Tree</td>
</tr>
<tr>
<td>Elaeocarpus reticulatus</td>
<td>Blueberry Ash</td>
</tr>
<tr>
<td>Synoum glandulosum</td>
<td>Scentless Rosewood</td>
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Climate

The climate of the coastal areas of Sydney is a very mild frost-free, warm temperate climate with warm summer temperatures and a relatively mild winter. The average annual rainfall is over 1200mm. This mild climate with good rainfall allows for a great range of species to grow, however, of most importance now is the microclimate of specific locations. This has a significant influence on how well a tree will grow in a particular location.

A major factor for the more coastal areas are the strong and often salt laden winds and the impact these can have on tree health and vigour. Areas with direct exposure to these coastal winds are typically better served by the use of very hardy and salt tolerant species. Tree species intolerant to salt exposure may survive but usually produce poor quality trees with stunted growth and are prone to pest and disease.
1.4 The Street Tree Master Plan

Street tree planting is a very significant component in the appearance of our streets and is a critical factor in the overall impression one has of the public domain. The most significant factor that makes "a place" is often its street tree planting. The development of this Street Tree Master Plan gives recognition to the immense range of issues that are associated with the planting and management of street trees. Street tree management is fundamentally important to the social, environmental and economic well being of the area.

Trees can transform a street, creating definition and consistency in urban character. They can be as important as the built forms in many locations. Interestingly, most "great streets" commonly have evenly and closely spaced trees. The use of a single species usually has the greatest impact on people's positive perception of a street. Deciduous trees are also often considered more appropriate for smaller and narrower urban streets as they permit sunlight to reach the streets and adjoining homes in winter.

Street trees play a myriad of functions and roles in the urban setting that effect our daily lives. The Street Tree Master Plan is a plan for the effective short and long term management of this important asset. This document establishes clear directions for the future development, planting and management of street trees within the Woollahra LGA.

The key objectives of the Street Tree Master Plan are to:

- Promote and capitalise on the benefits of Woollahra’s existing urban forest whilst minimising the ongoing costs of maintenance;
- Provide direction on the most appropriate species and planting techniques;
- Establish an appropriate street tree species palette that is suited to the environmental conditions of the public realm;
- Maintain, and increase where appropriate, the number of trees and overall canopy coverage of the municipality in line with the values and objectives of the NSW Local Government Association (LGA) Urban Forest Policy;
- Improve street tree establishment and survival rates;
- Guide the maintenance and management of existing and new trees to ensure that they survive and thrive in harsh urban conditions;
- Improve the community’s knowledge and understanding of good urban tree and forest management;
- Maintain, reinforce and enhance the leafy characteristics of identified precincts by selecting the most appropriate trees that are suited to the character of the location and relevant site constraints;
- Guide Council decision making and provide a transparent and accountable processes for planting, maintenance, customer requests and development application assessments;
- Assist the Council in the planning, budgeting, implementation, and maintenance of street tree planting by providing guidance on suitable species, locations and planting patterns and
- To recognise risk management principles together with the aims and objectives of the Statewide Best Practice Manual for Trees and Tree Root Management (2003).
1.5 The Strategic Framework

The Street Tree Master Plan 2014 is only one part of the Woollahra Tree Management documentation, which provides the necessary tools to effectively manage street trees in the area. The Woollahra Tree Management documents also comprise:-

- Tree Management Policy
- Tree Preservation Order
- Register of Significant Trees
- Street Tree Master Plan
- Individual Open Space Plans of Management

Figure 1.8 shows the relationship between the tree management documentation.

Woollahra Tree Management Policy

The Woollahra Tree Management Policy is the overarching and guiding document regarding trees. It outlines the key principles and processes the Council uses in maintaining its public and private trees, in a safe, healthy and environmentally sensitive way.

It recognises that many people are attracted to live in Woollahra LGA due to the trees and landscape character and that the future environmental benefits of trees may become even more important.

This Policy guides the Street Tree Master Plan by recognising and outlining the following key points:-

- That trees are dynamic living assets that can be difficult to manage;
- Woollahra's tree population is diverse and stems from a variety of periods;
- The leafy character of Woollahra should be maintained and promoted;
- That significant cultural and historic planting is recognised and continued;
- That local resident needs should be considered and that they should not be unreasonably impacted by Council tree planting;
- That there equally needs to be an appropriate balance between public and private amenity;
- Tree replacement programs allow for the emergence of new significant characters and future significant trees;
- That tree maintenance is regular and best-practice and the risks to persons and property are kept within acceptable limits.

Woollahra Register of Significant Trees

To recognise trees of heritage significance the Council has developed a Register of Significant Trees. This document is a systematic listing of trees, public and private which are identified as being significant under the following assessment criteria:

- Historic and commemorative associations
- Social associations
- Ecological values
- Botanic and scientific values
- Visual and aesthetic qualities

Significant groups of trees, often with very noteworthy individual trees occur throughout the municipality. They are usually related to the original historic estates or older subdivisions. There are also fragmented stands of remnant indigenous vegetation.

A number of street trees are listed in the Council's Register of Significant Trees. Significant trees seldom occur in isolation; rather they form part of a broader context and are important elements in defining the character of the wider landscape and relationships to historic buildings.

The management and protection of trees in NSW are also governed by other various laws and regulations.
Noxious weeds Act 1993
Species that have been declared as noxious plants under the Noxious Weeds Act 1993 or prescribed for Woollahra Local Government area should not to be planted within the road reserves and should be removed upon identification.

Existing street tree species, such as Camphor Laurel (Cinnamomum camphora), may be listed under the Noxious Weeds Act but are not prescribed for the Woollahra LGA, thereby exempting them from removal without consent.

Roads Act 1993
The removal or pruning of street trees is permitted in association with approved road works under sections 88, 107, 138 and 139 of the Roads Act 1993. Council is largely responsible for all planting, removal and maintenance of street and roadside trees. Declared main arterial or 'State' roads are the responsibility of the Roads and Maritime Services (RMS) (previously the Roads and Traffic Authority).

The municipality of Woollahra contains three 'State' roads that fall under the jurisdiction of the Roads and Maritime Services (RMS). They include New South Head Road, Oxford Street and Old South Head Road (south of its intersection with New South Head Road).

Electricity Supply and the NSW Electricity Supply Act 1995 No 94
Ausgrid is the state owned corporation responsible for the electricity network that provides power to over 1.6 million homes and businesses throughout Sydney, the Hunter and the Central Coast.

The act and relevant regulations require street trees to be trimmed to ensure there is a minimum safety clearance between trees and powerlines. Ausgrid is responsible for doing this work. Where a tree on private property is entering the safety clearances of wires in the street, Ausgrid will also trim the tree for residents, free of charge, to meet their safety obligations. In residential areas the vegetation safety clearance is typically 1.5m around bare, low voltage overhead wires and 2m around the power poles. The safety clearance, however, depends on the voltage of the overhead wire and higher voltage lines may require larger clearances.

If trees are within 3m of Ausgrid powerlines, only vegetation management workers authorised by Ausgrid are permitted to carry out the work. Trimming is carried out by contractors who follow the Australian Standard AS4373-2007 Pruning of Amenity Trees. Ausgrid also employs qualified arborists to audit the work of their contractors. Each contractor also employs arborists to monitor standards and ensure they are maintained.

Woollahra Council and Ausgrid have an ongoing program to convert some conventional overhead wires to Aerial Bundled Conductors (ABC). From the ground ABC looks like a single thick cable however ABC contains the normal group of overhead services bundled together to reduce the cross sectional area necessary for the provision of overhead services. This method of cabling reduces conflict with trees. Pruning requirements are usually reduced and branches can be trained around the ABC more easily. Priority for ABC conversion is given to major roads and particular problem streets where the conflicts between trees and overhead services are identified.

Green Web
Green Web Sydney was an initiative of the combined Sydney Regional Organisations of Council's (SROC) that promoted the establishment of a ‘web’ of native vegetation corridors throughout the wider Sydney Region. These corridors aimed to protect, conserve and enhance remnant bushland and as a result improve biodiversity values, habitat quality and connectivity across the Sydney region. The Sydney Metropolitan Catchment Management Authority took over responsibility for the program in 2003 and since then have been working with local Councils, State Government and private landholders to continue implementing the Green Web program.

The protection of ‘core’ bushland and habitat areas remains of central importance for the conservation of biodiversity, however ‘corridors’ play an important role in a highly fragmented landscape like Sydney where they are used to link ‘core’ areas of bushland and habitat.

Woollahra Council has developed plans that identify various streets and other foreshore areas that are considered significant corridors. These have been considered in the preparation of this Street Tree Master Plan and where feasible and practical, the species suggested for these areas gives preference to endemic native species. (Refer Figure 1.9)
Figure 1.9- Map of the identified Green Web areas of Woollahra
Sydney Harbour Catchment Regional Environmental Plan

Sydney Regional Environmental Plan (Sydney Harbour Catchment) 2005 (Harbour REP) covers all the waterways of the Harbour, the foreshores and entire catchment. It establishes a set of planning principles to be used by councils in the preparation of planning instruments relating to the hydrological catchment of the Harbour.

The Harbour REP includes a range of matters for consideration by consent authorities assessing development within the Foreshores and Waterways Area of the Plan. These are aimed at ensuring better and consistent development decisions and include such issues as ecological and scenic quality, built form and design, maintenance of views, public access and recreation and working harbour uses. The Harbour REP includes provisions relating to heritage conservation and wetlands protection and provides planning controls for strategic foreshore sites.

The provisions of the plan have been considered during the planning of street tree matters close to the Harbour and within visually prominent areas fronting the Harbour as the maintenance of scenic quality is a key component of the above Plan in Figure 1.9.


Under the Heritage Act 1977 (amended 1998), the Heritage Branch of the NSW Office of Planning (formerly the NSW Heritage Office) administers and maintains the State Heritage Register (SHR), a register of items and places that are considered to have heritage significance at a state level.

The Heritage Branch also compiles a Heritage Database, which is a collated database of all places listed on statutory heritage lists, including Local Environmental Plans. Listing on the Database has no statutory implications for development at the listed place and simply reflects the listing of the place on the relevant LEP’s.

1.6 Benefits of Street Trees

Street trees are a vital urban and suburban element that can transform the character of streets and provide numerous environmental, aesthetic, cultural and economic benefits. In the long term, they often create a very real ‘sense of place’ and enhance the public domain. Trees are living things that work all day, every day, for all of us to improve our environment and quality of life.

Some of the environmental benefits of street tree planting include:-

- Carbon sequestration and storage. A single mature tree can absorb carbon dioxide at a rate of 21 kg/year and release enough oxygen back into the atmosphere to support 2 people’s needs.
- Shading of pavement, cars and buildings, thereby reducing our energy consumption. Shading of asphalt pavements can also extend its life.
- Removal of many gaseous pollutants by absorbing them with normal air components through the stomates in the leaf surface. (eg. Sulfur Dioxide, Ozone, Nitrogen Oxide).
- They also capture and help remove particulate matter and dust from the air.
- Acting as natural pollution filters. Their canopies, trunks, roots, and associated soil, filter polluting particulate matter out of stormwater flows and away from drains and creeks. They also slow and reduce the flow of runoff, reducing the amount of pollution that is washed into a drains and ultimately the Harbour. Trees also take up and utilise nutrients like nitrogen, phosphorus, and potassium which can otherwise pollute streams.
- Intercepting and reducing raindrop impact and runoff and thereby reduce erosion of soils and siltation of creeks and drains.
- Providing habitat and a food source for urban fauna.

Some of the economic benefits of street tree plantings include:-

- Improving economic performance by increasing the attractiveness of businesses and tourism areas. People typically linger, shop and dine longer in tree-lined streets.
- Reducing energy consumption, through shading and reductions in the “urban heat island” effects.
- Shops, apartments and housing in well planted areas usually attract higher rents and sale prices.

Some of the social and psychological benefits of street tree plantings include:-

- Calming traffic, slowing speeds, and providing a buffer between pedestrians and cars. They are also useful in delineating and signifying curves in a street.
- Improved sociological benefits with studies showing strong correlation of well planted areas with reduced social services, domestic violence, and strengthened community ties.
- Creation of feelings of relaxation and well-being. Hospital patients, for example, are shown to recover quicker and with fewer complications when in rooms with views of
trees. Workers and students are also shown to be more productive when their environments have views to trees.

• Improving comfort and general amenity as street tree canopies can shade pedestrians, diminish traffic noise, screen unwanted views and reduce glare.
• Defining precincts and links with history. Tree lined streets can provide orientation, and contribute to the overall urban character.
• Providing a human scale that contrasts with apartments and larger buildings that can otherwise dominate some streets.
• Providing seasonal interest and natural beauty through foliage and their interesting leaf patterns, flowers, bark, fruit and canopy.
• Providing a link to nature and a source of delight.

1.7 Street Trees and the Urban Environment

Although trees present a myriad of benefits we have to recognise that they may also present problems, costs and risks, particularly if poorly planned, planted or managed. A tree is a dynamic living organism and can be a potentially large ‘structure’. Every species is genetically determined to achieve certain proportions, within the limits imposed by its immediate environment. A tree gets bigger as it grows and so its mature size has to be accounted for when planning any new planting or when designing new structures close to existing trees.

The interactions between trees and structures are often complex and there are likely to be many factors contributing to any given situation. It is not beneficial to focus concern entirely onto the tree or tree species when developing a tree management strategy.

There is no such thing as the ‘perfect’ street tree that will fulfil all aspects of our selection criteria. Trees are living entities that can present a variety of forms and habits even within the one species type and within the one street. We must remember that we are planting trees in an artificial and constructed environment that is far removed from its natural habitat. In this situation there are bound to be some negative aspects associated with trees in the urban environment. However, it is generally considered that the benefits that trees contribute to our wider environment usually far outweigh many of the negative aspects.

Woollahra has a wide and varied population of residents, living in apartments, terrace houses, small and large lot suburban housing. Each resident will have a different perspective and interaction with street trees and the wider urban forest. The community as a whole also includes business owners and employees who may visit and engage with the area and its trees every day. As such, Woollahra encompasses many people with an extremely diverse range of interests and attitudes towards street trees. These views are influenced by an equally diverse range of factors such as the persons age, income, education, cultural background and previous exposure to natural environments. At the extreme, some may have an irrational fear of trees, even though statistically there is far greater chance of being killed by lightening than dying or being injured due to a tree failure.

The most common causes of problems and concerns with trees, including street trees, are:-

• cracking and lifting of pavement and walls;
• clogging of pipes and services;
• obstruction of views;
• obstruction of pedestrian and vehicle access and street signage;
• dropping of leaves and fruit;
• attraction of animals and birds that may cause mess and irritation;
• shedding of larger branches;
• excessive shading or blocking of sunlight.

These are all valid concerns and often they will need to be addressed. People need to be educated and informed about the most appropriate ways to deal with these issues. It also needs to be understood that unnecessary tree removal and the repercussions of individual actions can threaten the long term viability and sustainability of the urban forest. Often many of the common issues can be adequately addressed without tree removal. Appropriate maintenance and pruning can often alleviate most concerns, and appropriate repair or redesign of infrastructure can also be undertaken with little impact to the tree and the tree can continue its valuable contribution for many decades.

It is also important that people recognise, and are informed about, the need for change. Trees are living organisms and as such will grow, mature and eventually die. As trees age they will typically require maintenance and then eventually require removal and replacement. In a natural ecosystem this happens gradually and with little problem or impact to people. In an urban environment an aging or hazardous tree can not be left until it completely fails as is the case in natural areas.

Tree removal can be traumatic and emotional. Often trees have been there for many decades, people have grown up with them and become attached to their presence, their size and their aesthetic appeal. The trees may also represent associations and links to past events and historical places. For these and many other reasons, some parts of the community often have expectations of trees being retained for very long periods. They may even entertain retaining street trees no matter what the costs. There will come a time, however, when the benefit of keeping an individual tree is far outweighed by the risk to life or property and the monetary cost of maintaining it.

In summary, when managing and establishing an urban forest the needs of the ‘many’ may often have to over ride the desires of the ‘few’.

Street trees can evoke a negative perception within the community. The most commonly raised topics are discussed in the sections below.
Allergies

Concern is sometimes raised that particular tree species cause allergies/irritation and respiratory problems. It is important to note there is a difference between an allergic reaction and an irritation. All flowering plants including grasses produce pollen. Generally species that rely on wind pollination create a greater pollen load to ensure continuation of the species. Pollen in the air can contribute to hayfever, eye allergies and other respiratory problems.

Platanus species are by far the most prevalent pollen producers and have a long pollen season. Grasses rely on wind to disperse their microscopic pollens, which are produced in vast quantities. In Sydney the grass pollen season goes from September into January or February depending on prevailing weather.

Plane Trees are often cited as a primary cause for allergies or irritations, however, it is difficult to isolate their contribution to urban pollen levels when there are many different species including grasses producing pollen at the same time. Plane Trees do produce pollen, but they have a limited season of pollen production of only a few weeks in Spring. The young leaves of Plane Trees do also have fine pointed hairs which are gradually shed as the leaves mature. Similarly, the round fruits tend to drop and shatter in autumn. The leaves and seeds have hairs called trichomes which may cause allergic reactions to some people.

The latest research into Plane Tree allergies indicates they may not be the allergen they are anecdotally believed to be. A study titled “London Plane Tree bioaerosol exposure and allergic sensitisation in Sydney, Australia” (Dr Euan Tovey MSc, PhD, et al 2011 Dec) indicates that other allergens are more likely to be causing symptoms than Platanus pollen. Sixty-four subjects with self-reported Platanus symptoms were recruited from inner-urban Sydney. Allergic sensitisation was determined by skin prick test to 13 allergens. Airborne concentrations of Platanus pollen, trichomes, and achene fibres, and other pollen and fungal spores, were measured over the spring and summer of 2006-2007. The subjects’ allergic symptoms were monitored concurrently.

It was found that Platanus pollen constituted 76% of total pollen between July 2006 and April 2007. While Plane Trees were the major pollen source, the season was brief and did not correlate with the subjects’ symptoms and only 25% of the test subjects were found to have an allergic reaction to Plane Tree pollen.

The fine spiky hairs (trichomes) from Plane Tree leaves may however play a role as a respiratory and skin irritant. Even though the science may dispel some of the concerns regarding Plane Trees and their contribution to allergies, the perception by the community will always be very different, especially when such debris loads are seen every day throughout the growing and fruiting seasons.

There is no such thing as the perfect street tree. On balance the structural and other characteristics of the Plane tree, its tolerance to difficult conditions and the benefits it provides as a large street tree can often outweigh its negative attributes. Eye allergy symptoms may be reduced by wearing wrap around sunglasses and a hat. This has the potential to exclude the majority of pollen grains affecting the eyes.

Leaf and fruit droppings

All trees, including evergreen species, drop leaves. Strategies that can be employed to reduce the impact of leaf litter in our streets will be the coordination of our street sweeping resources to target problem areas and seasons.

Species with fleshy fruits or leaves that become slippery on decomposition will typically be avoided for selection, particularly in paved areas.

Damage to pavements and structures

Many old established trees in our area can and have caused footpath uplift and cracking. These trees are generally the vigorous and larger growing species. In adhering to the principle of the ‘right tree for the right location’ future tree selection will be mindful of the potential of various tree species to cause pavement damage.

An important factor is site preparation and the establishment techniques used for new tree planting. To minimise pavement damage, the use of nature strips, median planting, and in-road blisters (where possible) will be considered. Also maximising the size of the planting ‘cut outs’ in pavements and the use of flexible pavements will assists.

Factors that commonly contribute to negative interactions between trees and structures include:

- The soil type, structure and depth;
- The tree species and its genetic disposition that influences its size and shape;
- The design of the nearby structures;
- The construction materials, quality of installation and methods adopted;
- The age of the structure (as with trees, most structures have a ‘useful life span’ and have to be maintained and then replaced within in set time frame); and
- The type of previous land use (eg. industrial sites where soil contamination and/or layers of fill can impede normal biological processes).

Whilst trees do not ‘think’ - they do react. Despite popular opinion, roots do not have intentions and they cannot ‘seek’ out resources as is commonly believed. Roots are opportunistic and they do not act ‘aggressively’. Root growth occurs via extension at the very end of the root tip and it can only occur when there is sufficient soil oxygen and moisture.
Roots will not grow if there is too much water, not enough oxygen, or if the spaces in the soil are too small or compacted. Knowledge of root growth characteristics can be used in the design of infrastructure in proximity to trees. Equally important is the provision of sufficient space for the growth of healthy trees.

Tree roots are also storage organs and they do have the potential to generate new roots after being cut. In most cases, a tree will generate new roots when roots are cut cleanly, but if roots are torn or crushed then they are most likely to decay and die leading to a potential loss of tree stability.

Property Clearances, Views and Solar Access

Pruning

The Council will prune trees to maintain a reasonable and safe clearance between trees and pedestrians, vehicles and private property. Refer to the Woollahra Tree Management Policy 2011, Section 2.7 for detailed guidelines whereby tree pruning applications will be considered.

The Council has developed specific guidelines with regard to tree pruning for clearances and to maintain views and solar access. Refer to the Woollahra Tree Management Policy 2011, Section 2.7 for a diagram that graphically illustrates the proposed clearances and offsets for tree pruning. Refer also to 2.12 and 2.13 for the detailed guidelines whereby tree pruning applications will be accepted.

In summary, Council has adopted a policy that allows a ‘user pays’ system to prune a tree for pre-existing views or solar access. Council will avoid pruning practices which disfigure the tree or are detrimental to its healthy and safe condition.

When planting new street trees Council will consider the impact the mature tree may have on surrounding residents views and will, as far as practicable and reasonable, avoid planting overly large trees that will block previously unencumbered views.

If an existing large trees is removed, any replacement tree will be similar in scale and form and will be planted in close proximity to the original tree. It will be allowed to reach its natural potential unless a pre-existing pruning right is clearly established. In this case Council will consider planting a smaller growing species to limit the need for frequent, ongoing and unsustainable pruning practices.
Identified Tree Risks and Hazard Abatement

The degree of risk and hazard a tree poses will vary greatly depending on the size of the tree, the type and location of the defect, the tree species, and the nature of the target areas around the tree. Council undertakes an annual inspection regime of all publicly owned trees in their streets and parks.

The following table outlines some of the strategies that Woollahra Council employs to monitor and reduce risks and hazards associated with its street trees. If a problem is identified, a visual assessment will typically be undertaken by Council officers, and if required, a formal hazard assessment will then be performed and the appropriate risk management strategy determined. Some of the common approaches to hazard abatement are outlined below.

<table>
<thead>
<tr>
<th>Hazard Abatement Strategy</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monitor trip points</td>
<td>Where no other practical method can be employed to prevent this occurring, a regular trip point inspection program should be instigated and pavement replaced or repaired as necessary.</td>
</tr>
<tr>
<td>Flexible pathways</td>
<td>Use of flexible material such as bitumen, paving, or rubber compounds for footpaths and tree surrounds, will reduce the occurrence of trip points and is less expensive and easier than concrete to maintain or replace when necessary.</td>
</tr>
<tr>
<td>Re-direct pathways</td>
<td>Where space allows, pathways should be re-directed away from trees/tree roots. It may also be beneficial to reduce the newly directed pathway width.</td>
</tr>
<tr>
<td>Bridging Footpaths</td>
<td>Self-supporting construction methods, such as pier and beam could be used to raise pathways above the roots, allowing for root expansion without damaging the pavement. Timber bridges are an effective option.</td>
</tr>
<tr>
<td>Root pruning</td>
<td>Non-structural roots could be pruned on a predetermined basis under the guidance of a qualified arborist. This practice could be combined with installation of root barriers where appropriate.</td>
</tr>
<tr>
<td>Root barriers</td>
<td>Where future problems can reasonably foreseen or damage by tree roots can be proven, barriers in specific cases may be installed to deflect roots away from structures or services. These are typically very site-specific and are not encouraged except as a last resort.</td>
</tr>
<tr>
<td>Tunnelling for services</td>
<td>Tunnelling (directional boring) rather than open trenching for underground service installation, will greatly reduce public risk as well as reducing injury to tree roots. If located deeply, root contact with the pipelines may be minimised as the majority of roots of most species will remain within the top 1 metre of soil (based on a soil with medium texture).</td>
</tr>
<tr>
<td>PVC welded piping</td>
<td>Replacement of old earthenware pipes with PVC or polyurethane will significantly reduce the potential for tree root entry.</td>
</tr>
<tr>
<td>Preventative tree maintenance</td>
<td>Trees in public areas should be regularly inspected and maintenance activities, such as dead-wooding and formative pruning carried out as prescribed. Pruning should always be undertaken in accordance with AS 4373-2007.</td>
</tr>
<tr>
<td>Raising pathways</td>
<td>Where appropriate, pathways could be raised to reduce direct root pressure on the pavement. Care must be taken not to build up soil against the trunk of a tree. Aeration piping, in conjunction with geotextile fabric and gravel should be installed between root zone and new pavement to aid with gas exchange to roots. Care should be taken to shape the new surface to drain water away from the trunk of the tree.</td>
</tr>
<tr>
<td>Insulated (ABC) cabling</td>
<td>Replacement of uninsulated overhead powerlines with insulated and bundled cables will reduce both the clearances needed and the pruning costs and severity.</td>
</tr>
<tr>
<td>Undergrounding of power and communications cables</td>
<td>The initially high cost of installing power underground may in fact be a practical option when compared with the projected cost of repeated pruning, the risk that this work involves to operators, the negative impact on tree health, loss of public amenity and of urban forest economic contributions.</td>
</tr>
</tbody>
</table>
1.8 Tree Removals, Replacements and Implementation Strategies

Overview
Trees like all living things, must grow, age and eventually die. Council aims to continue existing street characters and tree planting as much as possible, unless there are specific issues or problems to address or there are clear opportunities for streetscape improvement.

As per Woollahra Tree Management Policy 2011 Section 2.11 Council will generally not consider leaf, fruit, sap or bark drop or bird and bat droppings as valid reasons to prune or remove a street tree. These are natural processes of normal tree growth and wildlife.

Council will seldom remove a healthy street tree. If a certain type of tree is proposed for a street within this Plan, it does not mean that Council will remove the existing street trees in the short term to implement any new species. This will only happen gradually over time, as trees need replacing or if a specific opportunity exists to plant a new tree in an otherwise vacant area.

As such, existing street trees, regardless of species will normally be left to grow for their natural life and will only be removed once they have become a safety issue and an unacceptable hazard and ongoing remedial tree or infrastructure works are unviable. The exception to this policy may be when major street improvements or upgrade works are required or there is plan to revitalise a specific area. Even then, unnecessary tree removal will be avoided where possible.

Street Tree Removals and Replacements
As per Council’s Tree Management Policy, Council will aim to maintain and conserve the overall canopy coverage within the LGA. Where a street tree is removed, Council will install a replacement tree at or very close to the removal site. They will follow the spacing and placement guidelines outlined in this document and may locally adjust the placement as needed. The replacement species shall be as outlined for that particular street in the Master Plan. Where a choice of species is provided the species selected will take into consideration the localised environmental and functional and aesthetic aims. The species selected shall be at the discretion of the Council.

Where practicable and feasible the Council shall notify the affected residents of planned tree removals and replacements. If the proposed tree(s) being removed are particularly prominent or significant trees the Council shall also more widely advertise the planned removal at least 2 weeks prior.

Proposed New Street Tree Planting Strategy
The implementation of any new street tree planting needs to be carefully planned and considered.

New street planting will typically not be installed under the canopy or within very close proximity to larger and overhanging trees (either street, park or private). The resulting habit and condition of the newly planted tree is severely compromised, often resulting in a substandard tree form and future maintenance issues. This sort of conflict will be assessed by Council officers prior the finalisation of any planting program.

Unauthorised Planting on Council Land
As defined in the Council's Tree Management Policy 2011, Council may identify situations where resident's plant trees on the Council managed road reserve without the written approval of Council. Although these are sometimes suitable trees, there are a range of issues relating to insurance, public safety, environment and the integrity of overhead and underground services that must be considered.

Council does not permit planting of trees on Council land by persons other than Council staff or contractors and Council may remove any such trees.

Figure 1.13 - New in-road tree planting in Gipps Street, Paddington (Photo Arterra)
2.0 Tree Species Selection

2.1 Overview

The trees selected for our streets may occupy their planting sites for between 50 to 150 years, so species selection is vitally important as they are long term assets. In contrast, most residents will only occupy their houses for 5-10 years.

Most of Woollahra’s streets are already planted with well established trees. If these trees are performing well, are in-scale with the street and the surroundings, and provide a consistent and distinctive streetscape character, then generally the Street Tree Master Plan will follow and continue the existing pattern and species.

However, the Council adheres to the principle of the ‘right tree for the right location’ and some exceptions to this general policy will occur. These include species that have performed poorly, are considered out of scale with the street, or have proven themselves to be particularly damaging to pavements, kerbs, gutters, structures or underground services in that location.

This provides the opportunity to introduce additional tree species to our area and also trial new and better trees and cultivars that show promise as urban street trees.

Importantly, research has consistently shown that the greatest benefits are typically provided by medium to large trees compared to small trees. Large to medium sized trees will typically:

- Create more shade per tree due to a larger and wider canopy spread;
- Create better shade to buildings as they are taller and can cast shadow over adjoining roofs and walls of buildings;
- Intercept larger amounts of particulate pollutants and rainfall due to significantly larger leaf surface areas.
- Absorb more gaseous pollutants;
- Provide canopy cover with potentially less intrusion at the ground level from stems, trunks and lower branches;
- Be less susceptible to careless or malicious vandalism by passers-by once established;
- Be pruned to provide higher canopy clearances over roadways, parking lots and pedestrian footpaths;
- Contribute more to calming and slowing traffic on local streets than small trees.

Large trees may cost more to maintain and remove towards the end of their life. However, the cost to install a tree and then look after it in the first few years to establishment, are essentially the same regardless of whether the tree ultimately grows to a large or small size. Medium and larger growing trees are also commonly longer lived than small trees. Large trees do require larger soil volumes and more physical space above and below ground than small trees, but the ultimate benefits to the community are often exponentially increased over their lifetime. This increased soil volume should be designed and factored in to any new planting. Nevertheless, we must remember that some minor and reasonable infrastructure damage should be tolerated in return for the substantial benefits the trees provide.

Using the paradigm of right tree for the right location, a large tree will only be specified and planted for an area where there is obviously sufficient space, and the growing conditions are suitable for the foreseeable life span of the tree. Smaller trees will also have a place in Woollahra’s urban forest for areas where physical space, views or exposure are over riding factors.
2.2 Species Mix and Diversity

Species diversity is a critical component in managing sustainable urban forest. The wider the range of botanical species and families, the lower the likelihood of canopy cover degradation and loss in the event of unexpected pest and disease outbreak, or from impacts such as climate change. Increased diversity also helps to support more diversity of fauna, by providing a variety of food and habitat throughout different times of the year.

Species diversity is often measured by the percentage of the tree population in particular families, genera and species. Commonly accepted maximums to aim for are in the range of:-

- 30% - 40% for any one particular family;
- 20% - 30% for any one particular genus and
- 5% - 10% for any one particular species.

The Council's current street tree palette consists of more than 230 different tree species. The species diversity in private properties is likely to be substantially higher, as the constraints on planting (overhead and underground utilities, soil conditions, reduced water availability etc) are substantially reduced.

Whilst the number of the different species is high, it is important to consider the concentration of family and species numbers. A wide range of tree species helps to mitigate the potential impact from any new pest or disease incursion, ensuring any canopy cover loss from such an event is minimised to manageable levels.

The Council aims to achieve species diversity in its street trees by:-

- Implementing the relevant tree species selection and planting guides including this Street Tree Master Plan for all new street tree planting;
- Selecting the trees species for planting depending on their suitability for the site, aesthetic, functional and biological attributes, performance and potential to contribute to the environment, using the philosophy of the “right tree for the right location”;
- Assessing Development Applications to ensure that any proposed tree selection is compatible with desired canopy cover levels, biodiversity needs and landscape character for particular precincts or villages;
- Selecting tree species to meet the accepted diversity standards of no more than 40% for families, 30% genera and 10% for any one species;
- Considering known pest and disease impacts when selecting new tree species and managing tree replacements.

An assessment of the Council's street trees species has been undertaken, as outlined in the graph below. In terms of families, it shows that Myrtaceae at more than 38% of the total tree population, is the most common and is used extensively throughout the LGA. This is understandable; this family is native to Australia and includes more than 80 different species planted in the streets and parks alone. This includes trees such as the Eucalypts, Paperbark, Brush Box, Angophora, Corymbia, Turpentine and Lilly Pilly’s to name but a few.

In relation to individual species, the Brush Box (Lophoetmon confertus) is the most common tree with 15.9% of the total population, followed by Water Gum (Tristaniopsis laurina) at 7.1% and Bottlebrush (Callistemon sp) at 4.7%. As the Council is reaching the top of the range considered acceptable for these species, careful ongoing species selection will be required. This becomes more pronounced in individual precincts. For example the use of Brush Box within Bellevue Hill and Rose Bay exceeds 28%, but in Paddington and Edgecliff they represent less than 5% of the street tree population. This means that it may be appropriate to specify the use of Brush Box in suburbs where their current use is low, but may not be as wise to increase their use in suburbs where they already dominate.

This must be balanced by the species that are also planted in private property. These usually included a far more diverse mix of species and usually includes trees that are not commonly planted in the streets. This aids in the dilution of the overall populations noted above, when one considers the urban forest as a whole.

It is important to remember that this is a guiding principle and desire for increased diversity should not override the more appropriate requirement to select the right tree for the right place.

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2-2 Woollahra Street Tree Master Plan 2014
2.3 Street Tree Planting in The Past

Formalised street tree planting in Woollahra by the Council dates back to 1889 when Woollahra Council first passed a resolution to require builders and developers to plant trees as part of the beautification works for the newly developing area as it began to change from a predominantly market gardening and dairying land use to a residential area. Great emphasis on street beautification works continued well into the 20th century.

In 1918 a special committee advised by the Director of the Sydney Botanic Gardens, Joseph Maiden, distributed 321 Indian Laurel Figs (Ficus microcarpa nitida) and Brush Box (Lophostemon confertus) trees throughout the municipality that year. In 1919 an additional 300 Brush Box were planted together with 150 Camphor Laurels (Cinnamomum camphora), mainly throughout Bellevue Hill.

Other notable planting included the continued use of Indian Laurel Fig (Ficus microcarpa nitida) in 1921-22 planting programs along with London Plane (Platanus x acerifolia) and other deciduous varieties. Maiden also recommended Plum Pine (Podocarpus elata) to alternate with Figs on the wider sections of New South Head Road near Cranbrook.

Developers recognising the desirability of the area seized the opportunity with the construction of residential flats, greatly increasing the population in the inter-war period 1920-1945. Woollahra Council, recognising the pressures of its fast developing area, maintained its tree planting programs and the requirement that developers plant street trees to avoid a hard urban conurbation that was devoid of greenery.

As noted in ‘The Urban Garden’ by the 1930’s, “the Harbourside suburbs of Double Bay and Rose Bay had developed into intensely urban spaces but the built landscape had been softened by rows of trees, gardens and rockeries that had been planted in the streets by Council”.

Other notable street tree species planted either by Council or by private individuals in the period from 1890 to 1930 included many:-

- Moreton Bay Fig (Ficus macrophylla);
- Port Jackson Fig (Ficus rubiginosa);
- Norfolk Island Pine (Araucaria heterophylla);
- Cook Pine (Araucaria columnaris);
- Red Apple (Syzygium ingens syn. Acmena brachyanda);
- Coral Tree (Erythrina x sykesii);
- Camphor Laurel (Cinnamomum camphora)

Trees even in this early period proved to be contentious as evidenced by requests to Council to act on issues such as the blocking of views and leaf and fruit drop which generated heated debate among locals.

Figure 2.2- Wilberforce Avenue, Rose Bay with its row of mature Camphor Laurels (Photo Arterra)
From the 1920's tree planting slowly became more varied with species such as Crepe Myrtle (*Lagerstroemia*), Hill's Weeping Fig (*Ficus microcarpa var. hillii*), Golden Privet (*Ligustrum*), common Olive (*Olea europaea*) and Ti-tree (*Leptospermum sp.*) as well as more palms being used, such as Canary Island Date Palms (*Phoenix canariensis*) and Washington Palms (*Washingtonia robusta*). The palms were later judged to be too large or inappropriate for some road-side planting, with those planted in O'Sullivan Road being removed in 1929.

The streets of Woollahra LGA are now a legacy of the often well-meaning but inconsistent and ad-hoc approach to street tree planting that has occurred from the mid 20th century. From the earliest days of development of the municipality, Woollahra Council encouraged tree planting to avoid a barren suburban landscape and was quite visionary to the extent of wanting to achieve a verdant garden municipality. To achieve this ideal Council either supplied trees to residents or supplemented the costs of tree planting. These were based on a thematic approach to plantings which were largely carried through well into the 20th century.

Divergent planting variations began to appear from the late 1920's from the original concepts of the 1918 committee resulting from resident complaints regarding the type and size of some plantings. The palette of plants expanded after the removal of Canary Island Date Palms in 1929 from O'Sullivan Rd, mentioned previously, following the donation by Lady Fairfax of large numbers of Jacarandas, Poplars, Hibiscus, Flame Trees, Silky Oaks and Port Jackson Figs for the replanting of O'Sullivan Road and other sites nominated by her.

Following this development the Council expanded the number of species used for street tree plantings with the introduction of Kurrajongs, Eugenias, Jacarandas, Ti-trees, Plantain Bananas, Common Olives, Flowering Gums, Wattles and New Zealand Christmas Trees. It also grew and planted a large number of London Plane trees from its own nursery.

The inter-war years saw a further expansion of street tree plantings as Council kept pace with the development of the municipality and with the continued requirement for builders and developers to plant street trees and the added impetus of state wide tree planting campaigns, such as the visit of HRH Prince Henry Duke of Gloucester, which saw an additional 5000 trees planted in Woollahra between 1936 and 1938.

The decision to adopt a more arbitrary approach to tree species and an opportunistic approach to plantings, combined with ongoing removal of street trees has often led to many incohesive and inconsistent streetscapes, which has only in recent times started to be addressed by Woollahra Council.

There are still remnants of some of the significant trees of these earlier periods that remain and the management of these trees now presents an ongoing concern for Council as they age and decline.

Resident Planting
Residents have contributed to the development of the street tree legacy Woollahra has today. This was achieved through Council encouragement via the free distribution of trees during the early developing years, and later by the urge to plant something personally desirable on the street outside private property. This is reflected in the diversity of tree species and in the distinctively verdant but sometimes compromised character of many of Woollahra's streets.

Despite the often good intentions of residents, this legacy has created its own tree management problems as many trees have been planted without regard to the impact that the mature trees will have on nearby services, property, footpaths, kerb and gutters and the consistency of the streetscape vegetation.

Historically Significant Street Trees
The Street Tree Master Plan will advance the process of addressing streetscape planting cohesion by analysis of the existing planting characters and recommendations for future tree planting species. Some of the historically significant streets that warrant maintaining a similar character are outlined below. They may not be replaced with the exact same species, if they are likely to cause significant problems, but the continuation of trees that present a similar look and character should be used. These streets include:

- O'Sullivan Road – Figs
- Bennett Ave – Phoenix Palms
- South Avenue – Camphor Laurel
- Vickery Ave – Norfolk Island Pines
- Rosemount Ave – London Plane Trees
- Paddington St – Planes and Hill's Weeping Figs
- Ocean Avenue – Figs, Norfolk Island Pines, Candlenut
- Rosebay Ave – Phoenix Palms
- Holland Road – Mixed Palms

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2.4 Right Tree, Right Location

One of our key tree selection objectives is to ensure the selection of the 'right tree for the right location'. In other words, to ensure that the selection of the species is appropriate to the local environmental conditions and the constraints of the planting location. The selection of species aims to ensure that the tree makes a long term and positive contribution to environmental, amenity, aesthetic and heritage values of the area and any negative aspects and future hazards are minimized.

There is no ‘perfect’ street tree, so every selection has some compromise between positive and negative values. This often means providing a balanced decision between native and exotic species, deciduous and evergreen species and the ultimate size of the tree.

The Street Tree Master Plan tree selection criteria is divided into three main considerations :-

- Environmental issues;
- Functional requirements and;
- Aesthetic and design requirements.

Consideration of the criteria outlined in this section should ensure the selection of the species with the most desirable and appropriate characteristics, no matter what their origin or type.

In order to ensure the health and longevity of street trees, aesthetic and design considerations will be accommodated only where optimum conditions for plant growth are available.

The proven performance of the species, in particular to environmental conditions and functional requirements, will be the prime considerations for the proposed street tree selections.

2.5 Environmental Issues

The capacity of trees to establish and grow successfully depends heavily on the environmental conditions at the planting location being within the tolerance range of the species selected. Climate, exposure, soils, landform, pests and diseases, habitat, climate change, diversity and ecology are basic considerations in selecting any tree.

Unlike other street infrastructure trees are living organisms. They need to grow to survive and their behaviour is not always completely predictable or consistent. Being a living thing they:-

- Will typically all need to shed leaves, bark, fruit, flowers at some point throughout the year;
- Need to, and will, respond individually to the natural prevailing conditions;
- Can be easily damaged, disfigured and vandalised (particularly when young);
- Can be severely affected by pests and diseases that can kill or increase the stress on the trees.

Climate

In general the climate experienced in Woollahra is typical of subtropical east-coast Australia. We experience a warm, wet Summer and Autumn and a cool, drier Winter and Spring. The predominant wind in summer is north-easterly and in winter it is southerly with regular strong westerly winds during late winter & spring. Mean daily maximum temperatures (25°C) occur between December and March with mean daily minimum (<10°C) between June and August. Street trees selected will need to be able to tolerate these temperate and climatic conditions.

More important however is the consideration of microclimate for particular locations. Particularly, salt laden onshore winds, exposure, overshadowing caused by taller buildings, wind tunnel effects and reflected heat result in the need for tree species that are particularly hardy and resilient to such adverse conditions.

Geology and soils

The underlying geology and soil provides nutrients and water as well as physical support for trees. Soils differ in the conditions they provide in terms of quantities of nutrients, drainage characteristics and depth.

Woollahra LGA has a mix of soil types and conditions ranging from deep sandy alluvial loams, sandy and skeletal sandstone derived soils through to disturbed soils and landfills of varied and often unknown qualities. Generally the original soil types are derived from Hawkesbury Sandstone with sands or clay subsoils or dune sands over underlying Hawkesbury Sandstone. These are of varying depths which was reflected in the original vegetation cover and the ability of existing trees to grow and maintain good health and vigour.

Soil types greatly influence the health and vigour of trees, with some species more sensitive to soil types than others. Trees will usually grow best in soil types similar to the soils found in their original habitat. However most trees benefit from growing in well drained sandy loams and these are found widely in the Woollahra LGA.

An occasional occurrence found in Woollahra LGA is very shallow soils, where rock is found close to the surface and overlaid by a relatively thin layer of soil. This has considerable impact on the health and vigour of trees, often resulting in stunted growth and trees that succumb to pest and disease attack. Species that can readily adapt to shallow soils will be preferred in these areas. These tend to be the more adaptable Australian native species such as Brush Box (Lophostemon confertus), Angophora sp. and Banksia sp.

We must remember that many areas are also extremely disturbed and have had the original soil stripped and replaced by building debris and landfill materials including garbage. This is particularly common around the Harbour foreshores and the more commercial areas. Trees that adapt to a wide range of soil types and conditions are preferred in these areas.
Topography

The varied topography of Woollahra’s LGA has a strong influence on species selection from the more exposed ridge lines of Oxford Street and Old South Head Road to the flat or gently undulating basins of the Rose Bay and Double Bay areas with a backdrop of the elevated escarpments of Victoria Road and Edgecliff Road. Consideration will be given to the original water courses and creeks that flowed through the area that may benefit species that originated from these environments.

At a local level, topography can affect street tree establishment with steeper slopes being better drained than gentler ones, and slopes facing north and west receiving more sunlight and thus being hotter and drying out faster than those facing south or east. Deeper soils also typically accumulate down slope, with up slope areas and ridge lines often having very thin soils.

Tolerance in paved areas

Selected street trees need to tolerate the site conditions of fully paved areas. These trees must have the ability to adapt to lower than optimum soil oxygen levels and compacted and highly modified soil conditions.

Drought tolerance and climate change

Although Woollahra experiences good rainfall averages, and is close to the coast, it is expected that the pattern of water use restrictions and lower than average rainfall that Sydney recently experienced in the early 2000’s will be repeated in the long term. Street trees therefore should be capable of surviving an average drought period in reasonable condition without irrigation or reliance on town water supplies. Passive irrigation through the use of Water Sensitive Urban Design may assist with additional water being available to trees. However, in reality many existing streets are not able to be retrofitted without impacting the tree and major infrastructure changes.

Tolerance of pests and diseases

The selected tree species should be resistant to pests and disease. A diversity of species is also important in reducing the potential impact of any devastating diseases on specific tree species.

At the time of drafting this 2014 Master Plan, several major pest and disease threats hang over the Council’s tree population. These are typically introduced pests and diseases that can potentially have devastating impacts on certain species of trees.

Specifically this includes pests such as:
- Sycamore Lace Bug
- Myrtle Rust
- Fusarium Wilt
- Armillaria
- Phytophthora

Overseas precedents show that widespread infestations of harmful pests and diseases can have devastating consequences on parts of our urban tree populations.

Tolerance of atmospheric pollution

The more urban environment and areas traversed by busy arterial roads are subject to high levels of photochemical pollution produced by vehicle exhaust systems. Trees selected for these areas need to be able to tolerate vehicle emissions.

Deciduous trees are generally considerably more tolerant than evergreen species due to the duration over which different species retain their leaves. The longer the life of a leaf the greater the likelihood that the threshold levels for pollutant damage will be exceeded.

Native wildlife habitat

Trees provide shelter, food and other habitat resources for a range of fauna species. Wherever possible, consideration will be given to planting trees which expand on and provide a connection between open spaces or other important vegetated areas, particularly those identified as priority habitat areas in the Council’s Green Web areas. This increases the area of available habitat and assists in the movement of native fauna species between those areas. Although native trees are preferable in this regard, exotic species also have some habitat value and should not be discounted altogether. A mix of species may be used where appropriate.

Balance between native and exotic street tree selection

There is much debate about the use of locally indigenous species, that is, species that originally grew within the area. Whilst locally indigenous species may be the most appropriate for local environmental conditions, the growing conditions within the urban environment are often now very different, particularly in a street situation. Disturbed soil profiles, compaction, higher nutrient status, altered drainage patterns and paved surfaces are just a few of the problems with which urban trees must contend. When addressing this issue, a more useful division may be to view this point three ways:-

- Locally indigenous natives;
- Natives from other parts of Australia;
- Exotics trees being from outside of Australia.

Local natives have the advantage of being climatically suited and live in some equilibrium with native pest organisms such as insects and fungi. Use of local natives promotes biodiversity and creation of wildlife corridors, reinforces an ‘Australian’ sense of place, and can be very drought and exposure resistant.

Natives from other regions may also be climatically adapted and may enjoy freedom from local pest organisms but if they become infested are likely to succumb faster. Exotics may be almost completely free of native pests and diseases but run the risk of being devastated if other exotic pests are accidentally introduced.

Regarding local, or at least NSW east coast native species, and their suitability as inner urban and suburban street trees, the species that are best adapted are usually from drier rainforest and rainforest margins, particularly littoral rainforests where most trees are long lived and shade tolerant or from freshwater.
swamps and other areas that are poorly drained and aerated. Species from these later environments are highly resistant to root rot organisms and their root systems are well adapted to adverse soil conditions.

Many of the familiar natives such as Eucalypt trees are from the more open and drier vegetation communities. These species seem to perform poorly as street trees in the more urban areas due to more specialised physiology. They are often adapted to soils of very low nutrient status but with perfect drainage where rot organisms are at a disadvantage. Consequently these species are less tolerant to interference with their root system, including compaction, waterlogging and human damage. Depending on the design principles sought, natives can also display a somewhat variable habit or form which makes it difficult to establish and maintain a formal planted avenue, particularly in close proximity to roads and power lines.

Also they are highly adapted to fire and as a consequence they often 'bolt' in growth for brief periods when post-fire soil nutrients are temporarily higher. As this bolting of growth continues in a high nutrient, fire free environment the tree may become structurally weak and the foliage and bark becomes susceptible to attack by insects and other pests.

An important advantage of exotics in the urban context is that they include many useful deciduous trees which provide greater solar access to the streets through the winter months. Some natives are deciduous but generally in spring or early summer (an inheritance of their monsoonal origins). The red and white cedars (Toona ciliata, Melia azedarach) are the closest native trees we have to winter deciduous but both suffer from severe pest problems under urban conditions and are unreliable performers.

Many exotic deciduous species have the advantage of hundreds of years of selective breeding which ensures quality stock. They are pollution tolerant, more resilient to root area compaction and damage during construction works. The canopy shape and branch architecture of many exotics also facilitate the pruning and shaping required for urban infrastructure and narrow footpaths.

In summary, both natives and exotics have their strengths and weaknesses for use as street trees. The Street Tree Master Plan will aim to select the right trees for the right locations, for the right reasons and strike an appropriate balance between all the competing factors.

2.6 Functional Issues
Species selected for street tree planting also need to fulfill certain functional criteria to ensure successful establishment and reduced ongoing maintenance and management issues. Ability to provide suitable clearances, the form, and size of the tree are all particularly important to the selection. One must also consider solar access, potential mess from leaf, fruit, flower and bark, drop, the propensity of limb drop, longevity, and contribution to allergies. The ease of maintenance, commercial availability, ability to deal with pruning for overhead power lines and narrow street verges must also be considered.

Proven performance record
Proven performance of the species under the environmental conditions of the locality is vitally important. Trees are a long term investment and substantial amounts of money are often invested in their purchase, planting and maintenance. New species should be trialed on smaller scales before implementing their more widespread use. Similarly, premature failure in one given situation should not necessarily rule out further trials being undertaken of particularly promising new species.

Readily available and transplantable at advanced sizes
The selected plant species must be able to be commercially grown and available in a suitable size for street planting. Generally the tree nursery stock used will be super advanced stock to provide high initial impact and adequate resistance to casual or intentional vandalism.

Acceptable leaf and fruit fall characteristics
The selected species must have an acceptable level of nuisance created by the shedding of leaves and fruit for a street environment. Those with large or heavy seed pods, excessive leaf drop, or fleshy fruit or flowers which may lead to slip hazards will typically be avoided, particularly in paved environments.

Low risk of becoming an environmental weed
Some species are known to be, or have the potential to be serious environmental weeds due to their ability to readily self propagate and invade bushland areas. Species with known weed potential shall typically be avoided, particularly near bushland.

Not prone to major limb shear
Limb loss occurs on an occasional basis for most trees, sometimes due to wind induced mechanical breakage and sometimes for self regulated removal. This is a natural process and must be expected to occur from time to time. Some trees that are particularly renowned for having brittle branches and regular branch drop will typically be avoided for use as street trees.
Long lived
Many of the costs associated with the management of trees in the urban environment are at the early establishment period and over-maturity phases. Using long lived species will help minimise tree management costs over time and lengthens the period where a tree requires minimal financial and resource inputs. The useful life of the tree is also extended.

Capacity to lift pavements and kerbing
No guarantees can be given that a particular street tree species will not interact with nearby kerbs and pavements. However, species that are renowned for vigorous or particularly large root systems that have the potential to cause pavement uplift will be avoided. The exception to this may be where prevailing soil conditions, such a deep sands, mean this damage is less likely. The Council will also investigate the use of alternative footpath materials and designs to minimise tree root / paving interaction.

Low maintenance
Trees preferred by Council will be those that require minimal maintenance after the establishment phase. Trees with excessive maintenance requirements or need to be regularly treated for pest and diseases will not be selected.

Overhead Power Lines
The most significant functional factor that can limit a trees contribution to the streetscape is the potential conflict with overhead power cables. One solution to this problem is to select very small tree species. This is viable for narrow streets, however with wide streets these small trees are often out of scale with the surrounding streetscape and present a poor environmental, social and aesthetic outcome.

Another solution is to install Aerial Bundled Conductors (ABC). These consist of a number of insulated wires bundled into a single cable which then eliminates the need for the wide stringing assemblies that are the greatest problem from a street tree perspective. The ABC also allows for reduced line clearance standards resulting in less pruning and less impact on the establishing tree canopies.

Where ABC has been installed, Council may review existing tree performance and the nominated species within this plan. Planting larger trees may maximise the benefits received from the ABC. A number of streets warranting the installation or expansion of ABC are outlined in Appendix 5.2.

Underground services and structures
High pressure gas mains and electricity easements sometimes prohibit establishment of trees due to the depth of the service and potential liabilities if the service is damaged. Similarly underground structures, wall footings and the like may also limit the ability of a tree to be planted and successfully grow. These issues are often very localised and do not affect the whole street. Each identified planting site will be assessed by Council officers on its merits to determine the feasibility of establishing the trees with consideration to underground services and structures.

Narrow footpaths and verges
A critical factor in species selection is the width of the footway or verge. Trees planted in a footpath less than 1500mm wide (from building/ boundary line to the back of the kerb) force pedestrians, particularly those with strollers, to walk on the road. As it is far safer to encourage pedestrians to stay on the footpaths, trees will not be planted in verges less than 1500mm in width, unless alternative means of pedestrian thoroughfare can be provided. (eg. one side of the street is provided with a footpath but the opposite side is available to be planted.) In streets with footpaths less than 1500mm, that may already support tree planting, then in-road or shared zone options will be explored for any new tree planting, if possible.

Where site constraints limit the optimum size of street plantings, consideration may be given to mechanisms which minimise or remove the impact of these constraints. These could include for example, replacing overhead power lines with Aerial Bundle Conductors (ABC), planting trees within a median strip or within the road carriageway (where footpaths are narrow but streets are sufficiently wide) and increasing the root zone soil volume by use of vaulted pavements, structural cells, structural soils or similar technologies.

Figure 2.3 - Pruning for power lines has a major influence on street trees with some species more suited to under wire planting than others. The Plum Pines of Leura Road, Double Bay are now less than desirable specimens. (Photo Arterra)
2.7 Aesthetic and Design Issues

Woollahra is primarily a constructed cultural and urban landscape consisting of streets, buildings, parks and some remnant more naturalistic areas. Trees play an important role in enriching the cultural experience of the place and so the aesthetic characteristics of the trees need to be an important selection consideration. We must also consider the trends in property turnover. Increasing residents only stay in the one house for a short time which is evidenced by the fact that more than 42% of residents in Woollahra have moved house in the last 5 years. This is slightly higher than the greater Sydney average. In short, people move houses, but trees are there for 50-150 years and have wider public benefits.

Views

As a Harbour-side area, Woollahra LGA contains many areas with either elevated or Harbour edge properties that offer prestigious views to the Harbour and City skylines. The average property price paid in Woollahra is substantially higher than the Sydney average and reflects the value people are prepared to place on such views, the Harbour settings and the proximity to the Sydney CBD. Views are therefore treasured and must be considered as a very valuable commodity.

The interaction between street trees and property values presents a series of very complex considerations. People pay top dollars for views and therefore do not want trees growing up into views and blocking them. In many instances, however, there are still opportunities for small trees to be planted in the street, with houses overlooking trees while retaining their views. Woollahra Council offers a view pruning service in existing cases, please refer to the Woollahra Tree Management Policy 2001 Section 2.12.

Relationship with distinctive landscape characters

The selection of species may be made to reinforce specific historical, cultural or natural associations from our past, particularly the Victorian and Federation era landscape planting.

Ultimate size of tree canopies

Very large trees in confined spaces often result in unacceptably high management costs and impacts to residents. Conversely small growing trees in broad streets rarely contribute significantly to visual quality or canopy coverage.

Trees selected will typically be in scale with the streetscape and where appropriate, Council will utilise the largest appropriate species possible for the given location. The optimum range is not so small that it does not make any contribution to the amenity of the street, and not so large as to dominate and cause significant problems in the mature stages of the tree. Species will be selected such that the ultimate mature size of the tree is appropriate to the street giving consideration to the site constraints, such as verge width, overhead power lines, building alignments and vehicle clearances.

In some instances the constraints imposed by the particular street, or even a particular location, along the street will limit the optimum size of street tree or even restrict street tree planting altogether. This is the case with the majority of narrow lane ways and narrow footpaths throughout the area.

Form of tree canopies

Selected species should have an appropriate and predictable form, usually with an upright trunk and stable branch structure. Street trees usually need to have a form that allows traffic and pedestrian movements around and under the tree. In the urban areas desirable tree forms include trees with a single straight main trunk supporting a domed crown, or columnar form.

Deciduous versus evergreen

The street tree list includes both evergreen and deciduous trees. Evergreen species provide year round screening, greenery and shelter from winds. Deciduous trees provide stimulating seasonal events whilst maximising winter light.

In residential areas deciduous trees are useful to maximise summer shading and winter light, particularly for buildings located on the southern side of a narrow street with small set backs.

Palms

Woollahra has history of utilising palms within its streets. The continued and strategic use of some palm species may be warranted in some locations, particularly in view sensitive areas or in very tight streets. They can be useful trees in a street as they are typically very space efficient, contribute less to view impacts, and provide or continue a distinctive character.

2.8 Master Species Listing

The following schedule provides a list of the proposed species to be used in the streets of Woollahra. The listing is divided into native trees and exotic species then separates deciduous from evergreen species in each of those broader categories and is further broken down into small medium and large. Some species have very wide applications, while others will only be used in very specific locations.

There are a total 72 street tree species proposed for ongoing use in the Woollahra LGA:-

Tree Origin
28 (39%) are exotic species;
44 (61%) are native species of which;
30 (42% of all tree types) are endemic to the Sydney area.

Tree Types
52 of the species are evergreen trees,
13 of the species are deciduous trees,
7 of the species are palms.

Tree Sizes
24 (33%) are large trees
27 (38%) are medium tree,
21 (29%) are small trees

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<table>
<thead>
<tr>
<th>Botanical Name</th>
<th>Common Name</th>
<th>Canopy Size</th>
<th>Origin</th>
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<th>Type</th>
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## EXOTIC TREES

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</tr>
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<td>Xylosma senticosum</td>
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<tr>
<td>Caesalpinia ferrea</td>
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<td>Celtis australis</td>
<td>Nettle Tree</td>
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<td>Exotic</td>
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</tr>
<tr>
<td>Hibiscus tiliaceus</td>
<td>Coast Cottonwood Tree</td>
<td>Medium</td>
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</tr>
<tr>
<td>Jacaranda mimosifolia</td>
<td>Jacaranda</td>
<td>Medium</td>
<td>Exotic</td>
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<td>Koelreuteria bipinnata</td>
<td>Chinese Rain Tree</td>
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<td>Lagerstroemia indica</td>
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<td>Tipuana tipu</td>
<td>Pride of Bolivia</td>
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<td>Zelkova serrata ‘Green Vase’</td>
<td>Green Vase Zelkova</td>
<td>Medium</td>
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<tr>
<td>Araucaria columnaris (syn.A cookii)</td>
<td>Captain Cook's Pine</td>
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<td>Exotic</td>
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<td>Evergreen</td>
</tr>
<tr>
<td>Araucaria heterophylla</td>
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<td>Exotic</td>
<td></td>
<td>Evergreen</td>
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<td>Cinnamomum camphora</td>
<td>Camphor Laurel</td>
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<td>Exotic</td>
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<td>Evergreen</td>
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<td>Platanus x acerifolia ‘Bloodgood’</td>
<td>London Plane</td>
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<td>Deciduous</td>
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<td>Podocarpus elatus</td>
<td>Brown Pine, Illawarra Pine</td>
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<td>Exotic</td>
<td></td>
<td>Evergreen</td>
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<td>Ulmus parvifolia</td>
<td>Chinese Elm</td>
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<td></td>
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## PALM TREES

<table>
<thead>
<tr>
<th>Botanical Name</th>
<th>Common Name</th>
<th>Canopy Size</th>
<th>Origin</th>
<th>Endemic</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Archontophoenix cunninghamiana</td>
<td>Bangaly Palm</td>
<td>Small</td>
<td>Native</td>
<td>Endemic</td>
<td>Palm</td>
</tr>
<tr>
<td>Livistona australis</td>
<td>Cabbage Palm</td>
<td>Small</td>
<td>Native</td>
<td>Endemic</td>
<td>Palm</td>
</tr>
<tr>
<td>Butia capitata</td>
<td>Wine Palm</td>
<td>Small</td>
<td>Exotic</td>
<td></td>
<td>Palm</td>
</tr>
<tr>
<td>Howea forsteriana</td>
<td>Kentia Palm</td>
<td>Small</td>
<td>Exotic</td>
<td></td>
<td>Palm</td>
</tr>
<tr>
<td>Washingtonia filifera</td>
<td>American Cotton Palm</td>
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<td>Palm</td>
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<tr>
<td>Washingtonia robusta</td>
<td>Mexican Fan Palm</td>
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<td>Palm</td>
</tr>
<tr>
<td>Phoenix canariensis</td>
<td>Canary Island Date Palm</td>
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<td>Exotic</td>
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<td>Palm</td>
</tr>
</tbody>
</table>
3.0 Street Tree Design Guidelines

3.1 Overview

As a collective asset, street trees are considered and planted to reinforce public realm and landscape design principles, in particular to:

• Provide more consistency and visual uniformity for each street;
• Enhance the local character of distinct streets or areas by introducing a precinct based planting approach;
• Reinforce and celebrate key corridors and nodal intersections;
• Enhance key cultural and commercial sites;
• Permit solar access to smaller scale residences and narrow streets;
• Facilitate and retain views to the Harbour and city skylines where appropriate and such views already exist and
• Allow the adjoining landscape to take precedence over street tree planting where existing parks adjoin the street.

In adhering to these design principles consideration must be given to site specific site conditions that will determine an individual tree’s placements. These include footpath and verge widths, sight line clearances, underground utilities, overhead wires etc. Some of these are more fully outlined in Appendix 5.3 Street tree supply and installation specifications and 5.5 standard tree planting details.

Consistency and visual uniformity for each street

The intention of this principle is to establish a more uniform visual character for each street, creating a sense of identity or ‘sense of place’ that compliments the surrounding architectural forms and provides streets with a distinctive and recognisable character. Inconsistent street plantings with a large number of different species may be appropriate and can add interest to some streetscapes. However, they are also more difficult to manage and may be inappropriate in some locations or may have a negative impact on the amenity of the street.

In most cases the proposed species will be an extension or continuation of the dominant existing species, if that species has been deemed to be suitable in scale and growth habit.

Precinct based approach

Related to the principles of a more consistent and coordinated theme for individual streets is the concept of ‘precinct’ planting. All new planting will be based on a precinct approach where tree species selection and planting will help reinforce the distinct physical character of each area and be responsive to its more unique environmental conditions.

Mixed Species

Most streets have been designed to have a small mixture of species. This may, for example, be in the form of one side of the street being a smaller species to fit under overhead wires and a larger species on the other side where absence of services and verge space permit.

The number of species in each street has been limited as the management of single or relatively few species per street is far more efficient for Council. Issues such as tree supply, tree planting, tree maintenance and street cleaning frequency are all more difficult with highly mixed species streets. Having some flexibility however does provide some benefits in allowing Council to select the most appropriate tree for a given location and to deal with changes that often occur, even along the length of the same street in terms of views, verge widths, and service locations, etc.

Some streets may also benefit from a planned alternating mix of species. These are usually designed to cater for the continuation of a pre-existing street condition and importantly to balance the provision of native and exotic trees and/or deciduous and evergreen trees. Attempts will be made to alternate the two (or more) species to provide for the designed intention of the mixed species street.

The selection of which of the species to plant and the exact location within the street shall be at the sole discretion of the Council. Individual requests by adjoining residents for one or other of the species will typically not be accommodated.
3.2 Precincts

The Local Government Area of Woollahra occupies 1219.7 ha or 12.19 km². It contains 10 recognised suburbs. The precincts defined in the Street Tree Master Plan are based on the suburb boundaries with some minor adjustments to avoid streets being split longitudinally. The suburb boundaries do conform generally to the demarcations of important historical and physical boundaries such as landform, major streets and the dominant character of the built context.

There are 10 precincts. The location and extent of the precincts are displayed on Figure 4.1. They include the following:

<table>
<thead>
<tr>
<th>Precinct Name</th>
<th>Area (ha)</th>
<th>% of total area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bellevue Hill</td>
<td>237.1</td>
<td>19.4</td>
</tr>
<tr>
<td>Darling Point</td>
<td>66.7</td>
<td>5.5</td>
</tr>
<tr>
<td>Double Bay</td>
<td>77.9</td>
<td>6.4</td>
</tr>
<tr>
<td>Edgecliff</td>
<td>30.7</td>
<td>2.5</td>
</tr>
<tr>
<td>Paddington</td>
<td>116.1</td>
<td>9.5</td>
</tr>
<tr>
<td>Point Piper</td>
<td>35.6</td>
<td>2.9</td>
</tr>
<tr>
<td>Rose Bay</td>
<td>202.7</td>
<td>16.6</td>
</tr>
<tr>
<td>Vaucluse</td>
<td>264.6</td>
<td>21.7</td>
</tr>
<tr>
<td>Woollahra</td>
<td>126.1</td>
<td>10.3</td>
</tr>
</tbody>
</table>

3.3 Street Typology Summary

Streets are varied throughout the municipality, as one would expect, given the range of periods in which the suburbs were developed. There are also many streets that, rather unusually for inner suburban Sydney, have had the electricity supply undergrounded. This is particularly related to the Harbour side suburbs such as:

- Point Piper
- Darling Point
- Double Bay
- Rose Bay (parts)

There are just over 355 separate streets within the municipality (excluding minor laneways). Some are not capable of being planted with street trees due to space restrictions, however most do have opportunities or are currently planted with street trees.

In analysing the current street verges:

- 18% have verges wider than 5m and would be considered large.
- 26% have verges that are 3.5-5.0m wide and would be considered a medium or average size.
- 42% have verges that are between 1.8 - 3.5m wide and would be considered small.
- 14% have verges less than 1.8m wide and would be described as narrow.

The most common street typology within the LGA is a verge that is approximately 3.5 m wide with a 1.5m wide concrete path located on at least one side, and usually both sides, leaving a 1.5m wide grass strip in which to plant street trees. This leaves a reasonable opportunity to plant a wide variety of trees that are set 750mm from the road edge and 750mm from the adjoining path.

There are many particularly narrow verges that are only 1.5-1.8m wide particularly in the Paddington area and portions of Woollahra that are fully paved and represent a considerable challenge to street tree planting.

It is extremely noticeable, however, that the area is also blessed with some extremely generous verges (18%) that suit continued large scale tree planting with minimal likely impacts to surrounding infrastructure and buildings. This is a relatively high proportion for early developed suburbs so close to the city.

Reinforcement of major boulevards and avenues

The State and Regional roads in our area include some of the more major roads in eastern Sydney. These major roads form corridors of movement through the area and are often considered somewhat separate in character to the precincts and suburbs they traverse, divide or bound. A key initiative of this Master Plan is to strengthen and re-define the character and role of these streets with a more consistent and unified tree planting schemes for the decades to come.

The main street corridors through the Woollahra LGA are:

- New South Head Road
- Old South Head Road (typically one side controlled by Waverley Council)
- Oxford Street (typically one side controlled by City of Sydney)
- Hopetoun Avenue
- Victoria Road
- Bellevue Hill Road
- Glenmore Road
- Darling Point Road
- Edgecliff Road
- Ocean Street
- Dover Street
Enhance key cultural and commercial areas
The LGA has a few key commercial and cultural areas such as Double Bay, Rose Bay and Oxford Street. These commercial strips will typically be enhanced and distinguished through special tree planting.

Permit solar access
Species should be selected, where appropriate, that will provide an appropriate level of solar access to dwellings. This applies especially to the more urban areas and terrace houses and smaller dwellings on the southern side of the carriage way during winter. In meeting this objective, consideration needs to be given to other principles such as species diversity and the pre-existing street character.

Allow the borrowed landscape to take precedence around existing parks
Many of the LGAs parks, such as Rushcutters Bay Park-Darling Point, Steyne Park-Double Bay, Lyne Park-Rose Bay, Woollahra Park-Rose Bay and Roberston Park-Watsons Bay have very prominent boundary tree canopies that often extend well over the adjoining streets. Introduction of competing street tree planting along these streets is usually discouraged in order to avoid intrusive impacts on the park and minimise future canopy conflicts. This also allows major trees along the park edges to ‘read’ from the street.

3.4 Locating Street Trees
Overview
There are many limitations to the positioning of street trees on footways immediately behind the kerb. Distances from infrastructure elements such as intersections, light and electricity poles, stormwater inlets, underground service pits and bus stops, are important in determining final planting locations. Typically this will require individual site assessment and will be determined on a case by case basis.

Spacing of street trees
Taking into account other relevant clearance requirements, street trees are to be typically planted as follows:
- small trees – spaced at 7 to 10 metre intervals
- medium trees – spaced at 10 to 15 metre intervals
- large trees – spaced at 15 to 20 metre intervals

Width of footpaths and verges
An essential factor in species selection is the width of the footpath proposed for street tree planting. Too small a tree in a wide verge free of obstructions is a lost opportunity for a large shade tree that would greatly add to the appearance of the streetscape. Conversely a tree with too large an ultimate size for the width of the footpath can become both an expensive maintenance item, and a danger to pedestrians and infrastructure.

The Woollahra verges consist primarily of a concrete pathway with a grass strip, or a concrete/asphalt paving from building line to kerb line in the older and more densely populated areas or
Further problems occur on narrow roads where parking is restricted to one side only. Larger vehicles tend to ride up over the kerb onto the footway to avoid parked cars. In this case trees can only be planted on one side of the street even if the footway is sufficiently wide.

Trees planted in footways less than 1500mm wide (from building line to back of kerb) force pedestrians, particularly those with strollers, to walk on the road. As it is far safer to encourage pedestrians to stay on the footway, trees will not be planted in footways less than 1500mm in width.

It should be noted however that existing trees that have been planted in footways less than 1500mm wide will not be removed (unless considered unsafe), but more trees will not be added to the footway. In streets with footpaths less than 1500mm, which already support or warrant significant tree planting, in-road or shared zone options will be explored for any new trees.

**Wide verges with significant grassed portions**
Council footpaths with a grassed verge are generally constructed with a 1200-1500mm wide concrete path and 1800mm-5000m of grass up to the kerb. Trees have traditionally been planted half way between the kerb and the edge of the concrete footway. This method of planting allows a large area of water penetration to the roots of the tree and avoids some of the problems of pavement lifting by the roots of the tree.

In this type of footpath species selection is based upon the overall width of the verge from the building/ boundary line to the back of the kerb, i.e. small trees in narrow footpaths, medium trees in medium footpaths and large trees in wider verges.

**Obstructions and other considerations**
Overhead Wires and Aerial Bundled Conductors (ABC) - In streets with overhead services, smaller trees will typically be specified to facilitate planting that fits below the cables. Where ABC is already present or is likely to be reasonable to achieve, larger trees may be specified to take advantage of the ABC opportunities.

**In-road planting opportunities**
Many roads throughout the LGA have opportunities for additional and larger street tree planting, if the planting is located within the vehicular carriage way rather than the kerb. This allows trees to be planted in streets that have narrow footpaths or where overhead wires present great challenges to achieving successful tree planting. Any in-road street planting will take into consideration the existing traffic, lot access and parking issues, underlying soil conditions and services. Council will aim to minimise disruptions to, or excessive removal, of parking spaces. Special attention will be paid to achieving appropriate drainage to the tree planting together with adequate soil volumes, road pavement protection, and trunk protection via bollards or barrier kerbs.

**Views**
In streets where existing views are obviously obtained by residents, Council will endeavour to not unreasonably impact on these views with street planting. In these streets often a small scale tree will be provided as a listed option and Council will consider using this smaller growing species in order to maintain views, in line with the Woollahra Tree Management Policy directives. This will still allow tree planting without excessive or unreasonable ongoing view pruning and impact to residents. Often these issues change along the length of any particular street and where views don’t exist in parts of a street, Council will seek to install the listed larger growing trees.

3.5 Future Pest and Diseases

Overseas experience shows that widespread infestations of harmful pests and diseases can have devastating consequences on parts of our urban tree populations.

The impact of pest and disease on our urban forest is only likely to increase. This is due to a range of factors, such as climate change - with increased temperatures, storm events, greater or lower rainfall events, and with the increase in international travel and commodity importation with the risk of a pests ‘hitching a ride’ to Sydney.

At the time of drafting this 2014 Master Plan, several major pest and disease threats hang over Sydney’s tree population. These are typically introduced pests and diseases that can potentially have devastating impacts on certain species of trees.

This includes pests such as:-

- **Australian Honey Fungus** (*Armillaria luteobubalina*)
- **Plane Tree Anthracnose** (*Apiognomonia veneta*)
- **Cuban Laurel Thrips** (*Gynaikothrips ficorum*)
- **Fig Psyllid** (*Mycopsylla fici*)
- **Figleaf Beetle** (*Poneridia australis*)
- **White Rot** (*Phellinus sp.*)
- **Pink Wax Scale** (*Ceroplastes rubens*)
- **Fusarium Wilt** (*Fusarium oxysporum*)
- **Painted Apple Moth** (*Teia anartoides*)
- **Lantana Bug** (*Aconophora compressa*)
- **Myrtle Rust** (*Uredo rangelii*)
- **Phytophthora dieback** (*Phytophthora cinnamomi*)
- **Sycamore Lace Bug** (*Corythucha ciliata*)
- **Winter Bronzing Bug** (*Thaumastocoris sp.*)
- **Lantana Bug** (*Aconophora compressa*)
- **Myrtle Rust** (*Uredo rangelii*)

Tree species selection is an important part of managing the risk from pest and diseases. The more diversification, the less risk of canopy cover loss from a major pest or disease event. Similarly, trees once thought to be ‘bullet proof’ (such as London Plane Trees) can be severely debilitated by previously unknown pests and diseases. Some recently arrived pest and diseases are likely to be impossible to eradicate and treatments so far have proved to be relatively expensive, difficult to apply in street situations or limited in their efficacy.
A tree’s ability to cope with a pest or disease depends in-part on the environment in which it is growing. Generally those growing in very tough environments, already coping with compacted soils, shade, wind, pollution, limited water, constricted root system and regular pruning make it difficult for the tree to also deal with pests and diseases.

The selected tree species should be resistant to pests and disease as far as practicable. A diversity of species is also important in reducing the potential impact of any devastating diseases on specific tree species and reducing the likelihood of pest building up and sustaining plague proportions. Two of the more serious pests that are likely to influence the Street Tree Master Plan are outlined below.

**Sycamore Lace Bug**

Sycamore Lace Bug (*Corythucha ciliata*) is an insect pest introduced from North America that mostly affects Plane Trees. It was most probably introduced to NSW in 2006 and prefers to feed on Plane Trees (*Platanus x acerifolia*). The tiny adults and nymphs feed on the underside of the leaves, causing bronzing, chlorosis and premature leaf drop. Severe infestations can cause complete defoliation. Several consecutive years of infestation may kill affected trees. Control is difficult and expensive.

It is now widespread in the Sydney basin and evidence suggests it is spreading along major transport routes. Establishment of young trees in affected areas is proving to be particularly difficult.

The ultimate affect of this pest on Sydney’s Plane Tree population is still unknown but attempts have been made in this 2014 Master Plan to reduce the reliance on Plane Trees. Early evidence from City of Sydney trials into insecticide injections of affected trees is proving promising and should be further assessed and considered for Woollahra.

**Myrtle Rust**

Myrtle Rust (*Uredo rangelii*) is a particularly serious fungal disease native to South America. It was first detected in Australia on the Central Coast of NSW in April 2010. This fungus can affect plants belonging to the family Myrtaceae which includes many of the very common native species such as Eucalypts, Paperbarks, Myrtles, Lilly Pillys, Bottlebrush and Water Gums. These trees represent a very large proportion of Woollahra’s street trees and native vegetation communities.

It is very easily spread and the NSW Department of Agriculture, Fisheries and Forestry have now advised that they do not believe it can be effectively contained or eradicated. It has recently been listed as a Key Threatening Process under the NSW Threatened Species Act 1995.

When severely infected, young plants and new growth may become stunted and in worst case the plant may die. Little is currently known about the disease and its impacts to plants under wider Australian conditions.

Treatment using various fungicides may be possible, but this will usually prove unviable on trees in public areas. Control will really only apply to smaller plants and controlled nursery environments and the like. The ultimate affect of this disease is currently unknown.

**Possible Consequences to the 2014 Street Tree Master Plan**

If either of the above pests or diseases, or other such outbreaks, prove to substantially alter the viability of any of the existing or proposed street tree species within the Plan, then the Council shall reserve the right to alter the species shown for planting on any given street to a species that is either immune or less susceptible to the pest or disease. All attempts shall be made to match the species with that of a similar form, size and habit.

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Figure 3.3 - Sycamore Lace Bug - Adult Stage  (Source: www.flickr.com/photos/xx_chaton_xx/5139448467/sizes/l/in/photostream/-accessed 5/3/11)

Figure 3.4 - Illustration of the purple discolouration and distortion of the leaves and the prominent yellow fruiting spores of the Myrtle Rust. (Source: www.flickr.com/photos/48395196@N05/5402288905/sizes/1/in/photostream/ - accessed 5/3/11)