



CITY of PERTH

# STREET TREE FRAMEWORK

## 1. INTRODUCTION

Street trees are an invaluable asset to the city. They contribute significantly to the creation of a high quality public realm in terms of aesthetics, shade, and the health of the physical environment. Trees also contribute to the legibility of the city by reinforcing the hierarchy of streets and strengthening the distinct characters of the various precincts.

The City of Perth recognises the value of trees in the urban environment and is committed to ensuring that they are given due consideration in the planning and design of the city's streetscapes . It is to this end that following Street Tree Framework has been developed.

The specific objectives of the framework are:

- to identify opportunities to increase the number of street trees;
- to ensure that the most suitable species are planted within particular streets of the city, dependent on context and environmental factors;
- to provide a strategy for the replacement of trees when and where necessary

This framework is intended to serve as a guiding document for the City's Urban Development Unit and Parks and Landscape Services to ensure that the selection and placement of street trees is undertaken in a considered, rigorous, yet practical manner.

It is also intended that the framework contribute to a greater understanding and appreciation of the particular and necessary qualities that trees bring to the urban setting.

## **Format of the Framework**

The framework is divided into four parts:

- Tree Selection Criteria
- Tree List
- Tree Planting Matrix (illustrated and supported by the Street Tree Framework Plan)
- Tree Replacement Guidelines.

### **Section 1: Tree Selection Criteria**

This section outlines both the environmental criteria for selecting the palette of trees which would be suitable to use in Perth streets, and the design principles employed to match tree selection to the street hierarchy of the city (based on the Public Places Enhancement Strategy)

### **Section 2: The tree list**

This section answers the following questions:

- What street trees do we already have?
- Which ones are successful and we should keep on using?
- Which ones are not successful and should be replaced gradually?
- Which other trees, not currently used, could we introduce?

### **Section 3: Tree planting matrix**

Selecting from the tree list, the tree planting matrix is the guide for future planting. It is a result of matching the selected species with the environmental factors, the street hierarchy and any special conditions which should be considered.

### **Section 4: Tree replacement guidelines**

This section provides technical details of how trees should be replaced, along with guidelines for selection of nursery stock and tree planting.

## **SECTION 1: TREE SELECTION CRITERIA**

### **1.1 ENVIRONMENTAL FACTORS**

There are a number of factors which influence the selection of tree species in any given location within the city. Individual species have been chosen depending on what is considered to be the most appropriate in a particular context, given the range of the following criteria.

#### **1.1.1 Tolerance of the Urban Environment**

The urban environment is highly modified, and presents a set of conditions that are particularly adverse to the establishment of healthy trees. Selected tree species then must have a high level of tolerance/adaptability of the following.

- **Climate** - In addition to the prevailing climate, there are particular micro-climatic conditions that exist within the urban environment – wind tunnels, constant shade from buildings, radiated heat and glare from concrete and paved surfaces, humidity.
- **Soils** that are highly modified or disturbed, with low nutrient content and water-holding capacity. Paved surfaces and soil compaction also result in low levels of oxygen being available to the tree roots.
- **Atmospheric Pollution** - particularly in areas of high vehicular traffic. In general, deciduous species are considered to be more tolerant than evergreen species.

#### **1.1.2 Environmental Criteria**

Trees have a vital contribution to make towards the creation of a healthier physical environment within the city. Towards this end, selected species must also meet the following important environmental criteria:

- **Tempering of the climate and micro-climates**; particularly in areas of high pedestrian activity. Given the intensity of heat and light in Perth over the long summer months, selected species must be able to make a significant contribution towards providing essential shade, reducing glare and ultra-violet radiation. Trees that have a wide, dense, summer canopy, perform this function most effectively.

Winter deciduous trees which allow through sun and therefore warmth in the colder months are also important in moderating the physical environment.

Additionally, the evapo-transpiration of the leaves provides a cooling effect of the air surrounding the trees. Broad leafed species are more effective in this regard due to the larger surface area of the leaves.

- **Absorption of atmospheric pollution and dust control** - Broad-leafed, deciduous trees are believed to make a significant contribution to surrounding air quality through their ability to absorb atmospheric pollutants.
- **Minimal water requirements** – To reduce water usage, newly planted trees will be watered until they are established. Beyond this, established trees will be expected to survive without any watering (there may be certain exceptions to this with specific genera of trees)
- **Tolerance of pests and diseases** which are prevalent in the Perth area, in order that chemical control is kept to minimum. It is also recognised that it is important to have a diversity of tree species to reduce the impact of a particular pest or disease on any one species.

- **Wildlife Habitat** - In areas where there is significant wildlife, e.g. adjacent to natural areas such as the river foreshore and Kings Park in particular, selected tree species will help to support that wildlife with regard to habitat, shelter and food source. This function is best performed by local indigenous species. Where this is not possible, non-local indigenous species will be used.
- **Low risk of becoming an environmental weed** - Species which pose the danger of becoming environmental weeds will generally not be considered. This is particularly important given the proximity of the city to the natural areas of bushland: King's Park in particular.

### 1.1.3 Management Requirements

- **High Performance Record** - Trees need to have consistently performed well within the Perth city area, or in other cities where similar growing conditions exist. There will be scope however for the trialling of new species in certain situations.
- **Litter (leaf, fruit etc.) at acceptable levels** - The amount of leaf shed, fruit or seed drop must be at an acceptable level. This will vary according to location of particular trees. Management of tree litter is essential, particularly of species prone to shed litter at certain times of the year. Higher levels of leaf litter may be acceptable if procedures are in place for its management.
- **Low risk of major limb failure** - Trees notorious for their relatively high rate of limb failure, e.g. Erythrina, will not be considered for any new street tree planting. In areas where such species are already in existence, appropriate measures are to be undertaken for their management by remedial pruning techniques.

It should be noted that limb drop is a natural event, and despite proper management and monitoring, it is not always possible to predict or therefore avoid.

- **Longevity** - Only species which are known to be long-lived will be considered, thereby reducing the need for ongoing replacement.
- **Minimal disturbance by roots to pavements, kerbing and roads** - Species known to have vigorous and/or buttress root systems that lift pavements will be avoided.
- **Low maintenance requirements** - selected species should need little in terms of watering, fertilising and pruning once established.

### 1.1.4 Note on Indigenous vs. Exotic Trees

The value of planting local indigenous tree species is recognised. However, in the urban context, local species often fall short of many of the functional and environmental criteria outlined above. Species selection will always be made based on what is the most appropriate in a particular context, given environmental, cultural and functional considerations and, for this reason, exotic trees will often be chosen over indigenous.

Indigenous and local species will be planted where they are considered to be most appropriate, for instance, along streets that are identified as wildlife corridors/eco zones. Gateway plantings will also use local species where possible as a way of promoting south-western Australia's unique flora.

## **1.2 DESIGN PRINCIPLES**

In addition to these environmental considerations, the predominant reasons for introducing trees into city streets is to provide shade and comfort for pedestrians (and to a lesser extent, motorists) and to increase the aesthetic appeal of the city. In the process of doing so, tree species will be used to achieve a sense of unity within the street (ie. one species along its length); improve legibility and wayfinding (ie aid orientation by having particular species for particular streets, and other devices such as highlight trees at intersection or points of interest) and reflecting the street hierarchy (ie, grander trees for grander streets, smaller trees for more intimate people-places).

The major factor which will determine or restrict the tree species selection is the width of street and therefore size of tree. To a large extent this will correlate with the street hierarchy, since the major roads will tend to be wider streets.

A further category within status is high pedestrian use – effective, consistent shade is required in these streets.

### **1.2.1 Hierarchy of Streets**

#### **Centre**

The central core of the city comprises the Malls and Forrest Place. These streets, all of which are pedestrian malls, have the highest concentration of pedestrians in the city and priority is given to people, except for short delivery periods early in the day when these streets become shared zones. Trees are planted in clumps or nodes, rather than in a linear fashion, to further remove the notion of 'street' and to accommodate groupings of seats.

#### **Local Centres**

Local centres are destinations which provide a range of commercial or retail facilities for nearby businesses or residences. Tree planting is used to help reinforce the sense of place, using larger species and closer planting

#### **Major Roads**

The major avenues and boulevards of the city are the transport routes which bring people into and through the city by road. In these streets, emphasis is on vehicle movement, with comfort for pedestrians. Trees are planted at wider distances (average 7-8m) and are larger in scale and size.

#### **Pedestrian core and connections**

These are the streets which surround the city and local centres which. Although heavily used by traffic, they are also densely populated and the emphasis then is on pedestrian movement. These are walking speed streets with narrower, slower roads with wider pavements, seating opportunities, drink fountains at regular intervals and human scale lighting, planting and detailing.

Trees are planted at closer distances (say 4-5m). The size of the species selected may be large or small, depending on the street width and the building scale. Where streets are very narrow, it may be necessary to containerise trees, or to not include trees at all.

Species have been selected to provide a broad canopy of shade and produce a cooler microclimate beneath them.

### **Secondary transit streets**

Secondary transit streets are the roads which are used to a lesser extent to provide connections through the city.

### **Residential and commercial streets**

These streets are the least used by vehicles, being mainly for access to residential, and a lesser extent, commercial premises.

In the **Street Tree Matrix**, trees in residential and commercial areas have not been selected on a street by street basis. When planting new trees in these streets, species should be selected, in conjunction with the Arboriculturalist, from the list shown under the 'Residential and Commercial Streets' section. Where there are existing trees in a street, new planting can consist of more of these trees, providing they appear on the **Tree List** in Section 2 of this report under 'Existing trees – continue use', or 'New trees to trial'. If the existing trees fall into the category of 'Continue use but do not plant more' or 'Trees to be gradually replaced', then a new species should be selected from the list shown under the 'Residential and Commercial Streets' section of the Street Tree Matrix.

### **Indigenous species zones**

In these areas it is desirable to introduce or retain indigenous planting, particularly of local species. This is particularly important in streets close to areas of native planting such as King's Park, since it aids in the establishment of wildlife corridors through the city.

A wildlife corridor is the artificial joining of fragmented habitats. Wildlife corridors are created as a means of conservation or general improvement of the environment. A true wildlife corridor of sufficient depth, density and variety of species would not be possible to create in a road verge or central median of the City of Perth, but any corridor which in some way helps species to move, feed and breed, and therefore ultimately survive, is of value.

## **1.2.2 Special Areas**

### **Riverside Drive**

Riverside Drive holds the unique role in the city of providing a prestigious waterfront ceremonial route while at the same time supporting the delicate ecosystem of the Swan River. The street tree framework deals only with the central median, recognising that areas adjacent to this form part of the Foreshore Strategy.

### **Mounts Bay Road**

To a lesser extent than Riverside Drive, Mounts Bay road also constitutes a ceremonial route. Given that it is sandwiched between King's Park and the Swan River, species have been selected that respect and reflect the natural vegetation of the area.

### **Mount Street Precinct**

With its steep incline and proximity to the city, the Jacarandas of Mount Street make a dramatic spectacle in springtime.

### **Parliament Place**

As part of the West Perth Urban Design Study, Parliament House is to have a setting which reflects its significance. This will include an avenue of deciduous tree planting with seasonal change.

### **Nodes**

Nodes can be defined as intersections, road crossings, landmarks or heritage buildings, where it is considered important to draw attention to such a feature. Nodes are denoted with a

change of tree species (highlight trees) which may provide contrast through leaf form, leaf or flower colour or stature of the tree. Trees might also be set out of line with the rest of the avenue to increase contrast. Nodes may occur on any type of street, but in particular, avenues, boulevards and pedestrian orientated streets.

## SECTION 2: THE TREE LIST

The following is the list of trees currently used in the City of Perth together with a number of species not currently used, but recommended for introduction. Of the currently planted trees, a number of trees species have been found to be problematic: some of these will continue to be used but removed on failure or death, while others will be gradually removed and replaced under a tree replacement program.

### EXISTING STREET TREES – CONTINUE USE

WA Peppermint (*Agonis flexuosa*)  
Smooth Bark Apple (*Angophora costata*)  
Orchid Tree (*Bauhinia* cultivars)  
Norfolk Island Pine (*Araucaria heterophylla*)  
Illawarra Flame (*Brachychiton acerifolia*)  
Bottle Brush (*Callistemon* cultivars)  
Nettle Tree (*Celtis australis*)  
Marri (*Corymbia callophylla*)  
Red Flowering Gum (*Corymbia ficifolia*)  
Spotted Gum (*Corymbia maculate*)  
Tuart (*Eucalyptus gomphocephala*)  
Narrow leaf Black Peppermint (*Eucalyptus nicholii*)  
Iron bark (*Eucalyptus leucoxydon*)  
Native frangipani (*Hymenosporum flavum*)  
Jacaranda (*Jacaranda mimosaeifolia*)  
American Sweet Gum (*Liquidambar styraciflua*)

Chinese Sweet Gum (*Liquidambar formosana*)  
Liquidambar *forrestii*  
Broad Leaf Paperbark (*Melaleuca quinquenervia*)  
Olive (*Olea europaea*)  
Canary Island date palm (*Phoenix canariensis*)  
London Plane (*Platanus acerifolia*)  
Bradford Pear (*Pyrus calleryana* 'Bradford')  
Manchurian Pear (*Pyrus ussuriensis*)  
Pin Oak (*Quercus palustris*)  
Pink/White Wysteria tree (*Robinia pseudoacacia decaisneana*)  
Chinese Tallow (*Sapium sebiferum*)  
Chinese Elm (*Ulmus parvifolia*)  
Mexican Fan Palm (*Washingtonia robusta*)

### NEW TREES TO TRIAL

Red Flowering Gum (*Corymbia ficifolia*) (grafted)  
Chanticleer Pear (*Pyrus calleryana* 'Chanticleer')  
Blireana Plum (*Prunus blireana*)  
Southern Magnolia (*Magnolia grandiflora*)  
Magnolia *gradiflora* 'St Mary'

Salt Water Paperbark (*Melaleuca cuticularis*)  
Swamp Paperbark (*Melaleuca raphiophylla*)  
Coral Gum (*Eucalyptus torquate*)  
Swamp Mallett (*Eucalyptus spathulata*)  
Sheoak (*Casuarina* spp.)  
Flooded Gum (*Eucalyptus rudis*)

Other genera and species of trees may be added to the list as they become available for trial.

### CONTINUE USE BUT DO NOT PLANT MORE

Whilst the trees may be considered unsuitable for new planting we would not necessarily remove existing trees until such time as their health and conditions warrants such action.

Moreton Bay Fig (*Ficus macrophylla*)  
Port Jackson Fig (*Ficus rubiginosa*)  
Chinese fan palm (*Livistona chinensis*)  
Bay (*Laurus nobilis*)  
Queensland Brush Box (*Lophostemon confertus*)  
Variegated Queensland Brush Box (*Lophostemon confertus* 'Variegata')

Prickly Leaved Paperbark (*Melaleuca stypheloides*)  
Oriental Plane (*Platanus orientalis*)  
English Elm (*Ulmus procera*)  
California Fan Palm (*Washingtonia filifera*)



## **TREES TO BE GRADUALLY REPLACED**

Box Elder (*Acer negundo*)  
Leopard Tree (*Caesalpinia ferrea*)  
Camphor Laurel (*Cinnamomum camphora*)  
Coral Tree (*Erythrina indica*)  
Lillypilly (*Eugenia smithii*)  
Hills weeping Fig (*Ficus microcarpa hillii*)  
Honey Locust (*Gleditsia triacanthos*)  
New Zealand Christmas tree  
(*Metrosideros excelsa*)  
Variegated NZ Christmas Tree  
(*Metrosideros excelsa variegata*)  
Fiddlewood (*Citharexylum quadrangulare*)

Claret Ash (*Fraxinus oxycarpa*  
'Raywoodii')  
Norfolk Island Hibiscus (*Lagunaria patersonii*)  
Queensland Box (*Lophostemon confertus*)  
Variegated Queensland Box  
(*Lophostemon confertus* 'Variegata')  
Cut Leaf Plane (*Platanus orientalis*  
'Digitata')  
Cocos Palm (*Syagrus romanzoffiana*)  
Tipuana (*Tipuana tipu*)

## **SECTION 3: TREE PLANTING MATRIX**

The following are reasons why trees may be changed in the future:

- Tree species are not in keeping with the Street Tree Framework Plan;
- Tree species have been identified as poor performers;
- Trees are failing to thrive, are diseased damaged, or have died.

The attached spreadsheet lists the streets of Perth according to their importance in the street hierarchy, and is colour coded to match the Street Tree Framework Plan (starting from the city centre and working down to the residential streets).

**Column 1** shows the street name, listing the streets from west to east and from south to north, rather than alphabetically.

**Column 2** shows the street trees currently planted in the street.

**Column 3** shows the tree species which will eventually be planted in the street. Generally, where the current tree forms a good avenue, with the same species from one end to the other, with a species of tree which fits the Street Tree Framework Plan, the species will not change.

**Column 4** indicates a street where no change in species is proposed.

**Column 5** indicates when more trees should be planted in a street. Where there are already several tree species in the street, the ones to be used for additional planting are the ones with a coloured bar in this column.

## **SECTION 4: TREE REPLACEMENT GUIDELINES**

There are several streets within the City where the existing species is inappropriate and/or there has been an ad hoc mixture of species planted over a period of time.

Where the species of trees are inappropriate or unsuitable or have particular disadvantages one of the following courses of action should be adopted:

- 1.** The removal of all trees in one operation where the street is small with no more than 10 existing trees and where the street has a low public profile.
- 2.** Other streets should have alternate trees on both sides of the road removed in one year, or if the street is long eg, St George's Terrace, Wellington Street, the removal and replacement could be carried out progressively in sections and the remaining trees on both sides removed and replaced after a five year period which will reduce the impact of loss.

There may be some imbalance in terms of size for a few years in these circumstances which could be reduced by the use of larger trees in the second phase eg if 100lt size trees were planted in the first phase then 200 lt size trees could be used in the second.

- 3.** Planting new trees in between the existing trees could also be investigated and may be possible in certain streets where the distances would allow this to happen. The existing trees would then be removed when the new trees have become well established in 5 years time.

A dilemma arises where we have individual trees that require removal because they are either dead, dying, irrevocably storm damaged, dangerous or require removal owing to nearby development. In such cases it is suggested that the replacement trees should reflect the theme of the street until such time when a comprehensive approach to that street is taken, when these new trees are removed and replaced with the long term species.

Unless the species of tree is changed as part of a more comprehensive upgrade of the street, which has had a previous Council approval, it may be necessary to go out to public consultation and obtain Council approval where a complete change of species is recommended in either of the above three scenarios.

Where an existing dead, diseased or missing tree is to be replanted with the same species, this can take place without consultation. The Arboriculturalist should be consulted prior to planting in any other instance.

## **APPENDIX 1**

### **SELECTION OF NURSERY STOCK FOR STREET PLANTING**

The following information provides a list of important characteristics which must be checked when assessing and selecting nursery stock trees suitable for planting in a street situation.

The vast majority of nursery stock trees will be container grown and will range in size from **45lt, 100lt, 200lt and up to 400 lt**. In some cases available stock may only be available as Root Control Bags (RCBs) or in the case of deciduous trees in winter, as open ground bare rooted stock. When trees of these two categories are the only trees available at that time this must be referred back to the City's representative prior to purchase.

#### **Characteristics to look for above ground level**

- 1. True to type** – the trees selected must be exactly what the purchaser has ordered in terms Genera, species, variety ( for a recognised cultivar) and species provenance (ie identified source of production material particularly with the supply of native trees)
- 2. Health and Vigour** – in order to ensure that the trees are able to grow On successfully they must be healthy and vigorous at the time of delivery from the nursery. The foliage size, texture and colour must be consistent with that shown in healthy specimens of the nominated species. Extension growth must be consistent with that exhibited in vigorous specimens of the species nominated.
- 3. Free of pests & diseases** – trees should not show any evidence of P&D, however, a small amount of insect attack should not affect the long term health and must be less than 10% of the foliage affected.
- 4. Crown Balance & Uniformity of growth** – the crown should be well balanced either side of the stem axis ie 50/50. Any imbalance must not exceed 60/40.
- 5. Stem structure and potential for stability** – Stem taper is a measure of the tree's ability to be self supporting above ground level. Look for good stem taper. The calliper of the stem will vary with the size of the root ball. Minimum callipers :

400lt 100 -125mm @ 1m & 150mm @ 300mm  
200lt 60 – 75mm @ 1m & 80 – 85mm @ 300mm  
100lt min 50mm @ 1m & 60mm @ 300mm  
45lt min 20mm @ 1m & 25 @ 300mm

Crown height must be proportionate to stem calliper and rootball size.

- 6. Clear Stem Height** – for the majority of street tree planting trees with a clear stem height of 1.8m should be sourced where ever possible. Where this is not achievable, trees with the potential for this clear stem height with the removal of lower branches will be acceptable. This clear stem height is unlikely to be achieved with 45lt size trees.
- 7. Compatibility of Graft Unions** – When purchasing named cultivars propagated by grafting it is critical that the graft unions are sound with no evidence of structural weakness between scion and rootstock.
- 8. Apical Dominance** – many species of tree are best grown with a clear defined central leader in order to reduce the risk of stem failure in the long term future. In general terms, trees with a well defined central leader have a better form as a mature specimen.
- 9. Indication of North** – In order to ensure that the bark (cambium) sheltered from the sun in the nursery is not exposed on planting, it is advisable to indicate north on the bag during selection. The tree should be planted at the same orientation. This is particular important for trees 100lt upwards. Some species are more susceptible to sun scorch than others eg. Faxinus.

### **Characteristics to look for in the root ball (Container)**

In order for the tree to be self supporting without the aid of staking, which is the preferred method of planting, it is crucial that there is a well developed root ball within the container. The roots should be well distributed throughout the container without being “pot bound” and this can be determined by feeling the outside of the container for reasonable firmness, not hard, on the container surface. Significant voids within the rootball and therefore “softness” when pressed on the container, indicate that the roots have not developed sufficiently within the container and the tree therefore may not be capable of being stable without staking.

It is important to test the stem for movement between the base of the stem and the surrounding soil within the container. The stem should be rocked from side to side (a deflection of some 30 degrees) and there should be no movement in the soil. Movement between the stem and the soil indicates a poorly developed root system.

### **Root & Shoot Ratio**

As a guide to the approximate heights that can be expected for the container sizes and callipers previously mentioned the following figures can be used:

400lt = 3.5m – 4.0m

200lt = 2.5m – 3.0m

100lt = 2.0m - 2.5m

45 lt = 1.8m – 2.0m

The above figures should only be used as a guide as much will depend on species.