City of Canning

A welcoming and thriving city

Street Tree **Strategy** 2018

Section One

Contents

Section 1

1 Executive Summary

The City of Canning has prepared this Street Tree Strategy to identify planting opportunities within the City's streetscapes. The aim of this strategy is to provide clear information for residents, developers and Elected Members in regard to the characteristics of the street trees within the City, along with the City's vision for maintaining and increasing the number of suitable street trees.

This strategy acknowledges that the City of Canning was assessed in 2014 as having the third lowest canopy cover of 29 Perth metropolitan local governments. Infill development contributes to the loss of private vegetation and street trees. The City can help address the need to increase canopy cover by conserving the existing trees and planting more trees in public spaces under its control.

The Street Tree Strategy, in conjunction with the City's Local Biodiversity Strategy (2018), will be a key element in implementing the Urban Forest Strategy (Draft 2019), with the ultimate aim of defining targets and increasing the percentage of tree canopy cover across the City. Other strategies that will benefit from programmed tree planting include the City's Cycling and Walking Plan (2018), Environmental Management Strategy (2014) and Public Open Space Strategy (2015).

In addition to planting two trees for any street tree that has been removed, the City will continue its annual street tree planting programs with the aim of increasing canopy cover in the future. Streets that link areas of remnant bushland will be planted to develop wildlife corridors. Shade trees will be established along streets identified in the Cycling and Walking Plan.

The Street Tree Strategy provides guidance on the selection of tree species to limit the use of species that have proved problematic in verges. The revised selection of species aims to ensure that street trees make a positive contribution to environmental, amenity, aesthetic and heritage values of the area and to ensure that any negative aspects are minimised.

Technical specifications have been developed for trees in hardscape situations and the Approved Tree Planting List (2013) has been reviewed in respect of species suitability for use beneath overhead powerlines and for varying verge widths. Information sheets have been developed to better inform residents of what to expect from their new street tree. A strategy to encourage street tree planting requests is being developed along with an educational program that includes a survey to assist the City in determining how our community values trees.

The City's landscape projects, streetscape enhancement plans and subdivision development plans will have clear direction in regard to acceptable street tree species and tree numbers to be planted. The adoption of Local Planning Policy LP.09 Tree Retention and Planting- Development (2017) should allow the retention of more trees that may otherwise have been removed as part of development approvals.

The City is faced with the challenge of increasing canopy cover to benefit the community as a whole, which sometimes may not be supported by individual land owners, developers or residents. This strategy is intended to guide the City in meeting its objectives of maintaining and increasing tree canopy cover within streetscapes.

'Urbanisation and tree removal result in long-term physical changes to the environment that are difficult to reverse. For example, if urban development is undertaken in such a way that trees are 'designed out' of the physical environment, the opportunity to re-incorporate trees is limited.

'In addition, there will always be delays in replacing tree canopy when mature trees are replaced with young trees.' Cool Communities: Urban trees, Climate and Health (2013) - Curtin University

2 Introduction

In 2014 the University of Technology, Sydney (UTS) published the report Benchmarking Australia's Urban Tree Canopy that quantified the urban green space (UGS) of 139 local government authorities across Australia. Of the 29 local governments assessed within the Perth metropolitan area, the City of Canning had the third lowest canopy cover of 13 per cent (Appendix F part 1 refers).

More precise urban forest mapping was undertaken for the City of Canning in October 2015 and identified that the City's canopy cover is approximately only 9 percent. It is clear that urban canopy targets need to be developed and implemented across the City and the overarching (draft) Urban Forest Strategy will identify percentage canopy targets and timelines for the City.

The growth of in-fill housing is an integral part of the Western Australian Planning Commission's Directions 2031 Spatial Framework for Perth and Peel (2010), which aims to reduce the spread of the urban footprint and make the best use of the land and infrastructure available. This planning strategy, however, is leading to a large loss of trees on private and public land and an increase in hardstand which affects the mean land urban temperatures and so contributes to the urban heat island effect (Appendix F part 2 refers).

In recognition of this issue, the City's Local Planning Policy LP.09 Tree Retention and Planting - Development (2017) aims to improve the preservation of existing, and provision of new trees on both private and public land as part of developments in order to address the City's projected canopy loss. The policy states that the City's strong preference is for all street trees to be retained in their current locations. Prior to approving a development that may result in the removal of a street tree for a new crossover, all 'reasonable design alternatives' must be examined. Minimising the number of crossovers on verges allows for storm water capture, retention of a greater number of street trees and greater opportunities to plant more trees. The adoption of the City's Policy DO.02-Use of Verge During Building Works and Development (2015) now provides the requirement for developers to maintain a tree protection zone around street trees. This will help to reduce the loss of trees due to damage caused by construction works (Appendix F part 6 refers).

Figure 1. Street tree loss due to installation of underground services and crossovers to serve a new subdivision (Wilson)

3 Background

3.1 Policy - Strategic Framework

The Street Tree Strategy relates to the City's Strategic Community Plan 2017-2027 Grow performance indicators that are to increase the urban forest through implementation of the City's annual revegetation program, *increase canopy cover from 9 per cent and to educate the community about environment and sustainability.* Table 1 shows the City's policies and procedures that relate to and inform this strategy.

Table 1. Strategic Context

STRATEGIC CONTENT
City of Canning Strategic Community Plan (2017-2027)
Parks and Place Improvement Plan (2018-2021)
Local Biodiversity Strategy (2018)
Urban Forest Strategy (Draft 2019)
Environmental Management Strategy (2014)
Commercial and Activity Centres Strategy (2015)
Town Planning Scheme - 40 (1994, updated 2018)

OTHER RELEVANT DOCUMENTS
Bentley Regeneration Project - (in progress)
Bentley Regeneration Structure Plan (2015)
City Centre Activity Centre Plan (2013)
Community Engagement Strategy (2014)
Cycling and Walking Plan (2018)
Design Guidelines City Centre (Draft 2017)
Municipal Heritage Inventory (2017)
Public Open Space Strategy (2015)
Queens Park Local Structure Plan (2017)
Policy DO.02 Use of Verge During Building Works and Development (2015)
Water Management Strategy (2014)

Tree Management Policies and Procedures
Plans, objectives and principles to guide tree management

Policy ET 525 Trees in Streets, Thoroughfares and Reserves (2013, reviewed 2016)
Policy Procedure ET 525 Trees in Streets, Thoroughfares and Reserves
Approved Tree Planting List (2013, reviewed 2018)
Policy LP.09 Tree Retention and Planting - Development (2017)
AS 4970-2009 Protection of trees on development sites
AS 4373-2007 Pruning of amenity trees
AS 2303-2015 Tree stock for landscape use
Quantified Tree Risk Assessment (QTRA)

Street Tree Strategy
(to be implemented concurrently with the Tree Management Policy ET525)

3.2 Context

The City of Canning has a population of over 93,000 and covers an area of 65 square kilometres. Within the City there are 581km of roads managed by the City, 51km of State managed roads and approximately 35,600 rateable properties. The City has 29,086 street trees, including median trees, in residential, commercial and industrial areas. The 2016-2017 tree planting, pruning, maintenance and tree removal budget allocations for the City's total of 50,267 street and park trees was $1.99 million.

Controlled Access Roads such as Leach and Roe Highways require the approval of Main Roads WA in regard to landscape projects.

Primary Distributor Roads include Manning Road and Vahland Avenue, which have been targeted by the City in regard to median tree plantings where possible.

Roads classified as District B and Local Distributor will be primary targets for streetscape enhancement opportunities. Relatively large volumes of traffic use these roads, and tree canopies reduce glare for motorists and provide shade for pedestrians (Road Hierarchy Map - Appendix G refers).

4 Aims of the Street Tree Strategy

4.1 To play a significant role in achieving the percentage canopy cover targets that will be identified in the City's Urban Forest Strategy (Draft 2019) by maintaining and increasing street tree numbers within the City.

4.2 To identify and implement targeted, annual tree planting programs using suitable tree species, that will create shady streetscapes to benefit the wider community and improve the amenity of the City's streetscapes.

4.3 To develop streetscape planting plans that will develop wildlife corridors between bushland areas in accordance with the City's Local Biodiversity Strategy (2018), Environmental Strategy (2014) and Urban Forest Strategy (Draft 2019).

4.4 To develop streetscape planting plans that will support the City's Cycling and Walking Plan (2018) and Public Open Space Strategy (2015).

4.5 To identify tree species that make a positive contribution to the environmental, amenity, aesthetic and heritage values of the City's streetscapes.

4.6 To improve the successful establishment of trees that are planted in hostile environments such as medians, roadways, paved surfaces and under powerlines.

4.7 To develop plans to engage and inform the community about the benefits of street trees and improve overall community satisfaction with the City's implementation and management of street trees and streetscapes.

4.8 To specify regular updating of the Tree Audit Database in accordance with the City's risk management and asset management obligations.

4.9 To expand the City's current tree planting palette to ensure a diverse tree species population to 'future proof' the adaptation and survival of street trees against the effects of diseases, climate change and the urban heat island effect.

5 The Benefits of Trees

Street trees within the urban environment provide environmental, economic, heritage, scientific, social and physiological benefits, detailed below.

5.1 Environmental

Trees:

a) Help alleviate the urban heat island effect and reduce urban temperatures which is an important climate change mitigation strategy.
b Reduce UV exposure.
c) Reduce glare and reflection.
d) Improve air quality by ameliorating air pollution and greenhouse gases.
e) Broad tree canopies intercept and mitigate the impact of heavy rainfall by reducing the amount of storm water run-off by holding and absorbing water.
f) Tree canopies and root systems reduce the amount of nitrogen, phosphorus and heavy metal content in stormwater that drains into waterways.
g) Increase biodiversity and provide habitat and food for birds and microfauna.
h) Are significant carbon sinks, sequestering atmospheric carbon dioxide for long time periods.
i) Mitigate the effects of wind.

5.2 Economic

Trees**:**

a) Provide summer cooling which lowers energy needs and costs.
b) May increase property values.
c) Shade heat-absorbing surfaces, including asphalt and masonry, thereby increasing the life of asphalt roads.
d) Reduce health costs for conditions that are a consequence of, or exacerbated by, heat and pollution.

5.3 Social and Physiological

Trees:

a) Create and enhance a sense of place and identity for the community.
b) May have cultural significance.
c) May have scientific significance.
d) May have historical significance.
e) Add aesthetic value to the streetscape.
f) Provide visual links along traffic routes.
g) Reduce the visual scale and impact of roadways and buildings.
h) Provide cool parking spots on hot days and reduce heat build-up in parked cars.
i) Provide shade and shelter, making streets more pedestrian friendly.
j) Can improve physical health and mental well-being by encouraging physical activity in shady environs.
k) Visually enhance traffic calming measures, such as medians and roundabouts.
l) Can serve as a buffer between moving vehicles and pedestrians.
m) Reduce the perception of noise pollution.

6 Heritage Trees within the City of Canning

Some trees have cultural as well as ecological, scientific and/or aesthetic significance, for example because of their great age or stature, or because they are associated with past land uses. Trees that have cultural significance, whether on private or public land, can be considered to be part of the City's cultural heritage, and listed in the City's Municipal Heritage Inventory (MHI).

The City's MHI includes significant trees as part of the historically significant 'Place' on which they grow, such as several mature trees at Castledare Village in Wilson.

The Heritage Council of WA includes a Bunya Bunya Pine at the Woodloes Homestead in the heritage statement of significance of that site. A Tuart Tree that grows at the junction of Hybanthus Road and High Road, Riverton, is a remnant indigenous tree of significance and was nominated in 2016 for inclusion on the City's MHI (Figure 2).

The State Heritage Office and Department of Planning have since advised the City that, rather than include nominated trees in the Municipal Heritage Inventory, the appropriate and consistent mechanism for the protection of such trees is through a Significant Tree Register. The City of Canning Town Planning Scheme No. 40 (the Scheme) does not currently include adequate provisions to enable the adoption of a Significant Tree Register. Liveable Canning will be initiating Scheme Amendment 232 to insert a new clause in the Scheme. A preliminary Significant Tree Register has been drafted that incorporates information about the trees that have been nominated for the Municipal Heritage Inventory. While the Scheme Amendment is being processed, the register will be finalised and processes will be put in place to guide the adoption and ongoing maintenance of the register.

There is a tendency for local governments not to include street trees on their heritage lists, possibly because it is assumed that, as an asset of the City, a significant tree is therefore protected. Unfortunately, private and public development may impact the road reserve which can adversely affect significant trees.

Culturally significant trees are a special class of trees that have exceptional values in terms of their contribution to our environment and sense of place. Trees that are likely to be of cultural significance are those that help us understand the past or enrich the present, and which will be of value to future generations.

The Australian International Council on Monuments and Sites (ICOMOS) Burra Charter uses the concept of cultural significance to justify conserving places, including trees. An explanation of the terms and concepts of the Burra Charter are in Appendix F part 3.

Figure 2. Proposed and Registered Heritage Trees

Tuart Tree (*Eucalyptus gomphocephala*) northern verge of High Road in Hybanthus Road, Riverton. A remnant, indigenous tree of culturally significant environmental and scientific value.

Woodloes Homestead, Cannington.
Bunya Bunya Pine (*Araucaria bidwillii*) Heritage Council of WA Place No. 433

7 Trees as Assets

Trees on public land have inherent environmental and amenity value and may also have cultural, scientific or historical significance. Unlike other assets, most of the benefits that trees provide increase as trees reach maturity and continue for many years until trees have visibly declined.

Trees are a highly significant asset to the community given the environmental, aesthetic, health and financial benefits they confer. Even though trees are not generally included in municipal asset registers they represent one of the larger asset classes managed by the City. Tree asset management integrates financial and arboricultural management practices to ensure that the level of service is provided at the most economical cost to the community. It is also intended to protect the environmental and social values of trees for the community.

While not assigned a monetary value and recorded in the City's asset database, trees are community assets. The City has invested resources in the establishment and management of trees, and as trees mature they return diverse benefits to society.

Recognised amenity tree evaluation formulae are used by some Perth metropolitan local governments such as the City of Stirling and the City of South Perth. The i-Tree method of tree assessment evaluates in monetary terms the environmental benefits that trees provide, including carbon sequestration, improving air quality, amelioration of storm water, energy savings and property value increases. As part of the future tree audits, the amenity value of trees will also be calculated (Appendix F part 4 refers).

Snow in summer (*Melaleuca linariifolia*)

8 Existing Trees

8.1 Street tree audit

A tree audit is a key tool in the management of risk. In 2010 an independent inquiry into management of trees on public land was prepared for the Local Government Association of South Australia. The objective was to review the benefits and risks of trees and how they are managed in order to make recommendations to protect and promote the benefits of trees, while responsibly managing risks.

The executive summary recommendations included the need for all South Australian councils to have a tree register, which is seen as an essential component in the management of tree risks. Councils were advised to be aware of, and consider the merits of, alternative options to manage risk where the last resort would be to remove the tree. Regular monitoring allows identification of maintenance requirements that reduce and manage potential tree failures, and tree replacement costs are also reduced.

In Western Australia under the Local Government Insurance Scheme (LGIS) councils must prove that 'reasonable steps' have been taken in regard to the management of risk and public liability. Local governments cannot prevent every risk associated with their assets and infrastructure, but are obliged to demonstrate best practice in managing what is 'predictable and practical' in regard to risk.

Since the 1990s the City has undertaken basic audits of trees in streets and parks under its management, excluding conservation areas and controlled access highways. The first spatial audit of street trees was undertaken in 2011-2012 but it was incomplete. The Canning Vale residential trees were audited in 2013, and the Willetton, Canning Vale and Welshpool industrial areas were audited in 2015. A budget has been allocated in the 2017-2018 financial year to survey the small section of the Welshpool industrial area where street trees have not yet been audited.

The audit of the City's street trees has assigned each tree a unique number, recorded each tree's condition and age profile, and whether infrastructure such as powerlines or footpaths are present. The audit is a layer in the Corporate mapping system. The City's tree audit has provided baseline data, and has allowed for the development of a detailed schedule of inspection, maintenance and management of public trees.

The tree audit has identified trees with poor structure, and the City has developed pruning programs based on this information to manage structural issues with a view to retaining suitable trees, and to remove and replace trees that cannot be remedially pruned. Trees identified as dead, dying or dangerous have been removed.

Trees are dynamic assets. To improve risk management and tree maintenance the tree audit should be reviewed at least every five years. In the intervening years the records of tree planting and removal will be added to the database. To allow for the review of the park and street tree audits, it is proposed to list $160,000 per annum in the 2018-2019 onwards budgets for tree audits.

8.2 Street tree age, condition and canopy cover

A review of the City's street trees was undertaken in 2013 as part of Report ET-050-13 - Review of Tree Management Policy ET525 and Tree Audit Information. Tree numbers, health, age, distribution across suburbs, and species diversity were addressed. Following the review, trees identified as being at the end of their useful lives were removed, and replacement trees have been planted.

The tree age classes (juvenile, semi-mature, mature and post-mature) shown in Diagram 1 are approximate and relate to the number of years post planting. Maturing can continue to 100+ years post planting depending on both genetic and environmental factors. The term 'in decline' does not equate with being structurally unsound; it describes the senescent phase of a tree.

The tree age ratio of approximately 15:25:60 (young: semi-mature: mature tree stock) is beneficial as it allows for a systematic tree replacement program that avoids the need for large scale tree replacement in a short period of time.

In regard to health, the City's tree audit shows that 93 per cent of the City's street trees are in fair to good condition (Diagram 2 refers). Trees rated as being in poor condition are being monitored, managed and, where required, they have been removed.

The current street tree audit data indicates that there are 12,800 properties within the City that do not have a street tree. This means that there are 20,400 properties with at least one street tree.

In October 2015 urban canopy monitoring was undertaken for the City of Canning. The report noted that the suburb with the lowest proportion of canopy cover (as a proportion of total land cover) is Welshpool at 8 per cent, and the highest is Ferndale at 33 per cent. The heat island mapping undertaken showed that the hottest suburbs were Queens Park and East Cannington. The suburbs of Wilson and Ferndale showed the greatest ranges of values, due in part to each bordering the Canning River, while hosting significant heat islands elsewhere. The coolest mean and median values were seen in the suburbs of Rossmoyne and Shelley, which both have a significant interface with the river.

Diagram 1. Street Tree Age

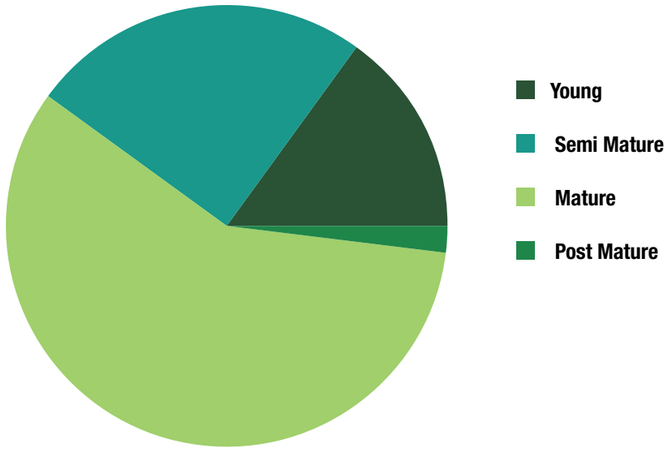
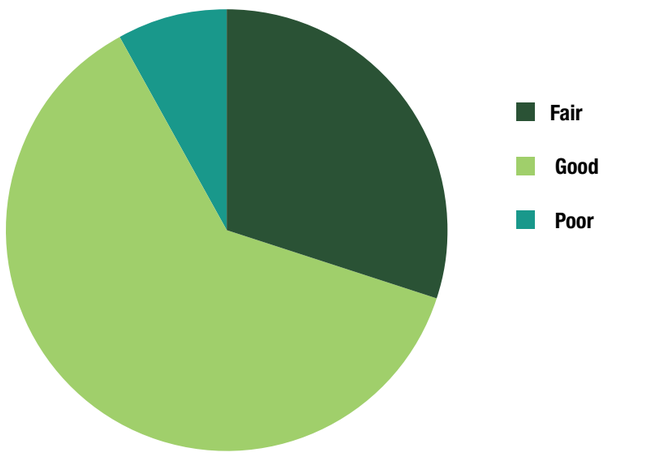


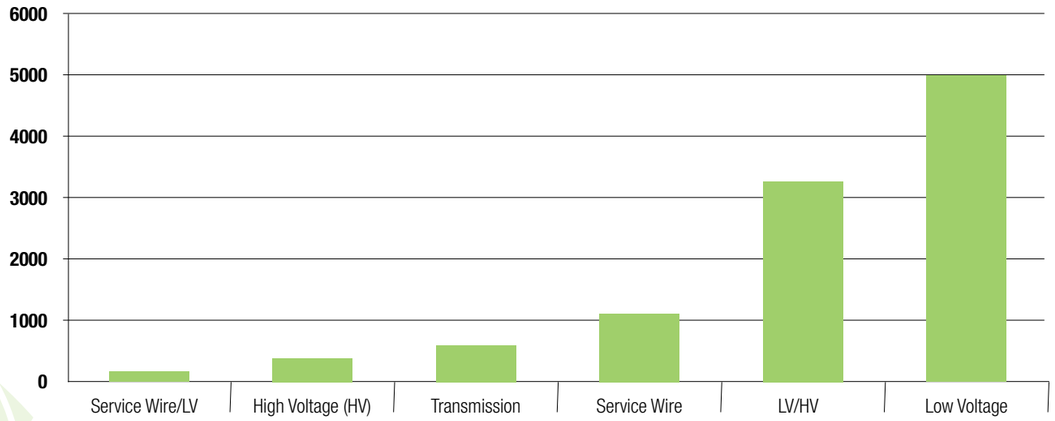
Diagram 2. Street Tree Condition



8.3 Management of trees under powerlines

Currently, 42 per cent of the City's street trees require pruning for powerline clearance. Future underground power programs are required so that street trees can develop fuller canopies and provide greater benefits to the environment and the community. This will also reduce the cost of annual powerline pruning requirements, which is approximately $560,000 in the 2017-2018 financial year. This figure has not included the costs for other street tree pruning, such as boundary clearance and under-pruning for sightlines and other clearances. The State of the Sector – Report on Urban Trees (Parks Base, 2017) notes that trees under powerlines cost local governments 35 per cent more per tree to maintain. The pruning and management of trees where overhead powerlines have been installed underground is discussed in Appendix A part 5. The number of street trees pruned for overhead powerlines is shown in Diagram 3 with a total of 10,544 trees.

Diagram 3. Number of street trees pruned annually for powerline clearance (Total 10,544 trees)



The reduced effectiveness of canopy provided by trees pruned for powerlines and the increased growth in canopy cover after powerlines have been put underground is indicated in Figure 3 below.

Figure 3. Powerline pruning before and after the undergrounding of powerlines

Armstrong Road, Wilson. Queensland Brush Box trees after underground power was installed in 2010

Houtmans Street, Shelley. Powerline and non-powerline pruning

8.4 Dominant street tree species and review of approved street tree list

A review of the street tree audit found that eight tree genera (comprising 50 species) made up 46 per cent of total trees. The dominant species are Bottlebrush, Jacaranda, Gum trees, Queensland Brush Box, WA Weeping Peppermint, Paperbarks, Bloodwood and Tipuana (Table 2. below refers).

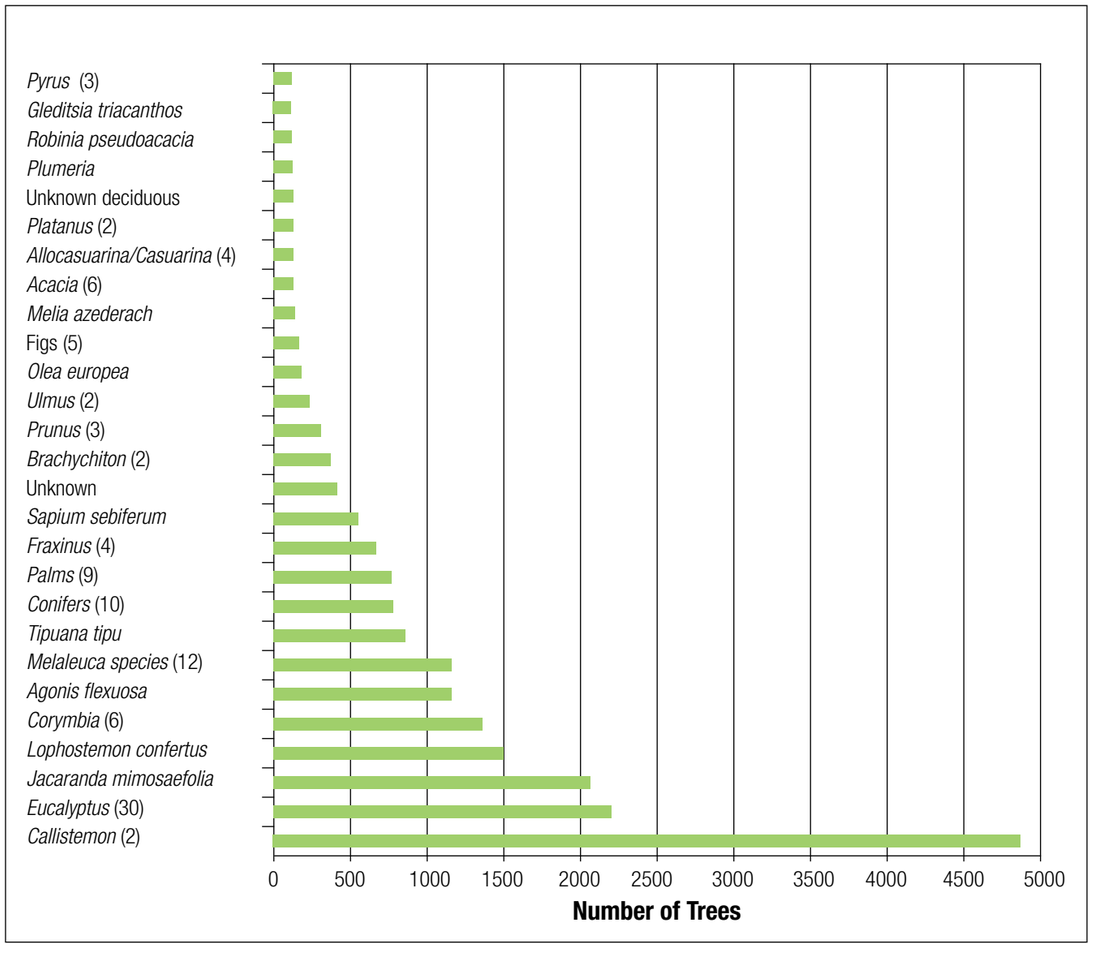
The large number of Bottlebrush trees (*Callistemon* species) and WA Weeping Peppermints (*Agonis flexuosa*) planted within the City is related to their suitability to powerline pruning. The Queensland Brush Box *(Lophostemon confertus*) was a popular street species in Perth after World War II, and was found to adapt to the repeated pruning required for powerline clearance. Paperbark trees (*Melaleuca* species) are also tolerant of powerline pruning.

The high number of Gum and Bloodwood trees (*Eucalyptus* and *Corymbia* species) is due in part to the 30 species accounted for across the City. Tipuana trees (*Tipuana tipu*) are no longer planted as street trees, as determined in the review of the (now superceded) approved tree planting list in 2013. While the Palms and Conifers would have been planted by residents, as they grow on the verge they are still maintained by the City.

Table 2. Dominant street tree species (the number of species/cultivars for each genus are shown in brackets)

Dominant Street Trees

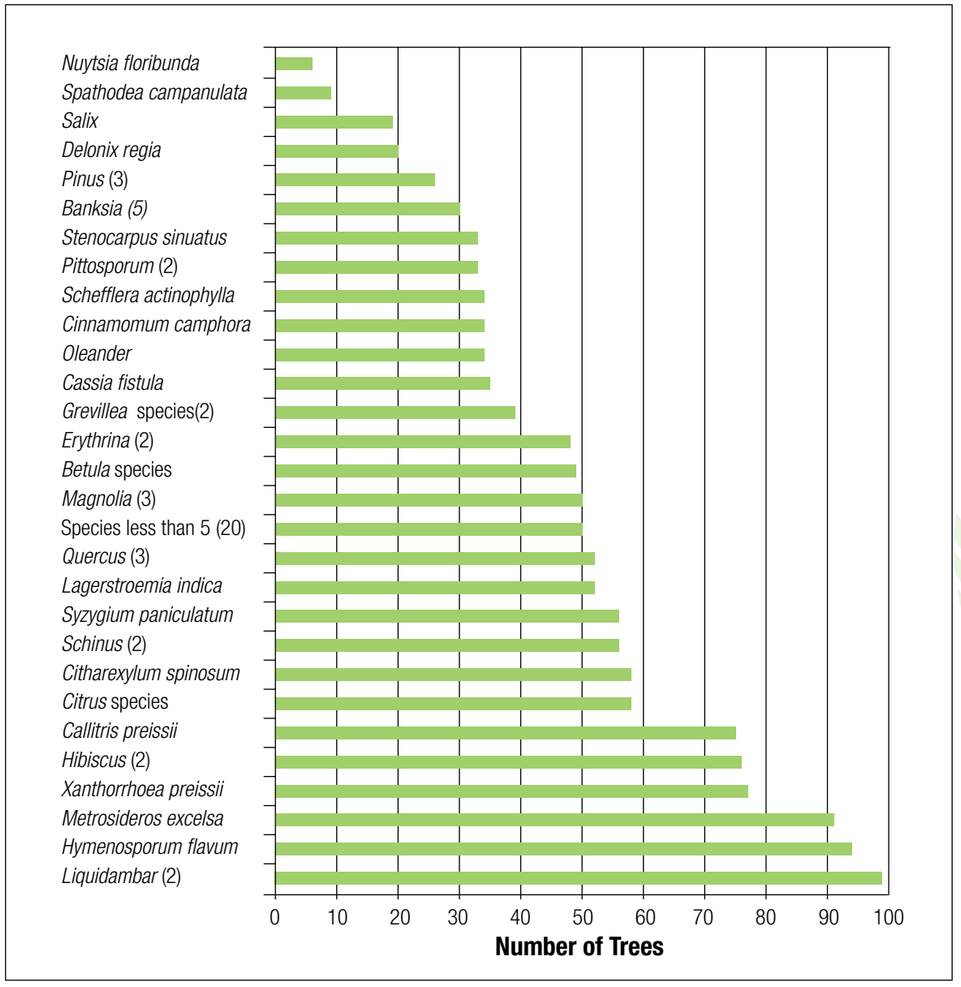
(at least one hundred individuals per genus listed)



Investigation into the functional criteria to select the 'right tree for the right location' has informed a review of the City's Approved Tree Planting List (2013). Environmental and aesthetic criteria have also been considered along with streetscape design principles and problems associated with street trees such as allergies, damage to infrastructure and debris. Issues relating to large trees, long-lived versus short-lived trees and the need for a diversity of tree species have also been addressed (Appendix A refers). The remaining 54 per cent of street trees are a mixture of 49 exotic species and 14 species native to Australia (Table 3. refers).

Table 3. All other street tree species within the City

All other street tree species within the City



Two revised tree planting lists have been developed for trees suitable for use beneath powerlines, and species that are not suitable for powerline pruning and are presented as a tree planting matrix (Appendix B refers). Data sheets have been developed that provide information about each species to better inform residents about the characteristics of each tree (Appendices C.1 and C.2 refer).

While smaller growing tree species can be accommodated on larger verges, the City aims wherever feasible to plant the largest mature tree suited to the area of verge available. Therefore smaller growing species will generally be used on small verges only.

A third planting list of local, native tree species has been developed to address the issue of increasing the diversity of street tree species, particularly in regard to the Local Biodiversity Strategy's aim of creating suburban wildlife corridors. Where trees are planted as part of a traffic management design there is often a requirement for a tree species that has a predictable form and habit. Local, native species will be trialled in streets that have wider verges that can accommodate the more irregular, mature habit of some local tree species (Appendix C.3 refers).

9 Community Attitudes to Street Trees

Community support is necessary to enable the successful implementation of the street tree, local biodiversity and urban forest strategies, in particular community support for planting trees to increase canopy cover. While most people agree that 'trees are good for the environment' there is resistance from some in the community to having a street tree planted adjacent to their property.

It is proposed that an education program be developed that advocates for more trees in the streetscape and encourages community acceptance of the perceived disadvantages related to living next to a street tree.

The WALGA Street Trees Guidance Report (no date) notes that community opposition or community apathy to street trees can occur for many reasons, including:

- a changing demographic including overseas migrants; an ageing population who may struggle with maintaining fallen leaves, nuts and fruit; and residents who prefer low maintenance gardens
- large numbers of rental properties where tenants may not be interested in, or have time, to maintain gardens and verges
- debris from falling leaves, bark and fruit
- damage to infrastructure caused by roots and branches
- the perceived risk of falling branches or trees
- shaded pools, gardens and solar panels
- blocked views
- the perceived high cost of planting and maintenance
- the perceived risk of trees contributing to allergies.

9.1 Community liaison and community awareness

At present the City assesses tree requests from residents and property owners, and where feasible, trees are planted. Where existing trees are removed they are replaced with two trees. Where possible and appropriate, at least one replacement tree is planted at the same location.

Some residents may not be aware that the City provides and plants street trees annually on request from the property owner. It is proposed to advertise each year that street trees are available to be planted on request and where practicable. A tree planting request form has been developed for the City's website, and will be advertised in local newspapers and via social media for a period of time each year to allow for a timely assessment, notification, collation and ordering of trees prior to winter planting (Appendix D refers). Due to the strong multicultural diversity within the City it would be an advantage if information on the public website could be provided in a range of languages that reflects the cultural diversity of our residents.

There is an opportunity for the City to communicate the benefits of increasing the tree canopy cover within the City. Public awareness strategies will be developed to engage and inform residents of the overall benefits of trees. Strategies will include information brochures, news articles, newsletters, website links and community workshops. Educating school children will help inform future generations, and as part of promoting the Local Biodiversity Strategy, could be aligned with special days such as National Tree Day and International Earth Day in addition to current educational programs and events presented at the Canning River Eco-Education Centre (CREEC).

The City will also trial the introduction of fruiting trees in appropriate locations with local community support to help stimulate more interest in trees that provide tangible benefits, and investigate implementing the Asset-Based Community Development model (ABCD) to better involve the community regarding tree planting.

Based on events held in the cities of Unley and Adelaide (South Australia) it is proposed to initiate 'tree tag' installations at City events.

The City of Adelaide undertook a tree tag project this year and deliberately chose to not include a dollar value on each tree tag, and instead focussed on the environmental benefits of a tree eg:

- *I provide 278m² of shade - that's equivalent to 88 beach umbrellas.*
- *I provide enough oxygen in one year for 47 people to breathe in one day.*

By moving away from a simple dollar value for a tree, it was hoped to inform the community about the intangible benefits that trees provide.

The use of the free i-Tree software will enable calculation of environmental benefits of trees (Appendix F part 4.2 refers). To access the software that converts this information into 'beach umbrella' calculations will require the engagement of an external consultant.

The City will continue to inform residents who live adjacent to proposed tree removal and/or planting and include the reasons for tree removal, information about the tree species to be planted and a copy of the City's Policy ET525 - Trees in Streets Thoroughfares and Parks and a street tree information brochure.

Figure 4. City of Adelaide Tree Tag. Credit: Dr Jenni Garden

With the adoption of the revised tree policy ET525 on 16 August 2016, clause 7.7 now requires that when an existing tree is removed for any reason, the tree shall be replaced with two trees of a suitable species appropriate to the location, somewhere in the City. While removal of mature trees results in the loss of the benefits these trees provide, as outlined in section 6 of this document, the planting of two replacement trees helps towards ameliorating these losses in the future.

9.2 Approach to Tree Vandalism

The City will not tolerate activities that damage street trees and will undertake all reasonable steps to protect street trees. The City will investigate measures, including through local law development and enforcement, to discourage acts of street tree vandalism and will seek to invoke all statutory powers to prosecute persons involved in such acts.

10 Summary

The City of Canning has the third lowest percentage canopy cover of 29 local governments assessed within the Perth metropolitan area. There is a continuing rise in the cost of maintaining street trees, particularly in regard to powerline pruning and risk management requirements, including tree audits. Maintenance activities to conserve existing trees are important in reaching canopy cover goals. Planting and establishing trees to achieve canopy targets to be determined in the City's Urban Forest Strategy will also require a significant investment by the City.

One positive aspect is that there is a growing community awareness of, and support for, the need to increase tree canopy cover within the City. The urban forest, street tree, biodiversity and environmental strategies will provide guidance to achieve this. The City must however work to engage with residents who may have a resistance to street trees growing near their property. A review of the City's tree planting list and information strategies to improve public attitudes and perceptions will help to increase community satisfaction with the City's streetscape management.

Designs have been developed to improve the successful establishment of trees that are planted in hostile environments such as roadways and paved surfaces. In addition to planting two street trees for each tree removed, the City will identify and implement targeted, annual tree planting programs to increase shade and improve the amenity of the City's streetscapes.

11 Recommendations

In accordance with the tree planting targets and time frames to be determined in the Urban Forest Strategy (Draft 2019):

11.1 Tree planting

a) Continue the existing programmed annual maintenance, infill-planting and replacement tree planting.

b) Design and manage annual streetscape planting plans, using appropriate tree species to increase the number of suitable street trees within the City.

c) Annually identify and select 'treeless' streets from each suburb within the City and develop and implement planting plans.

d) Forward ten-year budget provision to undertake street and park tree audits

e) In addition to programmed tree planting, undertake street tree planting programs in numbers that are supported by annual budget allocations, with sufficient resources to enable implementation, establishment, maintenance and management of the trees.

f) Work towards planting street trees so that where viable, every residential property within the City will have at least one street tree, and more trees will be planted if feasible in regard to the width of the property frontage, crossovers, paths and the presence of utility services such as service pit lids and power poles.

11.2 Biodiversity

Identify streets, with reference to the Local Biodiversity Strategy's Regional Ecological Linkages map, and the City's own local priorities, that when planted, will assist with the establishment of wildlife corridors between bushland areas. There will be a preference for endemic tree species to be planted along these corridors where appropriate.

11.3 Species selection

a) Select suitable tree species for future streetscape enhancement planting programs for a range of road reserve configurations that include the presence of overhead powerlines and power poles, underground services, paving, paths and varying verge widths (Appendices A, B and C refer).

b) To increase the variety of tree genera and species it is proposed to participate in research into alternative tree species and in planting trials to determine the suitability of trial species as street trees. This will include trials of fruiting trees. Trial planting schemes will also include one or two 'proven' tree species as insurance should the trialled species not perform as anticipated, to allow for establishment of some trees within each streetscape (Appendix A part 8c refers).

11.4 Hardscape modification

a) Trial technical specifications that have been developed, such as the use of 'root cells' to increase establishment success for trees planted in hardscaped inner urban areas and within roadways. This will allow for green cover to be established in hard surface areas as identified in the University of Technology, Sydney's Urban Tree Canopy study (Appendix F part 1 refers).

b) Trial specialised planting techniques such as the use of root cells beneath paved areas in defined activity centres to manage conflicts with other infrastructure (Appendix E refers).

11.5 Auditing

Improve risk management and tree maintenance by updating data annually and the tree audit at least every five years. To allow for the review of the Park and Street Tree Audits, it is proposed that funds be listed for consideration in future Draft Annual Budgets.

11.6 Community engagement

a) To investigate ways to better engage and inform the community regarding the benefits of street trees it is proposed to use the i-Tree Eco software, and an external consultant to develop tree tags that provide the environmental benefits provided by an individual tree.

   Based on recent launches of tree tag projects in South Australia it is planned that, as part of larger City events, tree tags will be hung from trees at the site. The City will undertake surveys and video interviews of attendees to gauge the level of awareness and support for the tree tags, and whether tree tags increase the community's knowledge about the benefits of trees.

   An increased awareness of the benefits of trees may develop an increased acceptance of trees within the community.

b) Actively promote the City's street tree planting program with the objective of increasing annually the number of resident requests for street tree planting (Appendix D refers).

c) Investigate the Asset-Based Community Development model (ABCD) to encourage involvement within the community regarding tree planting (Appendix F part 10 refers).

Figure 5. Street tree planting as a traffic engineering design, Fifth Avenue and Leach Highway, Shelley/Rossmoyne

TWO

Section

Contents

Section 2

Photographs: All photographs taken by P Walker, unless otherwise credited.

Appendix A - Tree Species Selection

1 The Right Tree for the Right Location

Street trees require sufficient ground space to establish sound root systems while limiting damage to built infrastructure as the trees mature. Urban design considerations require selection of appropriate tree species that can be accommodated within the soil volume available in the verge or median.

The Street Tree Strategy provides guidance on the selection of tree species to limit the use of species that have proved problematic in verges. Such species may still be suitable for use in wide medians. The selection of species aims to ensure that the tree makes a positive contribution to environmental, amenity, aesthetic and heritage values of the area and to ensure that any negative aspects are minimised.

This does not mean that tree species that have been shown to be problematic should necessarily be removed prematurely. Sound management practice is to address any issues that may arise, and where feasible, retain and maintain the existing trees for their useful life span.

There is no perfect street tree, so every selection has some compromise between positive and negative values.

2 Tree Selection Criteria

The tree selection criteria are divided into three main categories:

- Environmental tolerances
- 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.

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

3 Environmental Selection

The capacity of trees to establish and grow successfully depends largely on the environmental conditions at the planting location being within the tolerance range of the species selected.

Some of the environmental factors that affect tree selection are:

3a) Tolerance to paved areas and limited soil volume

Trees selected for hard paved areas and limited soil volume must have the ability to tolerate lower than optimum soil oxygen levels and often compacted and highly modified soil conditions. The limited soil volume within verges can restrict the mature dimensions of a street tree, and there are formulae that can be used to estimate the required soil volume for a given tree species (Appendix F part 5 refers).

Technical detail drawings have been prepared to ensure a consistent treatment for street tree planting throughout the variety of street environments typically encountered within the City (Appendix E refers).

3b) Drought tolerance and Water Sensitive Urban Design (WSUD)

It is expected that the increasing cost of mains water, restrictions on the use of bore and mains water, and the lower than average rainfall that Perth has experienced will continue into the long term. Street trees therefore need to be capable of surviving an average drought period in reasonable condition without irrigation. Passive irrigation through the use of water sensitive urban design (WSUD) may assist with additional water being available to trees but the locations of many existing trees are not able to be retrofitted without major infrastructure changes. Such changes would be likely to affect the root systems of existing trees. Accordingly, WSUD is generally only suitable for new plantings.

WSUD at a local level means capturing and harvesting stormwater in swales or other systems to permit filtration into the ground. Constructed wetlands may be created and plants are used to clean the water of contaminants from road surfaces, for example, before the water drains into rivers, lakes and oceans. WSUD systems can be extensive or quite small, depending on the catchment being serviced. The core principles in these instances are to capture and clean rain water before release to the natural environment, and provide passive irrigation.

3c) Tolerance of atmospheric pollution

The environment near highways and busy arterial roads is 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 considered to be more tolerant than evergreen species as deciduous trees annually shed leaves and the accumulated pollutants. The longer the life of a leaf the greater the likelihood that the threshold levels for pollutant damage will be exceeded. Nevertheless, many evergreen tree species are capable of withstanding the adverse effects of atmospheric pollution.

3d) Native wildlife habitat

Trees provide shelter, food and other habitat resources for a range of fauna including birds and insects.

Guided by the City's Biodiversity Strategy (2018) consideration will be given to planting trees that expand on and/or provide a connection between open spaces or other vegetated areas to increase the area of available habitat and assist in the movement of native fauna species between those areas.

Locally native trees are preferable in this regard however some exotic species also have habitat value. A mix of species will be used where appropriate.

Red Wattle Bird (*Anthochaera carunculata*) feeding on Jacaranda flowers

4 Functional Criteria

Species selected for street tree planting also need to fulfil certain functional criteria to ensure successful establishment and reduced ongoing maintenance and management issues, as set out below.

4a) Proven performance

Reliable performance of tree species under the environmental conditions of the streetscapes is important and has been considered as part of the review of the street tree planting list. Trees are a long term investment and there are substantial costs associated with purchase, planting and maintenance. New species should be trialled on a small scale and their performance assessed over several years before more widespread use.

4b) Readily available and good quality tree stock

The selected plant species must be able to be commercially grown and available in a suitable size for street planting. For residential street tree planting the stock used generally has a 30 to 40 litre rootball size. For tree replacements due to removal for approved development, the rootball size will be 90 to 100 litres. For city centre verges the tree nursery stock used will include super advanced stock to provide high initial impact and greater resistance to vandalism.

4c) Australian Standard AS-2303 - Tree Stock for Landscape Use

Successful establishment of street trees depends in part on the quality of tree stock sourced. Trees that are poorly grown by nursery suppliers are prone to failure. Poor nursery production practices can result in trees with pot-bound or girdled roots that limit the ability of a tree to take up water and nutrients and may provide inadequate support to the tree.

The Australian Standard AS-2303 was adopted in 2015 to provide an industry tree supply specification. It aims to improve the quality of tree stock with nurseries producing healthy, well-structured trees with a decreased risk of failing in extreme weather events. This would provide an economic benefit, as the cost of replacing failed trees, and trees with poor structure or health as a result of poor plant production practices, will be avoided. Now the standard has been adopted, the City will be able to require that the stock it purchases is compliant.

4d) Aesthetic/design criteria

Trees play an important role in enriching the cultural experience of a place so the aesthetic characteristics of the trees need to be considered. The character of streets and suburbs is determined in part by the dominant tree species as much as it is by architectural styles.

4e) Mature tree canopies

Species should still be selected such that the mature size of the tree is in scale with the streetscape, giving consideration to the site constraints, such as the width of the verge, overhead powerlines, building alignments and vehicle clearances.

The optimum range is not so small that it does not make a significant contribution to the amenity of the street, and not so large as to dominate visually and cause major difficulties with disruption to infrastructure. In some instances the constraints imposed by the street environment will limit the optimum size of street trees or even restrict tree planting altogether.

Given the need to increase the percentage canopy cover over the City, where verges are of adequate width, taller growing species with broader mature canopies should be considered.

4f) Tree Form

Selected species should have an appropriate and reliable form, with an upright, single trunk and stable branch structure. Street trees need to have a growth pattern that can be pruned and managed to allow clear sightlines, and traffic and pedestrian movements around and under the tree.

4g) 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 seasonal change while maximising winter light. They are also generally more tolerant of air pollutants. Deciduous trees, however, can cause a spike in the nutrient loading if their shed leaves, that generally decay faster than evergreen leaves, are washed into the stormwater system.

4h) Consideration of existing solar collection systems

Aerial photography will assist in initially determining where it is appropriate to plant deciduous tree species in consideration of solar access for existing, domestic thermal solar collection systems and photovoltaic cells.

Consultation with residents who have existing solar collection systems will also be undertaken in regard to proposed street tree planting. The use of deciduous trees in consideration of gaining winter solar incidence to a dwelling is discussed in Appendix B part 3.

West Australian Red Flowering Gum – grafted form (*Corymbia ficifolia*)

5 Trees and Services

5a) Overhead powerlines

Most significant of all the factors that limit the benefits trees can contribute to a streetscape is the conflict between overhead powerlines and tree canopies. Undergrounding powerlines is Western Power's responsibility and is either funded by the City as part of minor road improvement works or as part of a State underground power project that has generally been funded 50 per cent by property owners and 50 per cent by the State Government.

Power is usually put underground in new residential developments; however, verge widths in new subdivisions are often narrow which can limit the establishment of street trees able to reach a significant stature. In established residential areas, cost is a significant barrier to installing powerlines underground.

5b) Management of existing trees where underground power has been installed

In suburbs where overhead powerlines have been removed and underground power has been installed the existing trees have been regularly pruned to a certain powerline clearance profile. They cannot be left to 'grow away' once powerlines are underground. Remedial pruning is required to manage the regrowth because it grows from buds just beneath the bark and is not connected through the main woody structure of the tree. Consequently unchecked regrowth would be likely to fail if allowed to grow larger.

There are two options for managing the regrowth:

- continue the previous pruning regime as if the trees were still under wires, or
- prune existing tree frameworks so that in future they will require less frequent upper canopy pruning. This approach has a high initial cost but lower recurring maintenance costs. However, it would not be feasible with all species.

5c) Underground services and structures

High pressure gas mains, water pipes, telecommunications lines and electricity easements sometimes prohibit establishment of trees due to the limited depth of the services and potential liabilities if a service were damaged. Similarly, underground structures, wall footings and the like may also limit the feasibility of establishing trees. Each planting site needs to be assessed on its merits to determine its suitability for planting trees in relation to underground services and structures.

5d) Other factors impacting on street tree selection and establishment

Conflicts between trees and built infrastructure have an impact both on the health and maintenance cost of the tree and on the serviceability and maintenance cost of the hardscape. Balancing the interactions of street trees and their planting sites is critical to minimising costs and maximising benefits. Higher residential density codes are placing increased pressure on the ability of the City to retain existing street trees, and are reducing the opportunities to plant more trees because of the increasing number of crossovers.

6. No Street Tree is Perfect

6a) The 'Perfect' street tree

There is no such thing as a street tree that will fulfil perfectly all of the selection criteria (Figure 1. refers). Trees are living entities that can develop a variety of forms even within one species type and within the one street.

It must be remembered that the trees are being planted in a highly modified environment that is far removed from their natural habitat. In this situation there are bound to be some negative aspects associated with trees in an urban environment; however, it is generally considered that the benefits that trees contribute to the environment far outweigh many of the more negative aspects.

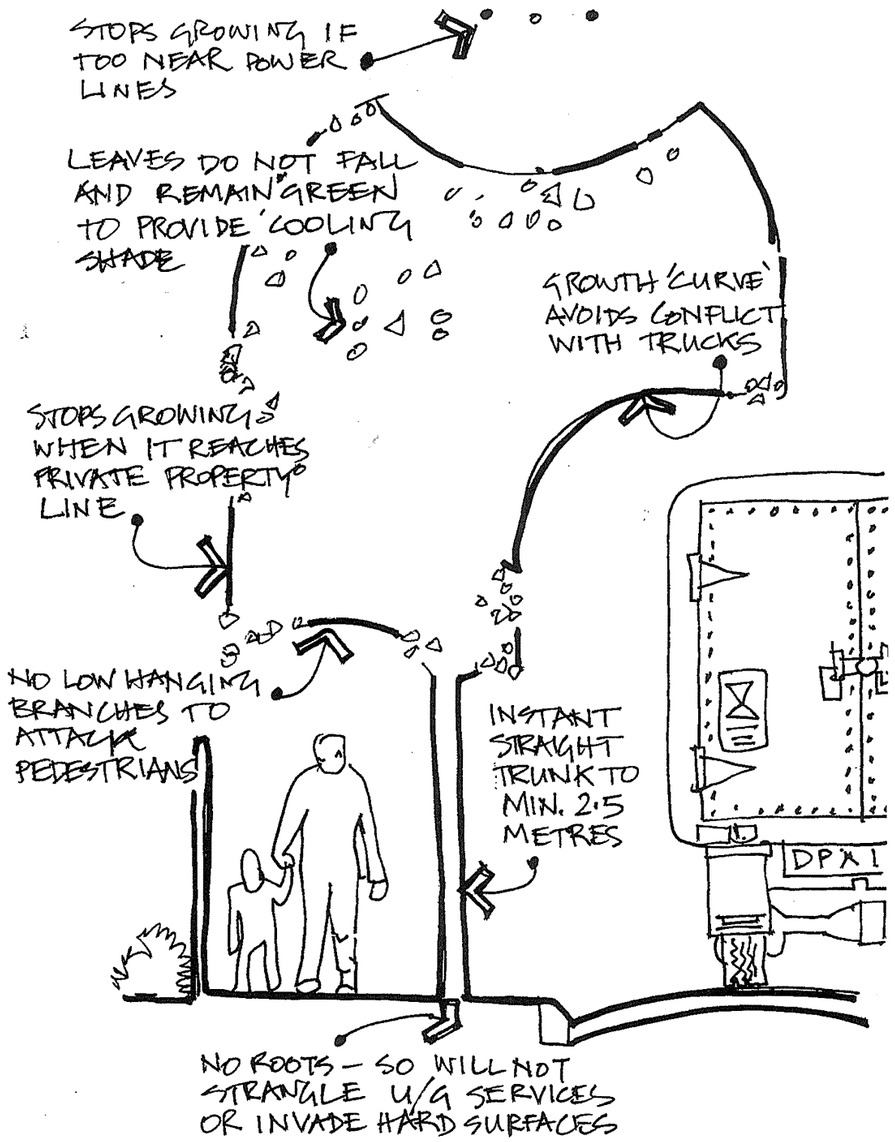


Figure 1. The 'Perfect' Street Tree. Credit: T. Thompson

Frequent negatives raised about street trees include the following:

6b) Allergies

Concern is sometimes raised that particular tree species cause allergies, irritation and respiratory problems. Various wind pollinated plants, particularly introduced grasses, can cause allergies such as hay fever for some people, especially during spring and early summer. 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 hay fever, eye allergies and other respiratory problems. Tree species that are insect-pollinated and therefore considered to be 'low-allergen' include the Bottlebrush (*Callistemon* species) and Paperbark (*Melaleuca* species). Wind pollinated species include conifers (for example Pine trees, *Pinus* species and Cypress Pines, *Callitris* species), Olives (*Olea europeae*) and Willow trees (*Salix* species).

6c) Leaf, bark and fruit drop

All trees, including evergreens, drop leaves.

The shedding of debris such as leaves, flowers, fruit and sometimes bark and twigs is part of the natural habit of healthy trees. The type and volume of the material and the timing of the shedding processes differ with the species and size of individual plants. The degree to which particular houses will be affected by tree debris depends on their construction type, roof pitch and roofing material, proximity to the trees and the direction of prevailing winds, as well as the volume and type of debris, and size of the tree.

Lopping is the pruning of limbs to a set height. Lopping a tree does not significantly reduce the amount of leaf debris produced by a tree over time. It has a detrimental effect on the structural stability of the canopy of the tree and may also affect its health. Lopping encourages some species to grow more vigorously, ultimately increasing the size of the canopy further.

To reduce the debris accumulating in nearby properties, the use of lower growing species would be required but lower growing species will still shed debris. Removing taller species entirely from the City's verges would change the appearance and the amenity of the streetscape by removing the strong vertical definition they provide. This action would also reduce valuable canopy cover in the City.

Lower growing trees are less dominant in the landscape and consequently are less impressive visually. They sequester less carbon and often have a shorter life span, which increases removal and replacement costs, and reduces the benefits that larger mature trees provide (Appendix F part 9 refers).

If other medium or small sized trees were to be introduced, matters to be considered would include whether to use locally native trees, trees native to other parts of Australia or introduced species, whether evergreen or deciduous. Most deciduous trees are species introduced from overseas. Deciduous trees have the advantage of shedding their leaves over a shorter period of time than evergreen trees, though the leaf drop is heavy, because all the leaves are shed over several weeks.

The City uses a sweeper to clean up heavy accumulation of fallen leaves in streets and has provided additional bins to some residents living adjacent to large street trees to assist with disposal of leaves.

6d) Damage to paving

Established trees can cause kerb and footpath uplift and cracking. These trees are generally the vigorous and large growing species.

An important consideration in minimising damage to this infrastructure is the selection of tree species with growth characteristics that are appropriate to the soil volume available in the verge. In older suburbs some tree species such as the WA Weeping Peppermint (*Agonis flexuosa*) and Queensland Brush Box (*Lophostemon confertus*) are now fifty or more years old. Encroachment into the verge area from road widening, footpath installation and increased crossover numbers over the years has resulted in less soil volume within the verge. As a result these now mature trees may cause more root damage to this built infrastructure. The City undertakes repairs where required within the road reserve and monitors the trees.

When a decision is made to remove trees that have damaged public or private property, an assessment as to whether the species is no longer appropriate or not should determine whether the same or a different species is planted as a replacement tree.

Horticultural formulae have been developed that can estimate the required volume of soil to sustain different tree species, which also indicates species that are not suitable for narrow verges (Appendix F part 5 refers). This, combined with horticultural knowledge of growth characteristics of different tree species, has helped inform the development of the City's revised Street Tree Planting List.

When planting trees in hardscapes, maximising the size of the planting cut-outs in pavements and the use of flexible pavements can reduce future pavement damage and the associated risk management issues.

Little Ghost Gum (*Eucalyptus victrix*)

7 Streetscape Design Principles

From a design perspective, street trees are selected to:

a) provide consistency and visual uniformity for each street where appropriate

b) enhance the local character of streets

c) reinforce and celebrate the gateways and key nodal intersections

d) reinforce major roads and avenues.

When using these design principles, consideration needs to be given to site specific conditions that will determine individual tree placements. These include footpath widths, sight line clearances, underground utilities and overhead wires.

7a) Consistency, visual uniformity and enhancing local character

The intention of employing these principles is to establish a uniform visual character for each street, a sense of identity or 'sense of place' that complements architectural forms and provides streets with a distinctive and recognisable character. Inconsistent street plantings using many different species can add interest to some streetscapes, but they may also be more difficult to manage, and the lack of unity may be visually confusing.

In many locations the streetscape is already established and if the dominant, existing species has been identified to be suitable in scale and growth habit, it will continue to be used in future plantings. In streets with few or no trees there are more opportunities for trialling different tree species.

7b) Mixed species street planting

The City's current practice has encouraged the planting of one or two species within a street where possible to create an avenue with similar characteristics and management requirements. A lower growing species is generally used under powerlines, with a larger species planted on the clear side of the street. A greater variety of species may be acceptable in locations where the established streetscape and landscape character supports a more diverse planting theme. Streets identified in the Local Biodiversity Strategy (2018) will be planted with a mix of tree species to help increase habitat.

The City has residential streets that contain a large mix of tree species and removal of mature trees to create a more visually uniform monoculture of one tree species is not supported.

7c) Reinforce major roads and avenues

The major highways running through the City are Albany Highway, Leach Highway and Roe Highway. Other major arterial roads are High Road, Burrendah Boulevard, Willeri Drive, Manning Road, Vahland Avenue, Nicholson Road, Sevenoaks Street, Railway Parade, Welshpool Road and Orrong Road.

These major roads form corridors of movement through the City and are considered as separate in character to the precincts and suburbs they separate and bound. These streets will be strengthened with consistent and unified tree planting schemes. Approval from Main Roads WA is required for landscape projects in Orrong Road and in Leach and Roe Highways which are controlled access roads.

7d) In-road planting opportunities

In-road tree planting is generally a traffic engineering design response aimed at slowing speeds in roads such as Fleming Avenue, Wilson, and Corinthian Road East, Shelley, where trees with bollards are planted at intervals centrally in the roadway to create traffic calming. Trees are also used to indicate roundabouts in many locations. In-road tree planting may require selection of a tree species with a naturally narrow canopy form to better allow for vehicular clearance.

In road tree planting (Kurrajong, *Brachychiton populneus*)

In streets with footpaths and narrow verges that preclude tree planting, nibs within the roadway adjacent to the verge could be used to provide shade and to improve the appearance of the streetscape.

8 Approved Tree Planting List

Part of the review of the Tree Policy ET525 in 2013 included assessment of the growth characteristics, water and maintenance requirements, as well as specific problems encountered with all tree species planted within the City. This review resulted in the adoption of the (now superceded) Approved Tree Planting List (2013) of tree species considered to be suitable for planting in verges, medians and parks (Appendix B Table 4 refers).

Limiting factors to street tree selection include overhead powerlines and the width of verges. In consideration of these restricting factors, the street tree section of the superceded Approved Tree Planting List (2013) has been further refined and a street tree matrix has been developed to guide the selection of appropriate tree species for varying site conditions. (Appendices B and C refer). The City's Park Tree Planting List will be reviewed as part of the Urban Forest Strategy (Draft 2019) and should allow for the use of a greater diversity in tree species, due to greater available soil volume, and fewer under- and above-ground services.

The review of the Approved Tree Planting List (2013) does not require the removal of existing trees of a species that are no longer listed. The City will continue to manage all structurally sound trees for their useful life span.

8a) Long versus short-lived tree species

The mature size of street trees largely determines the impact they have on street amenity and contribution to canopy cover. Planting more, smaller trees in preference to fewer large trees minimises hardscape maintenance, service impact costs and the concerns of some residents.

The lifespan of different tree species directly influences the length of time during which benefits can be derived from the trees and the frequency with which trees must be replaced. Maximum benefit is obtained from long-lived species. Frequent replacement of short-lived species increases the City's exposure to cyclical replacement costs, increases the management requirements of declining trees and reduces the period of benefit.

8b) Large street trees

Large mature trees in general and Gum trees in particular can be perceived as 'problem' trees due to shedding of bark, fruit and occasional branches. Some residents fear large trees simply because of their size, irrespective of whether the tree is independently and professionally assessed as healthy and stable. Management of debris on private property can be difficult for some residents.

One approach to the City's future tree management could be to remove all street trees above a certain height or girth to satisfy resident concerns about large trees; however, apart from the financial cost of this approach, the result would be a release of significant amounts of stored carbon, along with the loss of biodiversity and a reduction in nesting and food sites for native birds and microfauna. Shade and amenity would be lost, the urban heat island effect would increase, stormwater runoff could be problematic in some areas and it is likely that some residents would object strongly to such a policy.

These large species are no longer planted on verges and due to decreasing verge widths, increases in crossover numbers, and a trend to planting smaller growing species, fewer large trees will be planted in the streetscape except in wide medians and roundabouts.

As previously noted, large trees should not be removed prematurely, or just because they are large. Sound management practice is to maintain the existing large trees for their useful life span.

8c) Diversity of tree species

Species diversity benefits include a variety of visual character and a range of habitats. Most importantly species diversity helps to avoid widespread tree loss due to an outbreak of a plant disease specific to a particular tree genus or species. To achieve tree species diversity, the City of Melbourne has adopted an urban forest diversity target ratio of 5:10:20 being no more than 5% of one species, 10% of one genus and 20% of one family. The City of Sydney has adopted a ratio of 10:30:40.

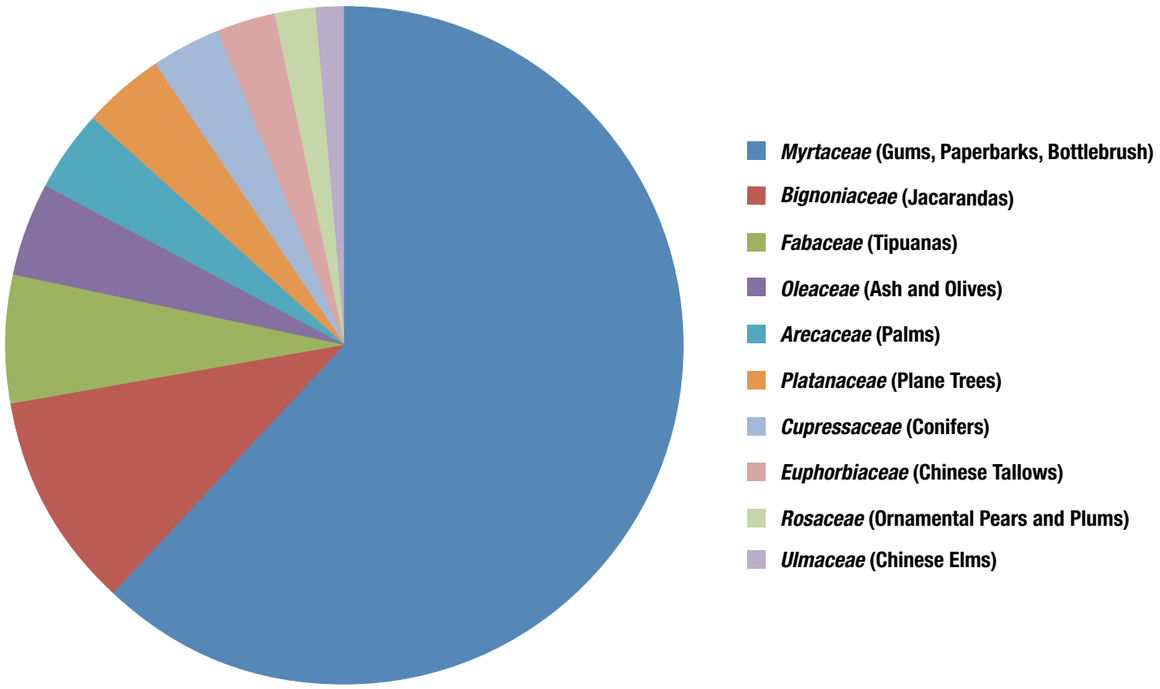
For Perth metropolitan local government authorities the difficulty in adopting this approach is the relatively low number of commercially available exotic tree species, or native tree species that are not in the *Myrtaceae* (Myrtle) family, which are also suitable as street trees in urban parts of South Western Australia. This approach could also lead to an increase in deciduous trees, which would increase the management requirement of autumn/winter leaf debris, apart from reducing the environmental benefits that native trees provide.

Western Australia's stringent quarantine restrictions, low soil fertility and the harsh climate further limit the variety of available and appropriate tree species that are not in the *Myrtaceae* (Myrtle) family. Furthermore, to implement the Local Biodiversity Strategy, the City will be limited to trees from the *Myrtaceae* (Gums, Paperbarks, Bottlebrush and so on) with options for *Proteaceae* (Banksia) and *Casuarinaceae* (Sheoaks). Trees in the *Proteaceae* family are susceptible to the dieback *Phytophthora* infection, sensitive to phosphorus and are generally brittle trees that can be easily damaged within a streetscape.

Street tree species within the *Myrtaceae* family form 55 per cent of all street trees within the City. This is due in part to the resilient nature of species native to Australia such as Gum trees, Bottlebrush, Queensland Brush Box, Paperbark trees and WA Weeping Peppermints, which are the dominant species within the *Myrtaceae* family planted in the City (Table 1. refers).

The street tree audit found that 8 tree genera, comprising 50 species, made up 46 per cent of total tree numbers. The dominant species are Bottlebrush, Jacaranda, Gum trees, Queensland Brush Box, WA Weeping Peppermint, Paperbarks, Bloodwood and Tipuanas. The remaining 54 per cent of street trees are a mixture of 49 exotic species and 14 other species native to Australia.

8c) Diversity of tree species



Cotton Tree (*Hibiscus tiliaceus*)

Table: 1. Most frequently occurring plant families within the City of Canning street tree population

Of the dominant families listed in Table 1, the City no longer plants Tipuanas, Plane Trees or Chinese Elms in verges. Palms and Conifers are also not planted by the City. The trees currently planted will be retained where appropriate and so still contribute to species diversity. Due to the limitations listed above, achieving a forest diversity target will be dependent on planting tree genera that are not in the *Myrtaceae* family in the City's medians and parks.

Another strategy could be to enlist residents to help increase the City's urban forest resilience by planting less common tree species on private property.

8d) Cultivated varieties (Cultivars)

To propagate true-to-type clones, many cultivated varieties (cultivars) must be propagated vegetatively through cuttings, grafting, or tissue culture. All stock of a cultivar is therefore genetically identical, and so may be more vulnerable to disease or pest outbreaks than genetically diverse plants grown from seed. Individual plants grown from seed however may be less predictable in regard to their growth habit or form (Appendix F part 8 refers).

Appendix B - Approved Street Tree Species Matrix (2018)

1 How the approved tree species have been selected

Limiting factors to street tree selection include overhead powerlines and the width of verges, as discussed in Appendix A.

In consideration of these restricting factors the street tree section of the superceded Tree Planting List (2013) has been further refined and two street tree matrices - City of Canning Approved Street Tree Planting List (2018) (Tables 5.1 and 5.2 below) have been developed to guide the selection of appropriate tree species for varying site conditions such as verge width, the presence of powerlines or a footpath, country of origin of the species and evergreen or deciduous characteristics.

Tree selection criteria include environmental, functional and streetscape design principles; anticipated mature dimensions of a tree species; diversity of tree species; deciduous and evergreen tree characteristics; leaf, bark and fruit drop; potential to damage infrastructure; tree form; and adaptability to pruning, particularly for overhead powerlines where necessary. Most importantly, the demonstrated performance of a species helped to confirm or otherwise its suitability for use as a street tree.

Further information related to each tree species has been included on separate information sheets (Appendices C.1 and C.2 refer).

As noted previously, the City's Park Tree Planting list will be reviewed as part of the Urban Forest Strategy (Draft 2019), and should allow for the use of a greater diversity in tree species, due to greater available soil volume, and fewer under- and aboveground services.

Orchid Tree *(Bauhinia purpurea)*

2 Tree species no longer to be planted on verges in the City

Table1 shows the tree species that will no longer be planted on verges by the City.

Tree species	No longer planted in Verges (V); Medians (M); Parks (P)		Evergreen Deciduous
Casuarina cunninghamiana	River She Oak	**V M P**	**E**
Corymbia citriodora	Lemon Scented Gum	**V**	**E**
Corymbia maculata	Spotted Gum	**V**	**E**
Conifer species	Conifer	**V**	**E**
Eucalyptus botryoides	Southern Mahogany	**V M P**	**E**
Eucalyptus camaldulensis	River Red Gum	**V M**	**E**
Eucalyptus globulus	Tasmanian Blue Gum	**V M P**	**E**
Eucalyptus grandis	Rose Gum	**V M**	**E**
Eucalyptus gomphocephala	Tuart	**V M**	**E**
Eucalyptus robusta	Swamp Mahogany	**V M P**	**E**
Ficus microphylla var *hillii*	Hill's Fig	**V M**	**E**
Gleditsia triacanthos 'Sunburst'	Gleditsia 'Sunburst'	**V M**	**D**
Melaleuca quinquenervia	Broadleaf Paperbark	**V**	**E**
Melia azedarach	Cape Lilac	**V M**	**D**
Tipuana tipu	Pride of Bolivia	**V M P**	**D**
Platanus species	Plane Tree	**V**	**D**
Palm species	Palm	**V**	**E**

Table 1. (Extract from) City of Canninng superceded Tree Planting List (2013)

West Australian Red Flowering Gum – grafted form (*Corymbia ficifolia*)

Table 2 shows the number of existing street trees of each species that will no longer be planted on verges.

Tree Species	**Common Name**	Number	NOTES
Casuarina cunninghamiana	River She Oak	11	
Corymbia citriodora	Lemon Scented Gum	171	Occasional food source for Black Cockatoos
Corymbia maculata	Spotted Gum	59	
Conifer species	Conifer	232	Includes hedge plantings
Eucalyptus botryoides	Southern Mahogany	23	
Eucalyptus camaldulensis	River Red Gum	112	
Eucalyptus globulus	Tasmanian Blue Gum	20	
Eucalyptus grandis	Rose Gum	32	
Eucalyptus gomphocephala	Tuart	10	Food source for Black Cockatoos
Eucalyptus robusta	Swamp Mahogany	78	
Ficus microphylla var *hillii*	Hill's Fig	74	
Gleditsia triacanthos 'Sunburst'	Gleditsia 'Sunburst'	134	
Melaleuca quinquenervia	Broadleaf Paperbark	318	
Melia azedarach	Cape Lilac	141	Occasional food source for Black Cockatoos
Tipuana tipu	Pride of Bolivia	812	
Platanus species	Plane Tree	605	Excluding 174 median trees
TOTAL		**3006**	**9.5% of total street trees**
Palm species*	Palm	755	2.6%

* To avoid skewing the figures related to existing tree species that are no longer planted by the City, Palms have been excluded from the calculations in Table 2. Palms within the City have generally been planted by adjoining landowners and are managed by the City in conjunction with residents' requests.

Of the other tree species listed in Table 2 those that are likely to have been planted by residents include Conifers, Hill's Figs and Tasmanian Blue Gums (total 326).

Table 2 Existing trees of species that will no longer be planted on verges

3 Consideration of solar incidence for dwellings

Solar incidence is a term used to describe the amount of sunshine striking glass in the living spaces of a home. The desired amount of solar access varies with climate.

Residents are advised in writing prior to street tree planting and are able to discuss their preferred replacement tree species should they wish to consider future solar access to their dwelling.

The City has not actively selected or programmed the planting of specific tree species adjacent to north facing dwellings to maximise solar exposure. The City's tree request records show that there have been few very resident requests for a deciduous species specifically related to managing solar access to their home.

The Street Tree Matrix lists tree species that may be suitable for planting on northern and western verges to assist with winter solar incidence to dwellings. A summary of deciduous trees approved for verge planting is shown in Table 3.

Tree Species			
Botanical Name	**Common Name**	**Deciduous**	**Verge**
Exotic Trees			
Bauhinia 'Purpurea'	Orchid Tree	**D**	**V**
Jacaranda mimosaefolia	Jacaranda	**D**	**V**
Lagerstroemia indica	Crepe Myrtle	**D**	**V**
Prunus x blireana	Purple Leaf Plum	**D**	**V**
Prunus ussuriensis	Manchurian Pear	**D**	**V**
Pyrus calleryana 'Bradford'	Bradford Pear	**D**	**V**
Pyrus calleryana 'Capital'	Capital Pear	**D**	**V**
Sapium sebiferum	Chinese Tallow	**D**	**V**

Table 3 Deciduous tree species - related to planting for solar incidence

It must be noted that attempts to modify the canopy of an existing mature street tree by heavy pruning to optimise solar efficiency may lead to problems with the structure of the tree's canopy. Lopping a tree canopy has financial costs including the need to monitor and maintain regrowth and may result in removal should the pruning be detrimental to its future structure.

Any tree, irrespective of species, could be considered by a resident to be inappropriate if it is perceived to be causing a nuisance, for example, by shading solar panels, dropping debris or where roots are damaging infrastructure.

'Feasibility' of pruning does not relate to a particular tree species, but the maturity, structure and form of each individual tree, its location relative to a property boundary and the amount of pruning requested.

It was reported as part of the City's Urban Canopy Monitoring (2015) that roadways have a relatively poor percentage of canopy cover, in part due to the number of trees that are pruned for powerline clearance. However, these trees still provide environmental and community benefits.

4 Superceded Tree Planting List (2013) relates to pages 34 - 37

Trees native to Australia	STREET AND MEDIAN TREES		
Botanical Name	**Common Name**	**Evergreen Deciduous**	**Verge Median**
Agonis flexuosa	WA Weeping Peppermint	**E**	**V M**
Brachychiton acerifolius	Illawarra Flame Tree	**D**	**V M**
Brachychiton populneus	Kurrajong	**D**	**V M**
Callistemon 'Kings Park Special'	KPS Bottlebrush	**E**	**V M**
Callistemon viminalis	Bottlebrush	**E**	**V M**
Casuarina equisitifolia var *incana*	Horse-tailed Sheoak	**E**	**V M**
Corymbia eximia	Yellow Bloodwood	**E**	**V M**
Corymbia ficifolia	WA Red Flowering Gum	**E**	**V M**
Corymbia maculata	Spotted Gum	**E**	**M**
Eucalyptus forrestiana	Fuchsia Gum	**E**	**V M**
Eucalyptus leucoxylon 'Rosea'	Yellow Gum	**E**	**V M**
Eucalyptus platypus	Round leaf Moort	**E**	**V M**
Eucalyptus todtiana	Coastal Blackbutt	**E**	**V M**
Eucalyptus torquata	Coral Gum	**E**	**V M**
Eucalytpus victrix	Little Ghost Gum	**E**	**V M**
Hakea laurina	Pincushion Hakea	**E**	**V M**
Hibiscus tiliaceus	Cotton Tree	**E**	**M**
Hymenosporum flavum	Native Frangipani	**E**	**V M**
Lophostemon confertus	Queensland Brush Box	**E**	**V M**
Melaleuca leucadendra	Weeping Paperbark	**E**	**V M**
Melaleuca linariifolia	Snow in Summer	**E**	**V M**
Melaleuca preissiana	Modong	**E**	**V M**
Melaleuca rhaphiophylla	Swamp Paperbark	**E**	**V M**
Melaleuca quinquenervia	Broadleaf Paperbark	**E**	**M**
Melaleuca viridiflora	Red Flowering Broadleaf Paperbark	**E**	**V M**
Stenocarpus sinuatus	Firewheel Tree	**E**	**V M**
Tristaniopsis laurina	Water Gum	**E**	**V M**

Table 4 – Superceded Tree Planting List (2013)

Exotic Trees	STREET AND MEDIAN TREES		
Botanical Name	**Common Name**	**Evergreen Deciduous**	**Verge Median**
Bauhinia 'Purpurea'	Orchid Tree	**D**	**V M**
Fraxinus griffithii	Evergreen Ash	**E**	**V M**
Jacaranda mimosaefolia	Jacaranda	**D**	**V M**
Lagerstroemia indica	Crepe Myrtle	**D**	**V M**
Magnolia 'Little Gem'	Little Gem Magnolia	**E**	**V**
Olea europaea	Olive	**E**	**V M**
Platanus x *acerifolia*	London Plane Tree	**D**	**M**
Platanus orientalis 'Digitata'	Cut Leaf Plane Tree	**D**	**M**
Prunus x *blireana*	Purple Leaf Plum	**D**	**V**
Pyrus ussuriensis	Manchurian Pear	**D**	**V M**
Pyrus calleryana 'Bradford'	Bradford Pear	**D**	**V M**
Pyrus calleryana 'Capital'	Capital Pear	**D**	**V M**
Quercus palustris	Pin Oak	**D**	**M**
Sapium sebiferum	Chinese Tallow	**D**	**V M**

Table 4 – continued Superceded Tree Planting List (2013)

Trees native to Australia	PARK AND RESERVE TREES		
Botanical Name	**Common Name**	**Evergreen Deciduous**	**Bushland Park**
Agonis flexuosa	WA Weeping Peppermint	**Park**	**P**
Allocasuarina fraseriana	WA She Oak	**E**	**P**
Allocasuarina torulosa	Rose Sheoak	**E**	**P**
Araucaria heterophylla	Norfolk Island Pine	**E**	**P**
Banksia species	Banksia	**E**	**B P**
Brachychiton acerifolius	Illawarra Flame Tree	**D**	**P**
Brachychiton populneus	Kurrajong	**D**	**P**
Callistemon 'Kings Park Special'	Weeping Bottlebrush	**E**	**P**
Callistemon viminalis	Weeping Bottlebrush	**E**	**P**
Callitris preissii	Rottnest Island Pine	**E**	**P**
Corymbia calophylla	Marri	**E**	**BP**
Corymbia citriodora	Lemon Scented Gum	**E**	**P**
Corymbia eximia	Yellow Bloodwood	**E**	**P**
Corymbia ficifolia	WA Red Flowering Gum	**E**	**P**
Corymbia ficifolia (grafted)	Red Flowering Gum	**E**	**P**
Corymbia maculata	Spotted Gum	**E**	**P**
Eucalyptus caesia	Gungurru	**E**	**P**
Eucalyptus camaldulensis	River Red Gum	**E**	**P**
Eucalyptus forrestiana	Fuchsia Gum	**E**	**P**
Eucalyptus gomphocephala	Tuart	**E**	**BP**
Eucalyptus leucoxylon 'Rosea'	Yellow Gum	**E**	**P**
Eucalyptus marginata	Jarrah	**E**	**BP**
Eucalyptus sideroxylon 'Rosea'	Red Ironbark	**E**	**P**
Eucalyptus rudis	Flooded Gum	**E**	**BP**
Eucalyptus todtiana	Coastal Blackbutt	**E**	**P**
Eucalyptus victrix	Little Ghost Gum	**E**	**P**
Ficus macrophylla	Moreton Bay Fig	**E**	**P**
Ficus microphylla var *hillii*	Hill's Fig	**E**	**P**
Hakea laurina	Pincushion Hakea	**E**	**P**
Hymenosporum flavum	Native Frangipani	**E**	**P**
Lophostemon confertus	Queensland Brush Box	**E**	**P**
Melaleuca leucandendra	Weeping Paperbark	**E**	**P**
Melaleuca linariifolia	Snow in Summer	**E**	**P**
Melaleuca preissiana	Modong	**E**	**BP**
Melaleuca rhaphiophylla	Swamp Paperbark	**E**	**BP**
Melaleuca quinquenervia	Broadleaf Paperbark	**E**	**P**
Melaleuca viridiflora	Red Flowering Broadleaf Paperbark	**E**	**P**
Tristaniopsis laurina	Water Gum	**E**	**P**

Table 4 – continued Superceded Tree Planting List (2013)

Exotic Trees	PARK AND RESERVE TREES		
Botanical Name	**Common Name**	**Evergreen Deciduous**	**Bushland Park**
Bauhinia 'Purpurea'	Orchid Tree	**D**	**P**
Ficus macrophylla	Moreton Bay Fig	**E**	**P**
Ficus microphylla var *hillii*	Hill's Fig	**E**	**P**
Fraxinus griffithii	Evergreen Ash	**E**	**P**
Fraxinus 'Raywood'	Claret Ash	**D**	**P**
Jacaranda mimosaefolia	Jacaranda	**D**	**P**
Lagerstroemia indica	Crepe Myrtle	**D**	**P**
Magnolia grandiflora	Southern Magnolia	**E**	**P**
Magnolia 'Little Gem'	Little Gem Magnolia	**E**	**P**
Platanus x *acerifolia*	London Plane Tree	**D**	**P**
Platanus orientalis 'Digitata'	Cut Leaf Plane Tree	**D**	**P**
Prunus x *blireana*	Purple Leaf Plum	**D**	**P**
Prunus ussuriensis	Manchurian Pear	**D**	**P**
Pyrus calleryana 'Bradford'	Bradford Pear	**D**	**P**
Pyrus calleryana 'Capital'	Capital Pear	**D**	**P**
Sapium sebiferum	Chinese Tallow	**D**	**P**
Ulmus parvifolia	Weeping Elm	**D**	**P**

Tree species no longer planted in	STREET AND PARK TREES		
Tree species no longer planted in verges (V) medians (M) parks (P	**Common Name**	**Evergreen Deciduous**	**Verge Median**
Casuarina cunninghamiana	River She Oak	**E**	**V M**
Corymbia citriodora	Lemon Scented	**D**	**V M**
Corymbia maculata	Spotted Gum	**D**	**V M**
Conifer species	Conifer	**E**	**V M**
Eucalyptus botryoides	Southern Mahogany	**E**	**V M**
Eucalyptus camaldulensis	River Red Gum	**E**	**V M**
Eucalyptus globulus	Tasmanian Blue Gum		
Eucalyptus grandis	Rose Gum	**E**	**V M**
Eucalyptus gomphocephala	Tuart	**E**	**M**
Eucalyptus robusta	Swamp Mahogany	**E**	**V M**
Ficus microphylla var hillii	Hill's Fig	**E**	**V M**
Gleditsia triacanthos 'Sunburst"	Gleditsia 'Sunburst'	**E**	**V M**
Tipuana tipu	Pride of Bolivia	**E**	**V M**
Melaleuca quinquenervia	Broadleaf Paperbark	**E**	**V M**
Melia azedarach	Cape Lilac	**E**	**V M**
Palm species	Palm	**E**	**V M**

Table 4 – continued Superceded Tree Planting List (2013)

5 Approved Tree Planting List (2018)

Part 1 - Powerlines present and Part 2 - No powerlines present (Tables 5.1 and 5.2 refer)

City of Canning Approved Tree Planting List (2018)

Trees Suitable for Planting Beneath Powerlines		Characteristics					Location						
Botanic Name	**Common Name**	Evergreen	Deciduous	Native	WA Native	Exotic	Powerlines	No Powerlines	Verge < 3m wide	Verge > 3m wide	Median	No Footpath	Footpath
Agonis flexuosa	WA Weeping Peppermint	■			■		■	■		■	■	■	■
Callistemon 'Kings Park Special'	KPS Bottlebrush	■		■			■	■	■	■	■	■	■
Callistemon viminalis	Weeping Bottlebrush	■		■			■	■	■	■	■	■	■
Eucalyptus forrestiana	Fuchsia Gum	■			■		■	■	■	■	■	■	■
Eucalyptus torquata	Coral Gum	■			■		■	■	■	■	■	■	■
Fraxinus griffithii	Evergreen Ash	■				■	■	■	■	■	■	■	■
Hakea laurina	Pincushion Hakea	■			■		■	■	■		■	■	■
Hibiscus tiliaceus	Cotton Tree	■		■			■	■		■	■	■	■
Lagerstroemia indica	Crepe Myrtle varieties		■			■	■	■	■		■	■	■
Lophostemon confertus	Queensland Brush Box	■		■			■	■		■	■	■	■
Magnolia 'Little Gem'	Little Gem Magnolia	■				■	■	■	■		■	■	■
Melaleuca leucadendra	Weeping Paperbark	■		■			■	■		■	■	■	
Melaleuca linariifolia	Snow in Summer	■		■			■	■		■	■	■	
Melaleuca preissiana	Modong	■			■		■	■		■	■	■	
Melaleuca rhaphiophylla	Swamp Paperbark	■			■		■	■		■	■	■	
Melaleuca viridiflora	Red Flowering Paperbark	■			■		■	■		■	■	■	
Olea europaea	Olive	■				■	■	■		■	■	■	
Prunus x blireana	Purple Leaf Plum		■			■	■	■		■	■	■	■
Pyrus ussuriensis	Manchurian Pear		■			■	■	■		■	■	■	■
Sapium sebiferum	Chinese Tallow		■			■	■	■		■	■	■	■

Please note: Due to Policy Guidelines ET-525, and site conditions, not all species listed above may be suitable for the verge in your street. Please email customer@canning.wa.gov.au or telephone Parks and Place Improvement on 1300 422 664 to discuss tree selection and location.

Table 5.1 Street Tree Matrix - Part 1 – Powerlines Present - City of Canning Approved Street Tree Planting List (2018)

City of Canning Approved Tree Planting List (2018)

Trees not Suitable for Planting Beneath Powerlines		Characteristics					Location						
Botanic Name	**Common Name**	Evergreen	Deciduous	Native	WA Native	Exotic	Powerlines	No Powerlines	Verge < 3m wide	Verge > 3m wide	Median	No Footpath	Footpath
Brachychiton acerifolius	Illawarra Flame Tree	■		■				■		■	■	■	■
Brachychiton populneus	Kurrajong	■		■				■		■	■	■	
Bauhinia 'Purpurea'	Orchid Tree		■			■		■		■	■	■	■
Casuarina equisitifolia var *incana*	Horse-tailed Sheoak	■		■				■		■		■	■
Corymbia eximia	Yellow Bloodwood	■		■				■		■	■	■	
Corymbia ficifolia	WA Red Flowering Gum	■			■			■		■	■	■	
Corymbia 'Summer' cultivars	'Summer' series varieties	■			■			■		■	■	■	■
Corymbia maculata	Spotted Gum	■		■				■			■		
Eucalyptus leucoxylon 'Rosea'	Yellow Gum	■		■				■		■	■	■	■
Eucalyptus todtiana	Coastal Blackbutt	■			■			■		■	■	■	
Eucalyptus utilis	Round leaf Moort	■			■			■		■	■	■	
Eucalytpus victrix	Little Ghost Gum	■			■			■		■	■	■	
Hymenosporum flavum	Native Frangipani	■		■				■	■	■	■	■	■
Jacaranda mimosaefolia	Jacaranda		■			■		■		■	■	■	■
Lophostemon confertus	Queensland Brush Box	■		■				■		■		■	
Melaleuca quinquenervia	Broadleaf Paperbark	■		■				■			■		
Platanus x *acerifolia*	London Plane Tree		■			■		■			■		
Platanus orientalis 'Digitata'	Cut Leaf Plane Tree		■			■		■			■		
Pyrus calleryana 'Bradford'	Bradford Pear		■			■		■			■		
Pyrus calleryana 'Capital'	Capital Pear		■			■		■		■	■	■	
Pyrus 'Chanticleer'	Chanticleer Pear		■			■		■	■	■	■	■	
Quercus palustris	Pin Oak	■	■			■		■		■	■		
Stenocarpus sinuatus	Firewheel Tree	■		■				■		■	■	■	
Tristaniopsis laurina	Water Gum	■		■				■		■	■	■	■

Please note: Due to Policy Guidelines ET-525, and site conditions, not all species listed above may be suitable for the verge in your street. Please email customer@canning.wa.gov.au or telephone Parks and Place Improvement on 1300 422 664 to discuss tree selection and location.

Table 5.2 Street Tree Matrix - Part 2 - No Powerlines Present- City of Canning Approved Street Tree List (2018)

Appendix C1 - Trees not suitable for planting beneath powerlines (2018) - Tree Data Sheets

City of Canning Approved Tree Planting List (2018)

Trees not Suitable for Planting Beneath Powerlines		Characteristics						Location						
Botanic Name	**Common Name**	Evergreen	Deciduous	Native	WA Native	Exotic		Powerlines	No Powerlines	Verge < 3m wide	Verge > 3m wide	Median	No Footpath	Footpath
Brachychiton acerifolius	Illawarra Flame Tree	■		■					■		■	■	■	■
Brachychiton populneus	Kurrajong	■		■					■		■	■	■	
Bauhinia 'Purpurea'	Orchid Tree		■			■			■		■	■	■	■
Casuarina equisitifolia var *incana*	Horse-tailed Sheoak	■		■					■		■		■	■
Corymbia eximia	Yellow Bloodwood	■		■					■		■	■	■	
Corymbia ficifolia	WA Red Flowering Gum	■			■				■		■	■	■	
Corymbia 'Summer' cultivars	'Summer' series varieties	■			■				■		■	■	■	■
Corymbia maculata	Spotted Gum	■		■					■			■		
Eucalyptus leucoxylon 'Rosea'	Yellow Gum	■		■					■		■	■	■	■
Eucalyptus todtiana	Coastal Blackbutt	■			■				■		■	■	■	
Eucalyptus utilis	Round Leaf Moort	■			■				■		■	■	■	
Eucalytpus victrix	Little Ghost Gum	■			■				■		■	■	■	
Hymenosporum flavum	Native Frangipani	■		■					■	■	■	■	■	■
Jacaranda mimosaefolia	Jacaranda		■			■			■		■	■	■	■
Lophostemon confertus	Queensland Brush Box	■		■					■		■		■	
Melaleuca quinquenervia	Broadleaf Paperbark	■		■					■			■		
Platanus x *acerifolia*	London Plane Tree		■			■			■			■		
Platanus orientalis 'Digitata'	Cut Leaf Plane Tree		■			■			■			■		
Pyrus calleryana 'Bradford'	Bradford Pear		■			■			■			■		
Pyrus calleryana 'Capital'	Capital Pear		■			■			■		■	■	■	
Pyrus 'Chanticleer'	Chanticleer Pear		■			■			■	■	■	■	■	
Quercus palustris	Pin Oak	■	■			■			■		■	■		
Stenocarpus sinuatus	Firewheel Tree	■		■					■		■	■	■	
Tristaniopsis laurina	Water Gum	■		■					■		■	■	■	■

Please note: Due to Policy Guidelines ET-525, and site conditions, not all species listed above may be suitable for the verge in your street. Please email customer@canning.wa.gov.au or telephone Parks and Place Improvement on 1300 422 664 to discuss tree selection and location.

***Brachychiton acerifolius* - Illawarra Flame Tree**	
Family	*Sterculiaceae*
Evergreen/deciduous:	Semi-deciduous
Height:	12 metres
Spread:	5 metres
Flowers:	Red, bell-shaped, in summer
Leaf colour:	Light green
Canopy:	Pyramidal
Origin:	Northern NSW/Queensland
Verge width:	> 3 metres
Under powerlines:	No
Note:	Spectacular in flower when leaves are absent

***Brachychiton populneus* - Kurrajong**	
Family	*Sterculiaceae*
Evergreen/deciduous:	Evergreen
Height:	12 metres
Spread:	6 metres
Flowers:	White, cream, pink, yellow, bell shaped in early summer
Leaf colour:	Deep green, glossy
Canopy:	Pyramidal
Origin:	Northern NSW/Queensland
Verge width:	> 3 metres
Under powerlines:	Yes
Note:	Wildlife habitat and food source for native birds

***Bauhinia purpurea* - Orchid Tree**	
Family	*Caesalpiniaceae*
Evergreen/deciduous:	Deciduous
Height:	8 metres
Spread:	4 metres
Flowers:	Pink to deep purple, February - November
Leaf colour:	Dark green
Canopy:	Rounded
Origin:	Southern China, SE Asia
Verge width:	> 3 metres
Under powerlines:	No
Note:	Showy, orchid-like flowers

***Casuarina equisetifolia* var *incana* - Horse-tailed Sheoak**	
Family	*Casuarinaceae*
Evergreen/deciduous:	Evergreen
Height:	10 metres
Spread:	5 metres
Flowers:	Small red flowers in winter/spring
Leaf colour:	Silver-grey needle-like
Canopy:	Open pendulous branching crown
Origin:	NSW, Queensland, NT, SE Asia
Verge width:	> 3 metres
Under powerlines:	No
Note:	Graceful arching branches

***Corymbia eximia* - Yellow Bloodwood**	
Family	*Myrtaceae*
Evergreen/deciduous:	Evergreen
Height:	12 metres
Spread:	7 metres
Flowers:	White, showy, in spring
Leaf colour:	Blue-green
Canopy:	Rounded
Origin:	NSW
Verge width:	> 3 metres
Under powerlines:	No
Note:	Bird attractant; yellow-brown mottled bark

***Corymbia ficifolia* - West Australian Red Flowering Gum**	
Family	*Myrtaceae*
Evergreen/deciduous:	Evergreen
Height:	8 metres
Spread:	6 metres
Flowers:	Variable from clear red, purple-red or white, in summer
Leaf colour:	Leathery deep green
Canopy:	Rounded
Origin:	WA
Verge width:	> 3 metres
Under powerlines:	No
Note:	Spectacular in flower; bird and insect attractant

***Corymbia* 'Summer' series of cultivars**	
Family	*Myrtaceae*
Evergreen/deciduous:	Evergreen
Height:	8 metres
Spread:	6 metres
Flowers:	Variable from red, orange or pink, in summer
Leaf colour:	Leathery deep green
Canopy:	Rounded
Origin:	WA
Verge width:	> 3 metres
Under powerlines:	No
Note:	Spectacular in flower; bird and insect attractant

***Corymbia maculata* - Spotted Gum**	
Family	*Myrtaceae*
Evergreen/deciduous:	Evergreen
Height:	30 metres
Spread:	10 metres
Flowers:	White, showy, in winter
Leaf colour:	Glossy dark green
Canopy:	Loosely rounded, open, irregular
Origin:	NSW, Victoria
Verge width:	Not applicable - medians and parks only
Under powerlines:	No
Note:	Flowers attract birds

***Eucalyptus leucoxylon* 'Rosea' - Yellow Gum**	
Family	*Myrtaceae*
Evergreen/deciduous:	Evergreen
Height:	15 metres
Spread:	8 metres
Flowers:	Pink/red in late autumn - spring
Leaf colour:	Grey-green
Canopy:	Rounded, moderately dense
Origin:	NSW, Vic. SA
Verge width:	> 3 metres
Under powerlines:	No
Note:	Bird attractant

***Eucalyptus todtiana* - Coastal Blackbutt**	
Family	*Myrtaceae*
Evergreen/deciduous:	Evergreen
Height:	8 metres
Spread:	4 metres
Flowers:	White, in summer
Leaf colour:	Pale-, or bluish-green
Canopy:	Rounded, open
Origin:	WA
Verge width:	> 3 metres
Under powerlines:	No
Note:	Native tree of the Swan Coastal Plain

***Eucalyptus utilis* (syn *E. platypus*) - Round leaf Moort**	
Family	*Myrtaceae*
Evergreen/deciduous:	Evergreen
Height:	8 metres
Spread:	5 metres
Flowers:	Lime-green to yellowish produced in winter/spring
Leaf colour:	Blue-green
Canopy:	Rounded, dense
Origin:	WA
Verge width:	> 3 metres
Under powerlines:	No
Note:	Bird attractant

***Eucalyptus victrix* - Little Ghost Gum**	
Family	*Myrtaceae*
Evergreen/deciduous:	Evergreen
Height:	10 metres
Spread:	8 metres
Flowers:	Cream in summer
Leaf colour:	Light green - grey-green
Canopy:	Open, spreading - informal
Origin:	WA,Central Australia, NT
Verge width:	> 3 metres
Under powerlines:	No
Note:	Smooth, powdery white trunk

***Hymenosporum flavum* - Native Frangipani**	
Family	*Pittosporaceae*
Evergreen/deciduous:	Evergreen
Height:	12 metres
Spread:	5 metres
Flowers:	Cream deepening to yellow with age, in spring
Leaf colour:	Glossy, deep green
Canopy:	Open, upright
Origin:	Northern NSW/Queensland
Verge width:	> 3 metres
Under powerlines:	No
Note:	Fragrant flowers

***Jacaranda mimosaefolia* - Jacaranda**	
Family	*Bignoniaceae*
Evergreen/deciduous:	Deciduous
Height:	10 metres
Spread:	6 metres
Flowers:	Purple, bell-shaped, in early summer
Leaf colour:	Dark green, fern-like
Canopy:	Upright, spreading with maturity
Origin:	Brazil
Verge width:	> 3 metres
Under powerlines:	No
Note:	Interesting seed pods

***Melaleuca quinquenervia* - Broadleaf Paperbark**	
Family	*Myrtaceae*
Evergreen/deciduous:	Evergreen
Height:	15 metres
Spread:	5 metres
Flowers:	White-cream, bottlebrush-like flowers in summer - autumn
Leaf colour:	Olive-green
Canopy:	Rounded
Origin:	Coastal NSW and Queensland, New Caledonia
Verge width:	Not applicable- medians and parks only
Under powerlines:	No
Note:	Distinctive, pale coloured bark; bird attractant

***Pyrus calleryana* 'Bradford' - Bradford Pear**	
Family	*Rosaceae*
Evergreen/deciduous:	Deciduous
Height:	11 metres
Spread:	9 metres
Flowers:	White, in spring
Leaf colour:	Glossy dark green, to plum red, scarlet and gold
Canopy:	Columnar
Origin:	China, Vietnam
Verge width:	> 3 metres
Under powerlines:	No
Note:	Showy display of spring flowers

***Pyrus calleryana* 'Capital' - Capital Pear**	
Family	*Rosaceae*
Evergreen/deciduous:	Deciduous
Height:	11 metres
Spread:	3 metres
Flowers:	White, in spring
Leaf colour:	Shiny dark green to reddish-purple
Canopy:	Fastigiate
Origin:	China, Vietnam
Verge width:	> 3 metres
Under powerlines:	No
Note:	Showy autumn colours and spring flowers

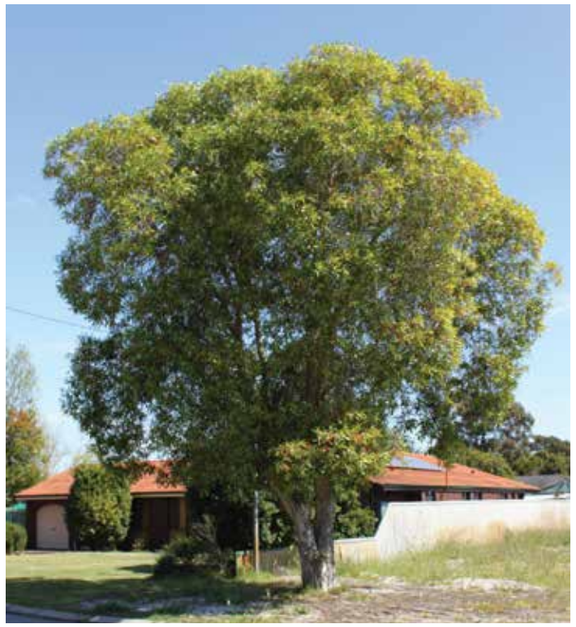
***Pyrus calleryana* 'Chanticleer' - Chanticleer Pear**	
Family	*Rosaceae*
Evergreen/deciduous:	Deciduous
Height:	11 metres
Spread:	3 metres
Flowers:	White, in spring
Leaf colour:	Shiny dark green to reddish-purple
Canopy:	Fastigiate
Origin:	China, Vietnam
Verge width:	< 3 metres
Under powerlines:	No
Note:	Showy autumn colours; tolerant of air pollution

***Pyrus ussuriensis* - Manchurian Pear**	
Family	*Rosaceae*
Evergreen/deciduous:	Deciduous
Height:	8 metres
Spread:	6 metres
Flowers:	White, in spring
Leaf colour:	Glossy dark green
Canopy:	Dense rounded, pyramid-shaped when young
Origin:	China
Verge width:	> 3 metres
Under powerlines:	No
Note:	Flowers are pale pink in bud

***Quercus palustris* - Pin Oak**	
Family	*Fagaceae*
Evergreen/deciduous:	Deciduous
Height:	15 metres
Spread:	10 metres
Flowers:	Insignificant
Leaf colour:	Glossy dark green, deeply lobed, to deep red
Canopy:	Pyramidal when young and irregular when mature
Origin:	Eastern USA
Verge width:	> 3 metres
Under powerlines:	No
Note:	Autumn colours; brown leaves remain on tree over winter

***Stenocarpus sinuatus* - Firewheel Tree**	
Family	*Proteaceae*
Evergreen/deciduous:	Evergreen
Height:	12 metres
Spread:	5 metres
Flowers:	Scarlet, wheel-like from summer to autumn
Leaf colour:	Deep green, lobed; new growth tinged with maroon
Canopy:	Columnar
Origin:	NSW, Queensland
Verge width:	> 3 metres
Under powerlines:	No
Note:	Striking looking flowers; small boat-shaped seed pods

***Tristaniopsis laurina* - Water Gum**	
Family	*Myrtaceae*
Evergreen/deciduous:	Evergreen
Height:	12 metres
Spread:	5 metres
Flowers:	Tiny, bright yellow, in summer
Leaf colour:	Olive-green with red tinge
Canopy:	Dense, rounded/upright when young
Origin:	Victoria, NSW, Queensland
Verge width:	> 3 metres
Under powerlines:	No
Note:	Attractive pale brown bark



Appendix C2 - Trees suitable for planting beneath powerlines (2018) - Tree Data Sheets

City of Canning Approved Street Planting List

Trees Suitable for Planting Beneath Powerlines		Characteristics					Location						
Botanic Name	**Common Name**	Evergreen	Deciduous	Native	WA Native	Exotic	Powerlines	No Powerlines	Verge < 3m wide	Verge > 3m wide	Median	No Footpath	Footpath
Agonis flexuosa	WA Weeping Peppermint	■			■		■	■		■	■	■	■
Callistemon 'Kings Park Special'	KPS Bottlebrush	■		■			■	■	■	■	■	■	■
Callistemon viminalis	Weeping Bottlebrush	■		■			■	■	■	■	■	■	■
Eucalyptus forrestiana	Fuchsia Gum	■			■		■	■	■	■	■	■	■
Eucalyptus torquata	Coral Gum	■			■		■	■	■	■	■	■	■
Fraxinus griffithii	Evergreen Ash	■				■	■	■	■	■	■	■	■
Hakea laurina	Pincushion Hakea	■			■		■	■	■		■	■	■
Hibiscus tiliaceus	Cotton Tree	■		■			■	■		■	■	■	■
Lagerstroemia indica	Crepe Myrtle varieties		■			■	■	■	■		■	■	■
Lophostemon confertus	Queensland Brush Box	■		■			■	■		■	■	■	■
Magnolia 'Little Gem'	Little Gem Magnolia	■				■	■	■	■		■	■	■
Melaleuca leucadendra	Weeping Paperbark	■		■			■	■		■	■	■	
Melaleuca linariifolia	Snow in Summer	■		■			■	■		■	■	■	
Melaleuca preissiana	Modong	■			■		■	■		■	■	■	
Melaleuca rhaphiophylla	Swamp Paperbark	■			■		■	■		■	■	■	
Melaleuca viridiflora	Red Flowering Paperbark	■			■		■	■		■	■	■	
Olea europaea	Olive	■				■	■	■		■	■	■	
Prunus x blireana	Purple Leaf Plum		■			■	■	■		■	■	■	■
Pyrus ussuriensis	Manchurian Pear		■			■	■	■		■	■	■	■
Sapium sebiferum	Chinese Tallow		■			■	■	■		■	■	■	■

Please note: Due to Policy Guidelines ET-525, and site conditions, not all species listed above may be suitable for the verge in your street. Please email customer@canning.wa.gov.au or telephone Parks and Place Improvement on 1300 422 664 to discuss tree selection and location.

***Agonis flexuosa* - WA Weeping Peppermint**	
Family	*Myrtaceae*
Evergreen/deciduous:	Evergreen
Height:	10 metres
Spread:	8 metres
Flowers:	White, in summer
Leaf colour:	Deep green
Canopy:	Round headed tree; can be pruned for powerlines
Origin:	South Western Australia
Verge width:	> 3 metres
Under powerlines:	Yes
Note:	Wildlife habitat and food source for native birds

***Callistemon* 'Kings Park Special' - Kings Park Special Bottlebrush**	
Family	*Myrtaceae*
Evergreen/deciduous:	Evergreen
Height:	5 metres
Spread:	4 metres
Flowers:	Crimson in spring/summer
Leaf colour:	Dark green
Canopy:	Rounded
Origin:	Kings Park, Perth variant
Verge width:	< 3 metres
Under powerlines:	Yes
Note:	Low pollen producer; attracts native birds

***Callistemon viminalis* - Weeping Bottlebrush**	
Family	*Myrtaceae*
Evergreen/deciduous:	Evergreen
Height:	6 metres
Spread:	4 metres
Flowers:	Bright red in spring/summer
Leaf colour:	Deep green
Canopy:	Rounded
Origin:	NSW
Verge width:	< 3 metres
Under powerlines:	Yes
Note:	Low pollen producer; bird attractant

***Eucalyptus forrestiana* - Fuchsia Gum**	
Family	*Myrtaceae*
Evergreen/deciduous:	Evergreen
Height:	6 metres
Spread:	3 metres
Flowers:	Bright red, with yellow stamens in summer - autumn
Leaf colour:	Dark green
Canopy:	Rounded, dense
Origin:	WA
Verge width:	< 3 metres
Under powerlines:	Yes
Note:	Bird attractant

***Eucalyptus torquata* - Coral Gum**	
Family	*Myrtaceae*
Evergreen/deciduous:	Evergreen
Height:	8 metres
Spread:	5 metres
Flowers:	Pink to red, in early summer
Leaf colour:	Grey-green
Canopy:	Rounded
Origin:	WA
Verge width:	< 3 metres
Under powerlines:	Yes
Note:	Buds bronze before bursting

***Fraxinus griffithii* - Evergreen Ash**	
Family	*Oleaceae*
Evergreen/deciduous:	Evergreen
Height:	7 metres
Spread:	3 metres
Flowers:	Decorative white flowers in spring
Leaf colour:	Glossy dark green, fern-like
Canopy:	Rounded to oval
Origin:	South-East Asia, India, China, Taiwan
Verge width:	< 3 metres
Under powerlines:	Yes
Note:	Fragrant flowers; seed pods are held on the tree into winter

***Hakea laurina* - Pincushion Hakea**	
Family	*Proteaceae*
Evergreen/deciduous:	Evergreen
Height:	6 metres
Spread:	3 metres
Flowers:	Globular crimson, studded with cream styles (pins) in autumn/winter
Leaf colour:	Grey-green
Canopy:	Rounded
Origin:	WA
Verge width:	< 3 metres
Under powerlines:	Yes
Note:	Bird attractant; attractive beaked pods

***Hibiscus tiliaceus* - Cotton Tree**	
Family	*Malvaceae*
Evergreen/deciduous:	Evergreen
Height:	8 metres
Spread:	4 metres
Flowers:	Yellow with crimson throat, in spring - summer
Leaf colour:	Light green, heart shaped - bronze when young
Canopy:	Dense rounded
Origin:	NSW, Queensland, South Africa
Verge width:	> 3 metres
Under powerlines:	Yes
Note:	Flowers through the year, most prolifically in spring

***Lagerstroemia indica* - Crepe Myrtle**	
Family	*Lythraceae*
Evergreen/deciduous:	Deciduous
Height:	7 metres
Spread:	4 metres
Flowers:	White, pink, mauve, purple in late summer
Leaf colour:	Mid-green
Canopy:	Vase shaped
Origin:	China, Korea, Japan, India
Verge width:	< 3 metres
Under powerlines:	Yes
Note:	Autumn colour; attractive mottled trunk when mature

***Lophostemon confertus* - Queensland Brush Box**	
Family	*Myrtaceae*
Evergreen/deciduous:	Evergreen
Height:	15 metres
Spread:	12 metres
Flowers:	White in spring
Leaf colour:	Bright green
Canopy:	Rounded
Origin:	NSW, Queensland
Verge width:	> 3 metres
Under powerlines:	Yes
Note:	Can be pruned for powerline clearance

***Magnolia grandiflora* 'Little Gem' - Little Gem Magnolia**	
Family	*Magnoliaceae*
Evergreen/deciduous:	Evergreen
Height:	6 metres
Spread:	3 metres
Flowers:	White, in spring and summer
Leaf colour:	Glossy dark green with rusty-coloured underside
Canopy:	Rounded, compact, upright when young
Origin:	USA
Verge width:	< 3 metres
Under powerlines:	Yes
Note:	Large, showy, perfumed flowers

***Melaleuca leucadendra* - Weeping Paperbark**	
Family	*Myrtaceae*
Evergreen/deciduous:	Evergreen
Height:	15 metres
Spread:	12 metres
Flowers:	Cream bottlebrush spikes, in summer
Leaf colour:	Bright green
Canopy:	Spreading, weeping
Origin:	NSW, Queensland, Northern Territory, South-East Asia
Verge width:	< 3 metres
Under powerlines:	Yes
Note:	Bird attractant

***Melaleuca linariifolia* - Snow in Summer**	
Family	*Myrtaceae*
Evergreen/deciduous:	Evergreen
Height:	6 metres
Spread:	5 metres
Flowers:	Spikes of small, white flowers in early summer
Leaf colour:	Dark green
Canopy:	Spreading. bushy
Origin:	NSW, Queensland
Verge width:	< 3 metres
Under powerlines:	Yes
Note:	Bird attractant

***Melaleuca preissiana* - Modong**	
Family	*Myrtaceae*
Evergreen/deciduous:	Evergreen
Height:	12 metres
Spread:	4 metres
Flowers:	Cream/white, bottlebrush spikes, in early summer
Leaf colour:	Light green, needle-like
Canopy:	Rounded
Origin:	WA
Verge width:	> 3 metres
Under powerlines:	Yes
Note:	Bird attractant

***Melaleuca raphiophylla* - Swamp Paperbark**	
Family	*Myrtaceae*
Evergreen/deciduous:	Evergreen
Height:	10 metres
Spread:	4 metres
Flowers:	Cream/white, in early summer
Leaf colour:	Light green, needle-like
Canopy:	Rounded
Origin:	WA
Verge width:	> 3 metres
Under powerlines:	Yes
Note:	Bird attractant

***Melaleuca viridiflora* - Red Flowering Broadleaf Paperbark**	
Family	*Myrtaceae*
Evergreen/deciduous:	Evergreen
Height:	8 metres
Spread:	4 metres
Flowers:	Red in summer/autumn
Leaf colour:	Dull, dark green (young leaves pink)
Canopy:	Dense, spreading, lightly weeping habit
Origin:	WA, Northern Territory, Queensland
Verge width:	> 3 metres
Under powerlines:	Yes
Note:	Attractive flowers that attract nectar seeking birds

***Olea europaea* - Olive**	
Family	*Oleaceae*
Evergreen/deciduous:	Evergreen
Height:	8 metres
Spread:	4 metres
Flowers:	Cream-greenish, in spring
Leaf colour:	Grey-green
Canopy:	Rounded
Origin:	Mediterranean
Verge width:	< 3 metres
Under powerlines:	Yes
Note:	Drought resistant; shade; screen; fruit

***Prunus x blireana* - Flowering Plum**	
Family	*Rosaceae*
Evergreen/deciduous:	Deciduous
Height:	4 metres
Spread:	4 metres
Flowers:	Pink, fragrant, in spring
Leaf colour:	Red-purple
Canopy:	small, rounded
Origin:	China
Verge width:	< 3 metres
Under powerlines:	Yes
Note:	Attractive purple foliage; showy spring flowers

***Sapium sebiferum* - Chinese Tallow**	
Family	*Euphorbiaceae*
Evergreen/deciduous:	Deciduous
Height:	10 metres
Spread:	6 metres
Flowers:	Yellow, in summer
Leaf colour:	Mid-green to red
Canopy:	Rounded
Origin:	China
Verge width:	< 3 metres
Under powerlines:	Yes
Note:	Autumn colour; showy seed pods

Appendix C3 - Trial Street Tree species as part of the Local Biodiversity Strategy (2018)

This list shows the species to be considered for street tree planting, where appropriate, as part of developing biodiversity links that have been identified in the City's Local Biodiversity Strategy (2018). The list contains four new plant families and seven new genera. The list will be added to as other suitable species are determined.

To assist with developing biodiversity corridors the City's Policy ET529-Verge Landscape Treatments (2016) encourages the establishment of verge gardens. One action of the Biodiversity Strategy is to focus on the use of local, native plant species for verge gardens within identified ecological linkages.

Trial Street Tree Species as part of the Local Biodiversity Strategy (2018)

STREET AND MEDIAN TREES

Botanical Name	Common Name	Family	Verge Median
Allocasuarina fraseriana	Common She Oak	*Allocasuarinaceae*	**V M**
Eucalyptus todtiana	Coastal Blackbutt	*Myrtaceae*	**V M**
Melaleuca preissiana	Modong	*Myrtaceae*	**V M**
Melaleuca rhaphiophylla	Swamp Paperbark	*Myrtaceae*	**V M**
Taxandria linearifolia	Swamp Peppermint	*Myrtaceae*	**V M**

PARK AND RESERVE TREES

Botanical Name	Common Name	Family	Bushland Park
Allocasuarina fraseriana	Common She Oak	*Allocasuarinaceae*	**P**
Banksia attenutata	Candle Banksia	*Proteaceae*	**BP**
Banksia grandis	Bull Banksia	*Proteaceae*	**BP**
Banksia ilicifolia	Holly leaf Banksia	*Proteaceae*	**BP**
Banksia littoralis	Swamp Banksia	*Proteaceae*	**BP**
Banksia menziesii	Firewood Banksia	*Proteaceae*	**BP**
Banksia prionotes	Acorn banksia	*Proteaceae*	**BP**
Eucalyptus marginata	Jarrah	*Myrtaceae*	**BP**
Melaleuca cuticularis	Saltwater Paperbark	*Myrtaceae*	**BP**
Melaleuca preissiana	Modong	*Myrtaceae*	**BP**
Melaleuca rhaphiophylla	Swamp Paperbark	*Myrtaceae*	**BP**
Nuytsia floribunda	WA Christmas Tree	*Loranthaceae*	**BP**
Santalum spicatum	Sandalwood	*Santalaceae*	**P**
Taxandria linearifolia	Swamp Peppermint	*Myrtaceae*	**P**
Xylomelum occidentalis	Woody Pear	*Proteaceae*	**BP**

Please note: Due to Policy Guidelines ET-525, and site conditions, not all species listed above may be suitable for the verge or park in your street. Please email customer@canning.wa.gov.au or telephone Parks and Place Improvement on 1300 422 664 to discuss tree selection and location.

West Australian Christmas tree (*Nuytsia floribunda*)

Holly Leaf Banksia (*Banksia ilicifolia*)

Appendix D – Tree Planting brochure and Free Street Tree coupon

1 Street Tree Planting Requests - Process

Residents will be advised in writing of the outcome of their tree planting applications including the tree species suitable for the location. Where a tree is proposed to be planted the letter will include an information brochure explaining the watering requirements and asking residents to contact the City if damage to the tree occurs.

Information in the letter to the applicant will include:

The City will water newly planted trees during the first summer establishment period, but it is difficult to ensure an adequate water supply to all new trees during Perth's hot summers, and any additional water you can provide would be welcome.

You can:

- *Provide additional water for trees in the summer months*
- *Keep grass away from the base of developing trees*
- *Avoid damaging trees when trimming lawns*
- *Report damaged trees to the City, so replacements can be programmed promptly*

A deep, drenching watering once a week encourages tree roots to grow deeper into the soil profile, whereas frequent, shallow watering can result in roots remaining close to the soil surface and the tree is therefore less drought tolerant.

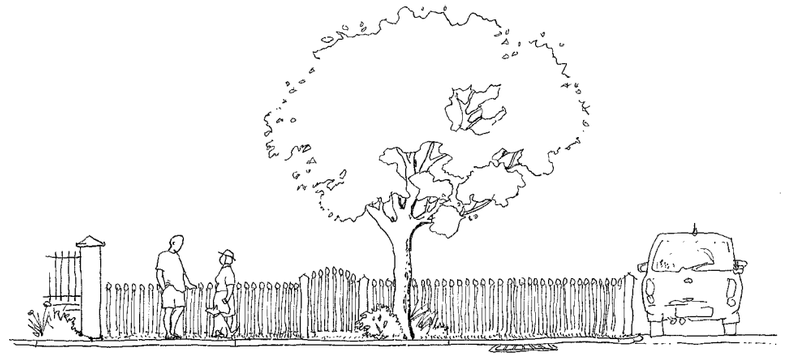
2 Street Tree Planting and Maintenance – Maintaining Our City's Trees brochure

On adoption of the City's Street Tree Strategy (2018), the Street Tree Planting and Maintenance brochure (2010) will be updated. A copy will be included in correspondence to residents relating to street tree planting requests.

The City will also actively promote that street trees are available on request (Figure 1 refers).

Free Trees

City of Canning
A welcoming and thriving city



Residents of the City are invited to apply for a street tree to be planted by completing and posting this form to

City of Canning
Locked Bag 80
Welshpool WA 6986

Or by email to **customer@canning.wa.gov.au**

You may apply online at **https://www.canning.wa.gov.au/places-and-events/places-to-play/parks-and-reserves/parks/street-tree-planting**

Staff will assess the verge and advise you if there is room for a tree, or trees, to be planted, and which tree species are suitable for the site. Planting only occurs in Winter to provide trees the best chance of establishing successfully. If you are a tenant of a property you must also provide written approval from the property owner.

Please note, to allow for site assessment, collation and pre-ordering of trees, planting requests must be received by the 31 December. Requests received after that date will be listed for planting in Winter in the following year.

Name..... Date.....

Address.....

.....

.....

Phone number.....

Email address.....

Property Owner

Signature .....

For further information please contact the City of Canning on **1300 422 664**

or email your enquiry to **customer@canning.wa.gov.au**

Figure 1. Street Tree Planting brochure

APPENDIX E - Technical Planting Specifications

1 Technical Drawings Overview

Technical detail drawings have been prepared to ensure that developers, the City of Canning and its contractors provide an appropriate and consistent treatment for street tree planting throughout the variety of street environments typically encountered.

The following diagrams (Figures 1, 2 and 3) illustrate the typical details to be applied with or without root cells. Root cells are one of the techniques the City encourages the use of for tree planting in a paved environment.

In-road tree planting and median strip details are dependent on the individual street widths, traffic and services and will therefore require site specific designs. The use of root cells, structural soil, and continuous planting trenches will be considered based on specific site conditions.

A (future) avenue of Jacaranda trees (*Jacaranda mimosaefolia*)

2 Trees in Paved Verges and Roadways

In some cases there are limitations to the position of street trees along footpaths due to the clearance required from infrastructure elements such as electricity overhead lines, stormwater inlets, underground service pits, streetlights and bus stops. Where this might occur will typically be in certain development nodes within the City such Albany Highway, the Bentley Regeneration Project and the City Centre.

Where trees are required to be incorporated into a paved area to join with a footpath, paving surface treatments such porous paving and in-situ rubber can be considered on a case by case basis.

Canning City Centre - Artist's Impression

3 Root Cell Trial - 2017

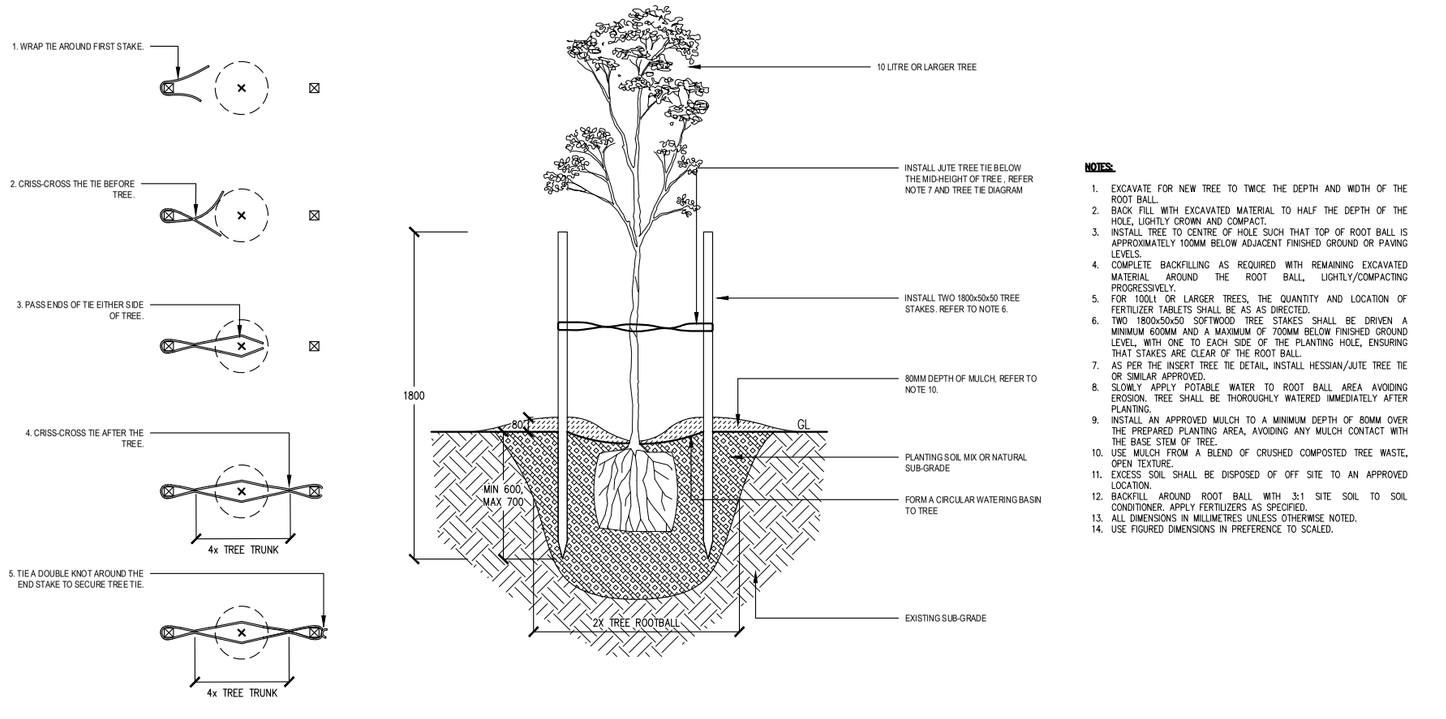
Trees planted in the road medians and tree planting nibs often suffer due to lack of space for root development and low oxygen levels under the hard surface environment. To promote healthy trees in hostile urban sites the City is installing root cells under the road which, based on trials undertaken in Australia and overseas, will provide an optimal growth zone for tree roots.

The first trial site is in Lynwood Avenue between Nicholson Road and Metcalfe Road, Lynwood, using the Firewheel Tree (*Stenocarpus sinuatus*). Six trees have been planted in root cells and seven without root cells. It was recognised by the principal engineer that this was a sufficient number of trees within budget to run a valid trial of one tree species. Following the installation of the cells, there will be annual pavement testings and tree growth observations for a period of five (5) years. The findings will be reported.

Root cell trial planting in Lynwood Avenue, Lynwood November 2017

Root Cell Trial. Photo credit: N Nguyen

Figure 1 Indicative - Typical tree planting - verge (not to scale at A4)



NOTES:

1. EXCAVATE FOR NEW TREE TO TWICE THE DEPTH AND WIDTH OF THE ROOT BALL.
2. BACK FILL WITH EXCAVATED MATERIAL TO HALF THE DEPTH OF THE HOLE, LIGHTLY CROWN AND COMPACT.
3. INSTALL TREE TO CENTRE OF HOLE SUCH THAT TOP OF ROOT BALL IS APPROXIMATELY 100MM BELOW ADJACENT FINISHED GROUND OR PAVING LEVELS.
4. COMPLETE BACKFILLING AS REQUIRED WITH REMAINING EXCAVATED MATERIAL AROUND THE ROOT BALL, LIGHTLY/COMPACTING PROGRESSIVELY.
5. FOR 100Lt OR LARGER TREES, THE QUANTITY AND LOCATION OF FERTILIZER TABLETS SHALL BE AS AS DIRECTED.
6. TWO 1800x50x50 SOFTWOOD TREE STAKES SHALL BE DRIVEN A MINIMUM 600MM AND A MAXIMUM OF 700MM BELOW FINISHED GROUND LEVEL, WITH ONE TO EACH SIDE OF THE PLANTING HOLE, ENSURING THAT STAKES ARE CLEAR OF THE ROOT BALL.
7. AS PER THE INSERT TREE TIE DETAIL, INSTALL HESSIAN/JUTE TREE TIE OR SIMILAR APPROVED.
8. SLOWLY APPLY POTABLE WATER TO ROOT BALL AREA AVOIDING EROSION. TREE SHALL BE THOROUGHLY WATERED IMMEDIATELY AFTER PLANTING.
9. INSTALL AN APPROVED MULCH TO A MINIMUM DEPTH OF 80MM OVER THE PREPARED PLANTING AREA, AVOIDING ANY MULCH CONTACT WITH THE BASE STEM OF TREE.
10. USE MULCH FROM A BLEND OF CRUSHED COMPOSTED TREE WASTE, OPEN TEXTURE.
11. EXCESS SOIL SHALL BE DISPOSED OF OFF SITE TO AN APPROVED LOCATION.
12. BACKFILL AROUND ROOT BALL WITH 3:1 SITE SOIL TO SOIL CONDITIONER. APPLY FERTILIZERS AS SPECIFIED.
13. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
14. USE FIGURED DIMENSIONS IN PREFERENCE TO SCALED.

TREE TIE DIAGRAM
NTS

TYPICAL TREE PLANTING
1:20

REV.	AMENDMENTS	DRAWN	AUTH'D	DATE
0	ISSUED FOR APPROVAL.			

SHEET 1 OF 1

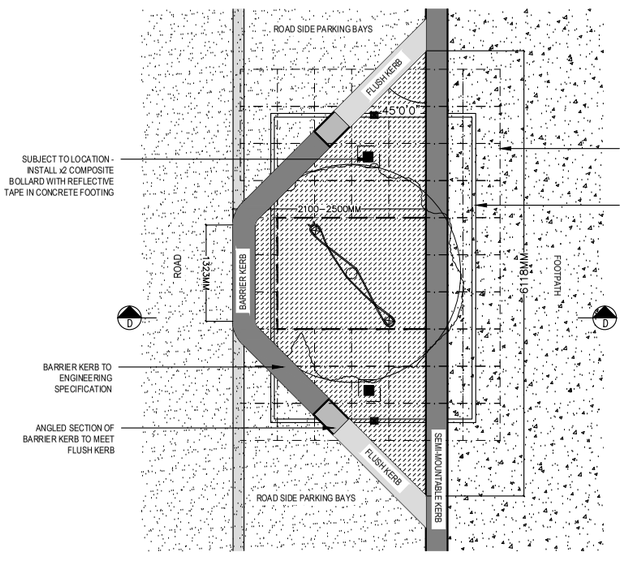
SCALE 1 : 20

DESIGNED	N.NGUYEN	5/2016
DRAWN	N.NGUYEN	5/2016
CHECKED		
RECOMMENDED	MANAGER	
APPROVED	DIRECTOR	

CITY OF CANNING
TECHNICAL DRAWING
TYPICAL TREE PLANTING

FILE No.	PLAN No.	REVISION	ORIGINAL
PR.G1.7	PCAD064 – 1	0	A3

Figure 2 Indicative - Typical tree planting – Tree planting in planting nib along parallel parking (not to scale at A4)



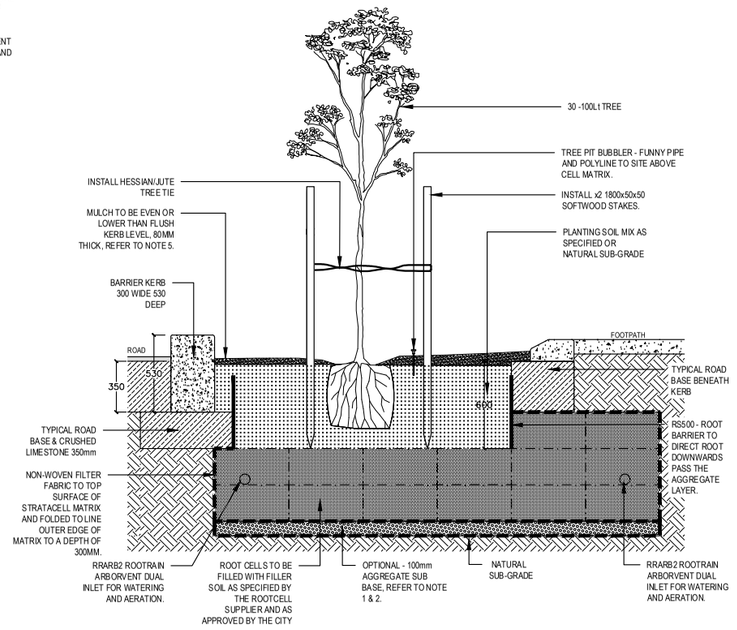
MULCH AREA, REFER TO NOTE 5.

ROOT CELL AREA - DESIGN BASED ON STRATA CELLS FROM CITYGREEN. REFER TO THE TABLE 1 FOR REQUIRED SOIL VOLUME

TABLE 1

TREE SIZE	SURFACE AREA*	SOIL VOLUME (M³)
SMALL - CANOPY DIA. OF 4m	20m²	5-15m³
MEDIUM - CANOPY DIA. OF 8m	60m²	20-40m³
LARGE - CANOPY DIA OF 16m	130m²	50-80m³

NOTE: THE RATIO BETWEEN SOIL VOLUME AND SURFACE AREA* IS 1:2.
* SURFACE AREA IS REFERRING TO THE TREE CANOPY AREA.



NOTES:

1. ALL KERBS TO ENGINEERING SPECIFICAITON.
2. SITE SOIL ANALYSIS IS TO BE CONDUCTED TO ENSURE ADEQUATE DRAINAGE OF SURPLUS WATER FROM BASE OF TREE PIT.
3. THE AGGREGATE SUB-BASE IS RECOMMENDED IF THE SITE SOIL IS NOT WELL DRAINED AND POSITIVE DRAINAGE TO MAIN STORM WATER SERVICE FROM BASE OF TREE PIT IS MANDATORY.
4. BASE OF TREE PIT MUST BE FREE OF DEBRIS AND LEVEL. COMPACT THE SUB-GRADE TO A MINIMUM OF 95% OF MAXIMUM DRY DENSITY AT OPTIMUM MOISTURE CONTENT IN ACCORDANCE WITH ASTMD 698 STANDARD PROCTOR METHOD.
5. USE MULCH FROM A BLEND OF CRUSHED COMPOSTED TREE WASTE, OPEN TEXTURE.
6. REFER TO CITYGREEN'S PRODUCT INSTALLATION SPECIFICATION PRIOR CONSTRUCTION WORKS.
7. FILLER SOIL - FILLER SOIL MIX SHALL COMPLY WITH THE ROOT CELL MANUFACTURER'S SPECIFICATION. SOIL MIX WITHOUT PRODUCT SPECIFICATION SHALL BE REQUIRED FOR TESTING TO MEET THE REQUIRED COMPOSITION. THE PREFERRED SOIL MIX IS DESCRIBED AS AN AMENDED TOPSOIL THAT CONTAINS ORGANIC MATTER; COMPLIES GENERALLY WITH THE TYPICAL USES OF AS 4419 (2003); AND IS FREE FROM UNWANTED MATTER SUCH AS STONES, ROCK, TOXIC MATERIALS, RUBBISH, ETC.
8. FOR REQUIRED SOIL VOLUME, USE FORMULA: $SV = \pi r^2 \times 0.6$ WHERE 'r' IS THE RADIUS OF THE TREE MATURE CANOPY.
9. DEPENDING ON TREE SPECIES AND CELL MATRIX DEPTH REQUIRED, OTHER ROOT CELL SERIES CAN BE CONSIDERED FOR THIS APPLICATION.

REV.	AMENDMENTS	DRAWN	AUTH'D	DATE
0	ISSUED FOR APPROVAL.			

SHEET 1 OF 1

SCALE 1 : 50

DESIGNED	N.NGUYEN	5/2016
DRAWN	N.NGUYEN	5/2016
CHECKED		
RECOMMENDED	MANAGER	
APPROVED	DIRECTOR	

CITY OF CANNING
TECHNICAL DRAWING – TREE PLANTING IN PLANTING NIB WITH ROOTCELL

FILE No.	PLAN No.	REVISION	ORIGINAL
PR.G1.7	PCAD066 – 1	0	A3

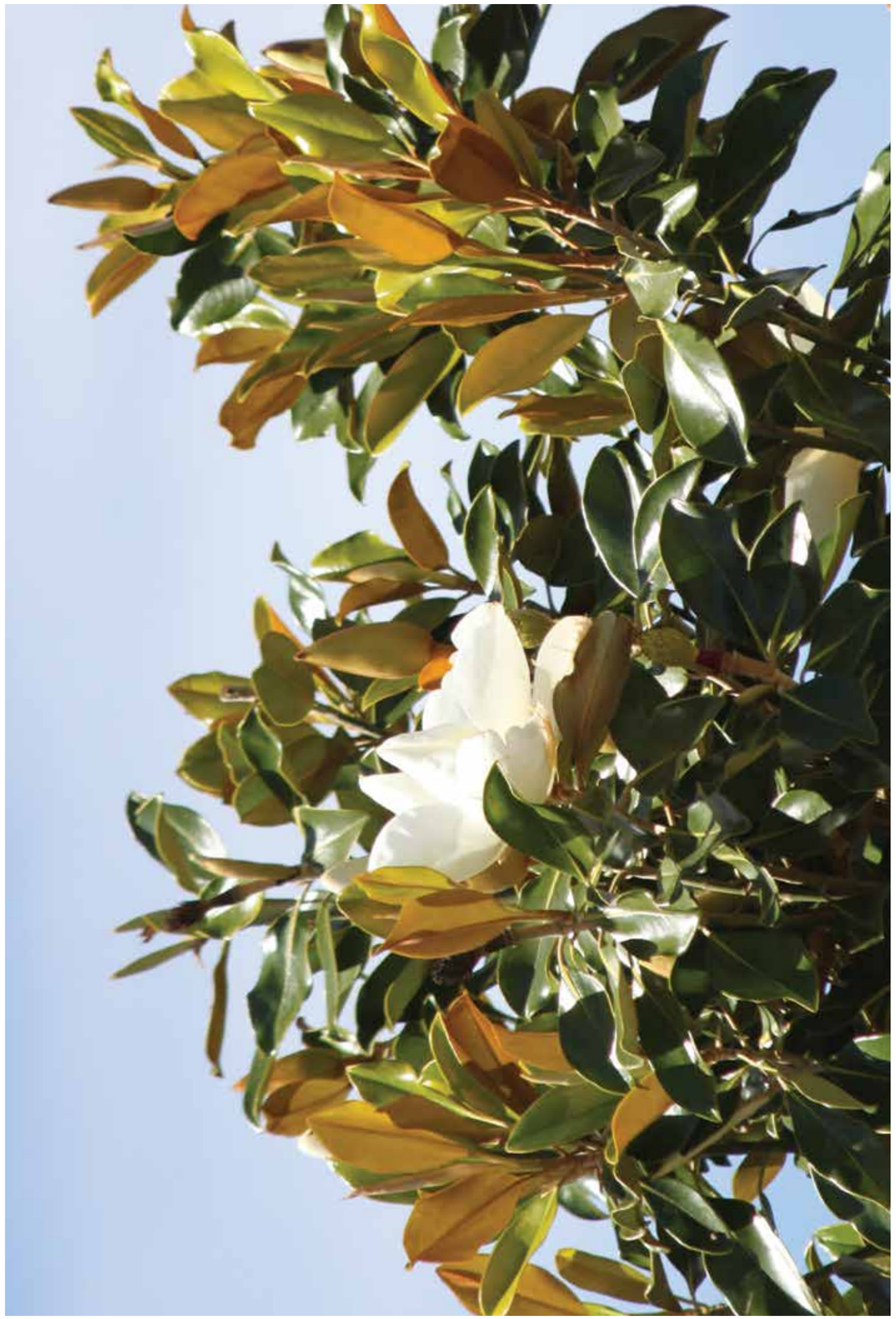
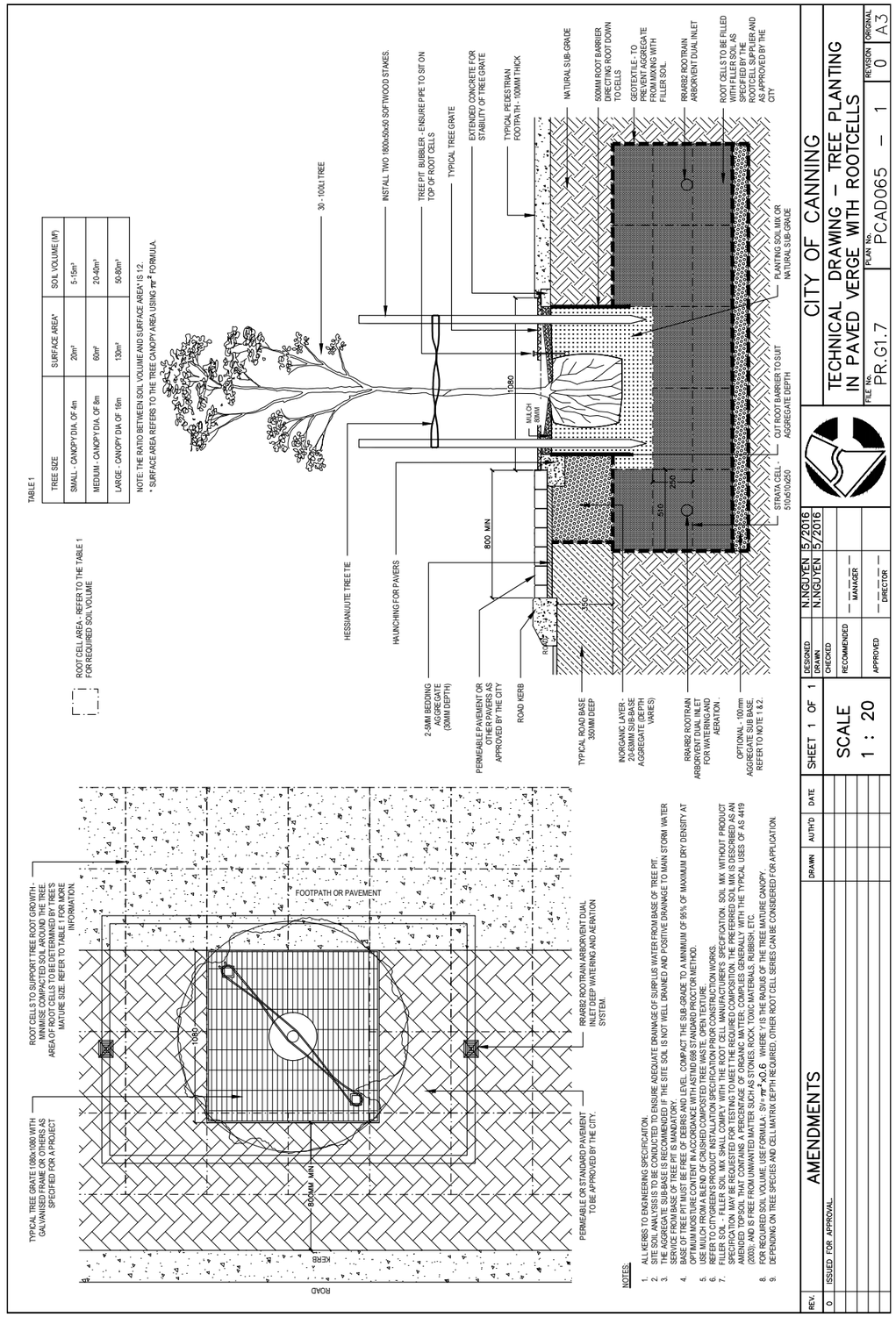


Figure 3 Indicative - Planting in paved verge (not to scale at A4)



APPENDIX F – Glossary - Street Tree Strategy

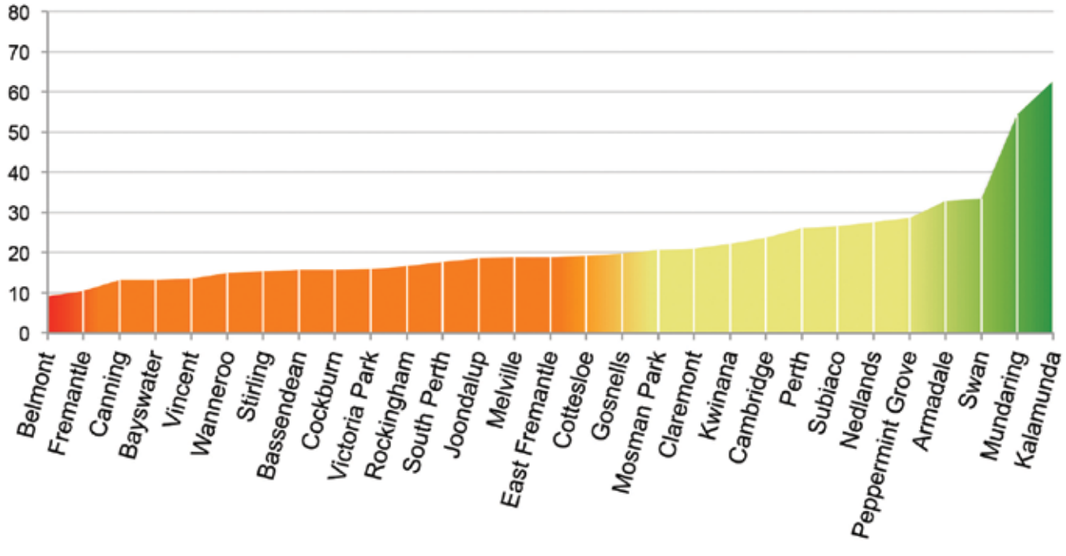
1. **URBAN CANOPY COVER - Benchmarking Australia's Urban Tree Canopy**
2. **URBAN HEAT ISLAND EFFECT**
3. **HERITAGE TREES**
4. **ASSETS – MONETARY EVALUATION OF TREES**
5. **TREE SOIL VOLUME REQUIREMENTS**
6. **PROTECTION OF TREES ON DEVELOPMENT SITES**
7. **TREE RISK MANAGEMENT AND QUANTIFIED TREE RISK ASSESSMENT**
8. **BOTANICAL NOMENCLATURE**
9. **CARBON SEQUESTRATION**
10. **ASSET-BASED COMMUNITY DEVELOPMENT MODEL (ABCD)**

1 Urban Canopy Cover - Benchmarking Australia's Urban Tree Canopy

In 2014 the University of Technology, Sydney published the report Benchmarking Australia's Urban Tree Canopy which quantified the urban green space (UGS) of 139 local government authorities across Australia.

Of the 29 local governments assessed within the Perth metropolitan area, the City of Canning had the third lowest canopy cover of only 13 per cent (Figure 1. copied below). More precise urban forest mapping was undertaken for the City of Canning in October 2015 and identified that the City's canopy cover is approximately only 9 per cent.

Figure 1 Canopy cover (%) for selected Western Australian Local Government Areas (Jacobs, B. et al, 2014).



The land cover in each local government authority was categorised into the following groups, which allows for determining where trees can be feasibly planted as shown in Table 1 and Figure 2 below:

Table 1: Classification of surface cover Cover Class	**Abbreviation**	**Description**
Hard surface	HS	Currently non-plantable
Tree	T	Canopy cover
Shrub	S	Understorey
Grass/Bare ground	G/BG	Potentially plantable

Figure 2. Western Australia – extract from tabulated results (%) sorted by canopy cover (Jacobs, B. et al, 2014)

	Percentage Cover (%)				**Land Cover (km²)**			
LGA	**HS**	**T**	**S**	**G/BG**	**HS**	**T**	**S**	**G/BG**
Belmont, City of	50.6	9.1	9.5	30.8	20.1	3.62	3.78	12.3
Fremantle, City of	65.1	10.4	6.1	18.4	12.4	1.98	1.16	3.51
Canning, City of	53.1	13.1	7.2	26.6	34.6	8.53	4.69	17.3
Bayswater, City of	53. 5	13.2	8	25.3	17.6	4.34	2.63	8.32
Vincent, City of	65.9	13.4	4.1	16.6	7.52	1.53	0.47	1.89
Wanneroo, City of	7.9	15	12.3	64.8	54.3	103.1	84.5	445.3
Stirling, City of	52.9	15.2	4.8	27.1	55.5	16	5.05	28.5
Bassendean, Town of	45.8	15.7	5.2	33.3	4.75	1.63	0.54	3.45
Cockburn, City of	26.5	15.7	23.4	34.4	44.6	26.4	39.4	57.9
Victoria Park, Town of	51.0	15.8	4.2	29.0	9.17	2.84	0.76	5.22

The opportunities and constraints relating to these findings will be addressed in the City's Urban Forest Strategy (Draft 2019).

2 Urban Heat Island Effect

Higher temperatures in city centres compared to non-urban areas as a result of land clearing and building is known as the urban heat island effect.

Dr Helen Brown of Curtin University described urban heat islands as a kind of localised climate change caused by three factors in urban development; built materials trapping heat, urban machinery producing waste heat and the removal of trees and their associated shading and cooling functions.

On 19 January 2016 in an address to the Sydney Business Chamber the (then) Minister for Environment, Greg Hunt, noted that:

> Increasing urban canopy coverage decreases heat, which improves health and quality of life. People living in large cities can be especially susceptible to the effects of extreme heat. Air temperature in cities are a number of degrees higher than in surrounding areas due to heat-absorbing properties of dark-coloured roads and other surfaces, as well as the effect of urban canyons trapping hot air.
>
> Extreme heat places the most vulnerable people in our cities – including the very young and very old – at high risk, and contributes to a number of deaths each year. An effective way to reduce the severity of the heat island effect is to increase the greenery in our cities. Greener cities tend to be healthier cities.

3 Heritage Trees - The Australian ICOMOS, Burra Charter (International Council on Monuments and Sites)

The following information regarding Significant and Heritage Trees has been taken from Culturally Significant Trees – Assessment and Management Guidelines (Treenet 2014, pp4, 10).

Definitions

The Australian ICOMOS, Burra Charter uses the concept of cultural significance to justify the conserving of places including trees. Cultural significance means aesthetic, historic, scientific or social value for past, present and future generations (Australian ICOMOS, Burra Charter Article 1.2, 1981) (Treenet 2014, pp4, 10).

Fabric: means all the physical material of the place. Species, age, location, biology, growing zone are considered to be the fabric of a tree.

Place: means the site, area, land, landscape and may include elements, spaces and views that are part of this place. The concept of place should be broadly interpreted. The elements include memorials, individual and avenues of trees, gardens, parks, places of historical events, urban areas, towns, industrial places, archaeological sites and spiritual and religious places.

Scientific

- Horticultural or genetic value
- Important source of seed or propagating stock
- Particularly resistant to disease or exposure
- Particularly old or venerable
- Remnant native vegetation
- Outstanding for its height, trunk circumference or canopy spread
- An outstanding example of the species
- Species or variety that is rare or of a very localised distribution (refer to the WA Threatened Species List).

Social

- Unique location or context
- Contribution to landscape
- Associated with Aboriginal activities
- Important landmark
- Spiritual or religious association
- Contemporary association with the community

Historic

- Forms part of an historic park, garden or town
- Associated with an important event
- Associated with an important person, group or institution
- Commemorates an occasion eg memorial or ceremonial plantings such as an avenue of honour

Aesthetic

- A tree of exceptional appearance
- A better than average example of its species, or in its particular location
- Exhibits curious growth form or unusual physical features whether naturally occurring, resulting from natural events or human intervention

4 Assets – Monetary Evaluation of Trees

4.1 Evaluation of the amenity value of a tree

As noted in section 7 of the Street Tree Strategy, the City of Canning's trees are not currently assigned a monetary value or recorded in the City's asset database. The Modified Burnley Method of Tree Evaluation, which has been tested in court and is suited to Australian conditions, has only been used by the City to establish the monetary value of a tree's amenity to inform planning or legal matters.

The most common use of monetary valuations of trees in Australia is to determine compensation when trees are damaged, when establishing tree preservation bonds on residential or commercial development sites or for inclusion in contract documents for public land. Tree monetary valuations may also form part of the assessment of notable trees to be listed on a significant tree register.

The City of Stirling and the City of South Perth use amenity tree valuation methods when calculating the total fee to be paid when a public tree is to be removed as the result of approved development. The City of South Perth uses the Maurer-Hoffman Formula (Dr. Peter Yau, 1990).

The Helliwell System of Amenity Tree Valuation is used to calculate a monetary value of the visual amenity provided by an individual tree and is the industry standard for many Perth local governments. As part of the future tree audits, the amenity value of trees will also be calculated.

4.2 Evaluation of the environmental value of trees - i-Tree software programs

Developed in the USA, the i-Tree programs have been adapted to suit Australian conditions. Using a City's tree inventory data, the i-Tree Eco program allows assessment of a municipality's street tree population. The program can calculate a dollar value for a tree's annual environmental and aesthetic benefits including energy conservation, air quality improvement, carbon dioxide reduction, stormwater control, property value increases and the total carbon stored and net carbon annually sequestered by trees.

Under the Kyoto Protocol (2009), however, urban vegetation currently cannot be included in the calculations of greenhouse gas emissions, as either sinks or for the purposes of sequestration, which means that street tree plantings are not eligible as a carbon offset.

The City of Melbourne's Urban Forest Strategy - Making a Great City Greener 2012-2032 (https://www.melbourne.vic.gov.au/SiteCollectionDocuments/urban-forest-strategy.pdf) attempted to calculate the environmental value of trees using a sample of 982 trees within five major inner city roads.

The environmental value of the trees was calculated using a tool called i-Tree Eco which considered their air pollution amelioration, carbon storage and sequestration, and energy saving benefits. The initial results showed that the 982 trees:

- remove 0.5 metric tonnes of air pollution per year at a dollar benefit of $3,820
- store 838 metric tonnes of carbon at a dollar value of $19,100
- sequester 24 metric tonnes of carbon each year at a value of $548 per year
- save $6,370 in energy costs each year through shading buildings in summer and providing solar access in winter
- avoid carbon emissions by reducing energy use by $114 per year
- have a structural value (replacement cost) of approximately $10.4 million.

Extrapolating those figures across the entire population of 70,000 trees provided an indication of the value of the City of Melbourne's urban street trees.

5 Tree Soil Volume Requirements

http://treelogic.com.au/facts/where-is-the-space-for-new-trees/

With an understanding of the potential growth characteristics of a tree species, the appropriate species can be selected for the available soil volume for optimum growth. Calculating the amount of soil required by a mature tree can assist in determining proper root zone volumes that provide a suitable growing environment for urban trees. Several methods for calculating required soil volumes are available.

The Crown Projection Method (adapted from Watson & Himelick, 1997) uses the expected mature width of the canopy, or half the expected mature height of the tree, whichever is greater, to provide a radial distance from the base of the tree which is used calculate the soil volume required. This method provides 0.6m^3 for each 1m^2 of ground space within this radial distance (crown projection).

The calculation is based on the expectation that tree roots will utilise the top 0.6m of soil. The calculation is represented as:
Soil Volume (m^3) = 3.14 x r^2(m) x 0.6(m).
Therefore a tree with a height of 10 metres and a crown spread of 16 metres would require the following soil volume:

Soil Volume (m^3) = 3.14 x 8m^2 x 0.6m

Required Soil Volume (m^3) = 121m^3

6 Protection of Trees on Development Sites

Australian Standard AS 4970-2009

To ensure protection of the trunk, canopy and an area of the root zone of a tree growing on or adjacent to a building development site, this Australian Standard prescribes methods for assessment of how to protect a tree at the planning and then at the development stage of a project. The tree must first be assessed as worthy of being retained, with adequate vigour to survive the damage that will occur to a portion of its root system, as tree roots generally grow well past the edge of a tree's canopy.

A tree protection zone (TPZ) is calculated based on the age, health, trunk diameter and canopy spread of the tree. A fence is installed around the tree, with the tree generally at the centre of the fencing. The fencing must be lockable and of a type that cannot be easily relocated by site workers wishing to temporarily utilise the area within the TPZ. Access to the area inside the fencing requires approval from the supervising arborist or tree officer, and signage must be placed on the fencing identifying that it is an exclusion zone from all site activities, soil disturbance and site workers.

The City's Policy DO.02 - Use of Verge during Building Works and Development (2015) has acknowledged this problem and the policy states in part:

5. Conditions imposed may also include, but are not limited to:

2. b) Protection of street trees and the need to maintain a Tree Protection Zone.

Before and after adoption of Policy DO.02- Use of Verge During Building Works and Development

7 Tree Risk Management

7.1 Quantified Tree Risk Assessment (QTRA)

The City's Tree Policy ET525 – Trees in Streets, Thoroughfares and Parks (2016) requires the Quantified Tree Risk Assessment (QTRA) framework be used when determining tree management, pruning and removal practices.

Policy ET525 states in part:

(1) The management of the City's trees will be guided by the principles set out in Australian Standard AS 4373-2007 Pruning of Amenity Trees, Australian Standard AS 4970-2009 Protection of Trees on Development Sites and the Quantified Tree Risk Assessment (QTRA) framework. All tree pruning shall, where practical, comply with Australian Standard (AS 4373 -2007) Pruning of Amenity Trees.

Hazards cannot be entirely eliminated from the landscape and managing liability and risk involves a balance. In the case of trees it involves balancing the benefits gained from trees with the likelihood and severity of harm that they may cause and the feasibility of reducing hazards.

The QTRA is an internationally accepted method of assessing a tree in relation to its immediate environment. Several staff within Parks and Place Improvement are QTRA licensees, as are the arboriculturalists engaged by the City to assess trees using this method. The QTRA allows for the assessment of the degree of risk, taking into account what the area beneath and close to the tree is used for. It includes a method for calculating the probability of failure for a tree. This brings a balanced approach to tree management and reduces unnecessary pruning and removal.

7.2 The Risk of Harm - QTRA (ref: Ellison 2013)

The QTRA is a method of risk evaluation in relation to the risk of tree failure. A risk from tree failure exists only if there is potential for tree failure and potential for harm to result. The outcome of a QTRA assessment is called the 'risk of harm' which allows a tree manager to evaluate the risks posed by a tree.

QTRA allows the tree assessor to evaluate and quantify the risk from tree failure in three areas:

a) The 'Target' which is the value of property and land use in terms of both vulnerability to impact and likelihood of occupation by people.

b) The 'Impact Potential' of the tree or branch being considered.

c) The 'Probability of Failure'.

These three factors are assessed and evaluated to produce a 'tolerability of risk framework' which considers a range of risk from 'broadly acceptable' where there is no need to consider further risk reduction to 'unacceptable', which is not to be tolerated.

People are constantly exposed to, and accept, varying degrees of risk. Travel by car, even with risk control measures such as seat belts, air bags, speed limits and crash barriers, is a significant risk that is taken for granted and accepted every day by millions of people in return for the convenience of travel. In Western Australia the probability of being injured in a road accident is one in 700 and the risk of death due to a car accident is 1 in 10,000.

The City has employed QTRA when assessing large growing specimens on verges in residential areas. The risk of harm to property, pedestrians and traffic for most of the trees assessed using this method was found to be one in 1,000,000, which is within the 'broadly acceptable' range in regard to the tolerability of risk.

8 Botanical Nomenclature

http://www.anbg.gov.au

Family

A family (Latin: familia, plural familiae) is a taxonomic rank between order and genus. A family may be divided into one or more subfamilies, intermediate ranks above the rank of genus.

eg *Myrtaceae* (Myrtle family) that includes genera such as *Eucalyptus, Corymbia, Melaleuca* and *Callistemon* (Gum trees, Bloodwoods, Paperbarks and Bottlebrush trees).

Family - (biology) a taxonomic group containing one or more genera.

Genus (plural Genera)

At the simplest level of scientific classification, each plant has a name made up of two parts, a generic (or genus) name and a specific name or epithet. Together, these two names are referred to as a binomial.

A generic name is a collective name for a group of plants. It indicates a grouping of organisms that all share a suite of similar characters. Ideally these should all have evolved from one common ancestor. The specific name allows us to distinguish between different organisms within a genus.

Binomial names are always written with the generic name first, starting with a capital letter eg *Callistemon.*

Species

The specific epithet always follows the generic name, starting with a lower-case letter eg *viminalis.* The full species name (binomial) is *Callistemon viminalis.*

Cultivar - www.hortax.org.uk/explanation-of-terms.html
Cultivar: a taxon of cultivated plants that is clearly distinct, uniform and stable in its characters and which, when propagated by appropriate means, retains those characters. Propagation is generally by asexual methods (cuttings, grafts, tissue culture) and therefore all members of a cultivar are genetically identical.

9 Carbon Sequestration

Trees absorb carbon from carbon dioxide in the atmosphere and store it in new wood growth and symbiotic fungi that grow on tree roots. This is known as carbon sequestration.

The carbon sequestering capacity of trees varies over time, being low at the seedling stage, to the peak period of early growth, followed by a slower carbon intake as the tree matures. However, as dead trees break down, much of the stored carbon is released back to the atmosphere. The cumulative carbon sequestered by an urban forest is the average carbon held by the trees over the cycle of growth and removal.

Factors that affect the unit cost of saved carbon include tree purchase and planting cost, maintenance cost, survival rate, labour and overhead costs, the type of species planted, location (urban versus rural), site suitability, leaf disposal costs and water costs.

10 Asset-Based Community Development Model (ABCD)

The Asset-Based Community Development model (ABCD) focuses on community strengths and assets. ABCD aims to find opportunities to build relationships and recognise the skills and abilities of individuals within the community.

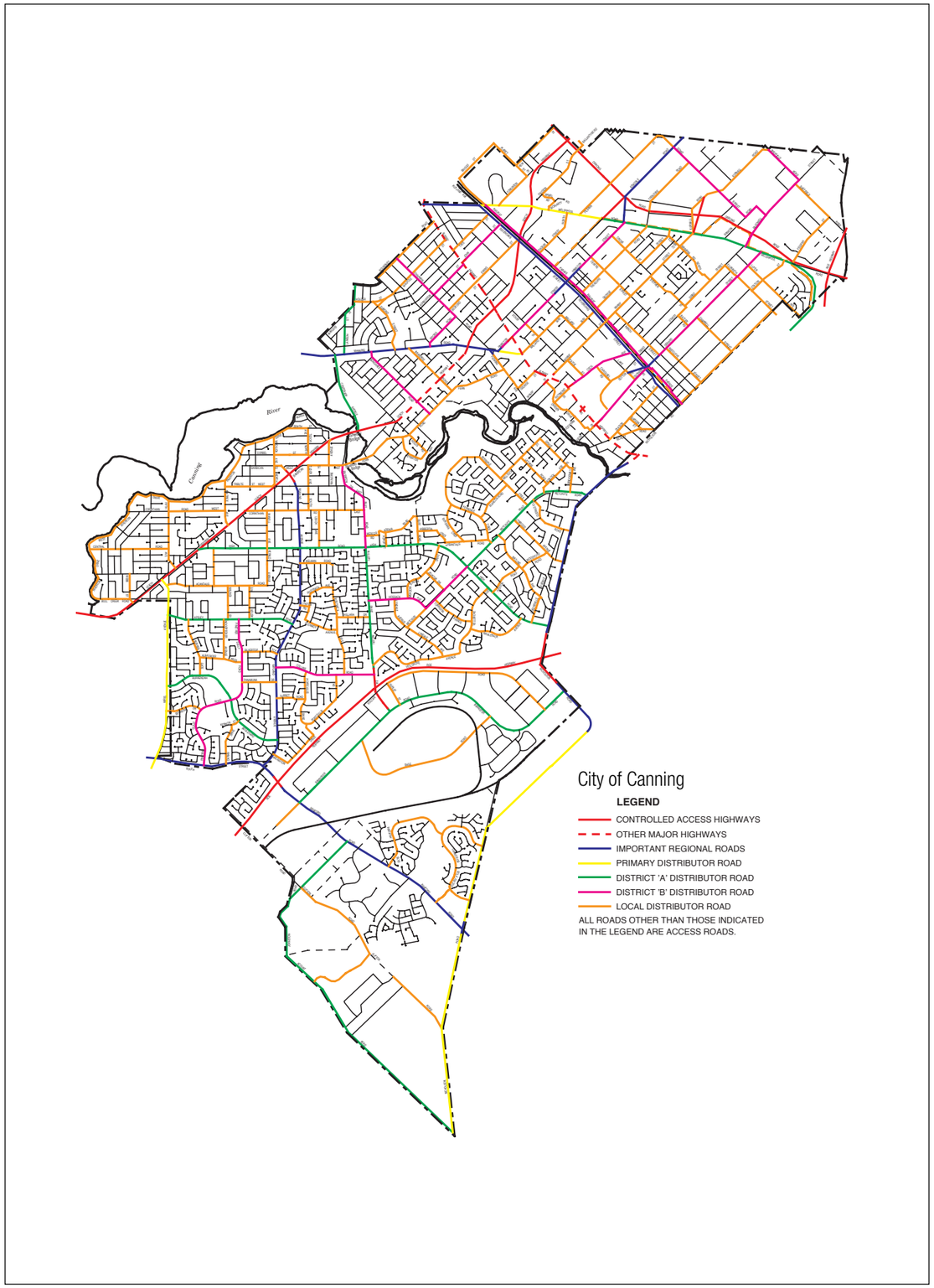
It focuses on community assets and strengths rather than problems, and identifies and mobilises individual and community skills and passions. It is community and relationship driven.

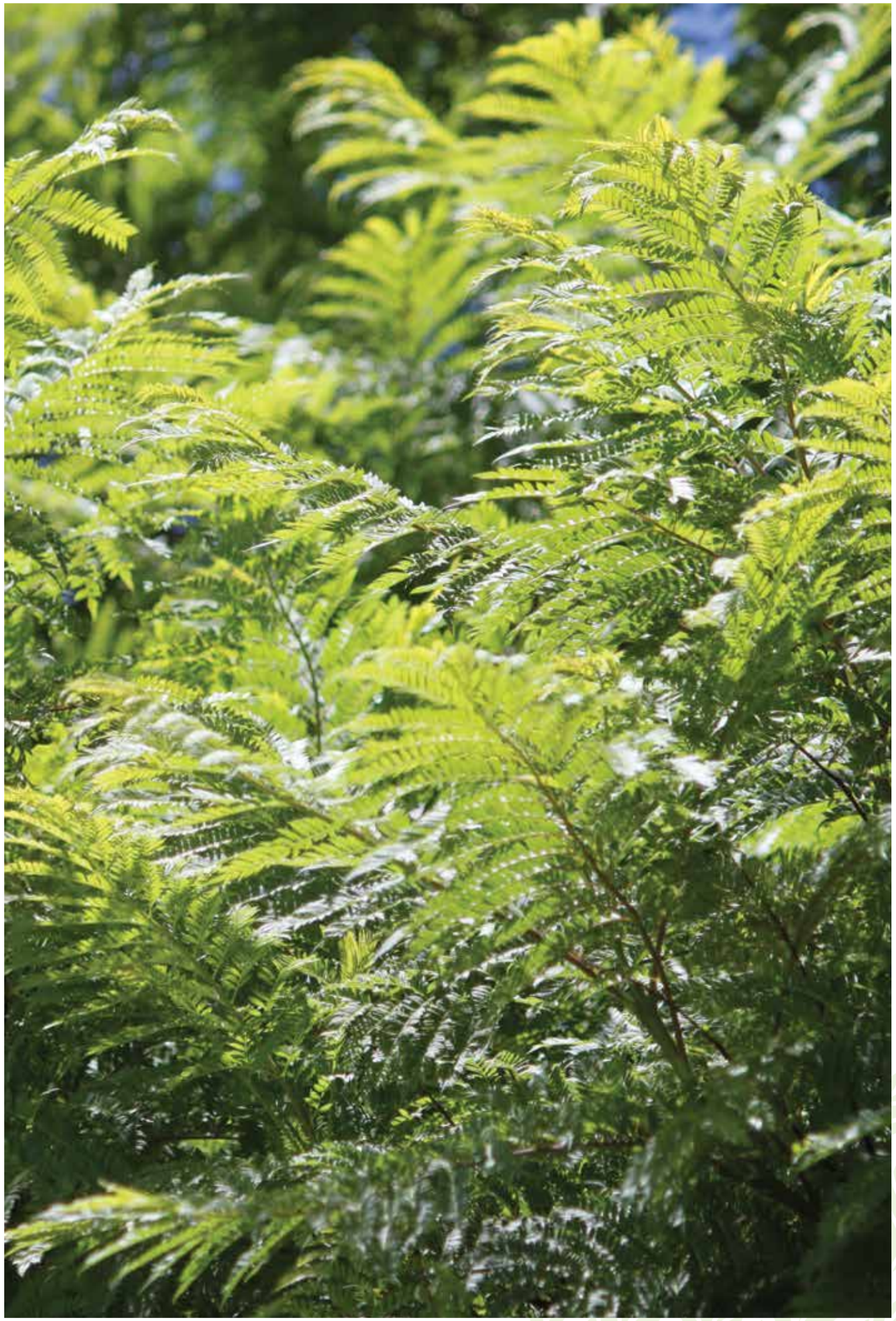
As part of the City's strategies to better engage the community, the ABCD model will be investigated in regard to tree planting, and undertaking measurements of trees as part of the tree tag project.

Tree Tags - City of Unley and City of Adelaide, South Australia. Credit: Dr J Garden.

Stenocarpus sinuatus - Firewheel Tree

Appendix G. Road Hierarchy Map





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