



STRATHFIELD TRIANGLE

Urban Tree Canopy Coverage Assessment

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Revision A For Information
by



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EXECUTIVE SUMMARY

Providing healthy green infrastructure in urban environments is challenging. Streets and higher density urban areas are highly used and contested spaces. Parks and open spaces need to fulfil many roles, such as providing for active and passive recreation. Similarly, urban development patterns, characterised by increasing density and infill developments, reduce the spaces available for trees and other greening. However, there is considerable and growing research and community recognition that trees and greening are essential infrastructure.

Green infrastructure, and particularly trees are a cities natural life support system, essential for all functions. There is growing realisation, that is backed by a rapidly increasing body of research, that green infrastructure very importantly also sustains and enhances community health and well-being. Urban heat mitigation through greening can significantly reduce human heat related morbidity and mortality, and can result in substantially decreased demand for energy due to air conditioning. In addressing extreme heat, numerous research studies outline the benefits that trees and canopy cover provide. These have been measured at the individual street level and on a precinct scale. When addressing the impacts of urban heat, the research confirms we need canopy at both the local and precinct scale - ideally with a minimum of 30 per cent canopy cover. Increased urban greening is now a mainstream technique to mitigate urban heat.

Canopy trees help to cool hot air and hot surfaces around them, through shading and evaporative cooling. Individual trees can make a valuable difference to air temperatures at the scale of individual properties, but recent studies have shown that groups of trees that combine to provide >40% canopy cover at the scale of a city block can reduce local ambient air temperature by more than 1.3°C. Reducing paved surfaces also helps to reduce heat that is absorbed and radiated into the air. Extreme heat is moderated most effectively where there is more tree canopy cover and less hard paved surfaces.

From high level analysis, we believe the minimum target of 25% urban canopy cover can be achieved with the current planning proposals. However, the more desired target of 28% can be easily achieved on the site. This figure can be achieved by:

- sensible and achievable mandated requirements within a precinct specific DCP with regard to private property canopy set to a minimum 15% of private site area
- appropriate and thoughtful street design that achieves a precinct wide canopy coverage to the street areas of 50%
- and thoughtful park design and species selection that achieves an ultimate canopy coverage to the proposed park of 75% while still providing sunshine and open kickabout spaces and lawns.

More importantly, with some considered and minimal modification the more aspirational target of 29% can most certainly be achieved, with an ideal 30% being the key aspirational target driving enhanced canopy coverage across the site.

If the urban forest and canopy cover initiatives outlined within this report are supported and implemented, most importantly it will contribute to many worthwhile initiatives, including:

- Increased canopy coverage wherever possible thereby reducing greenhouse gas emissions by shading buildings, cars and pavements.
- Mitigating urban heat island effects reducing ambient temperatures at ground level and improved cooling during extreme heatwave through evapotranspiration.
- Creation of more comfortable and walkable streetscapes, thereby promoting liveability and activity.
- Utilising trees to capture and reduce gaseous and particulate pollutants to improve air quality.
- Intercepting, storing and ameliorating rainfall runoff and stormwater flows.
- Improving biodiversity by advocating and implementing an appropriate and diverse mix of tree species throughout the wider precinct
- Utilising, where sensible, some endemic tree species that may provide beneficial habitat and linkages.
- Adapting to climate change by recognising that a gradual change and adoption of potential tree species that may be better suited to warmer climates and increased heatwave extremes.
- Promoting and readily adopting the use of water sensitive design strategies that passively irrigate trees, wherever possible, to allow them to better deal with extremes and future drought conditions.

1.0 INTRODUCTION

1.01 Background

Arterra have been engaged by Ethos Urban, on behalf of Canada Bay Council, as a specialist subconsultant, to undertake an Urban Tree Canopy Analysis for the precinct. Specifically this report is to undertake:

- An analysis to determine whether a 25% urban tree canopy target can be achieved for the precinct, and
- Prepare a plan to demonstrate how this target can be realised within the precinct.

Strathfield Triangle has been subject to ongoing development over the past 15 years, with a number of residential flat buildings having already been constructed towards the northern portion of the Precinct. Despite this, development activity in the Precinct has stagnated with a large portion of the Precinct remaining undeveloped, remaining as low density housing or vacant land (primarily the southern portion of the precinct).

Furthermore, since the inception of existing planning and contributions framework (adopted in 2013), land valuations and infrastructure costs have increased, causing the framework to be unfeasible to complete the regeneration of the area and limiting the ability to deliver on key infrastructure needs within the Precinct. Accordingly, a review of the planning controls and infrastructure delivery arrangements has been undertaken by Council to establish a mechanism for the viable delivery of essential infrastructure for existing and future residents of the Precinct.

The current Planning Proposal seeks to amend the Canada Bay LEP 2013 to support this outcome. The objective of the new Planning Proposal is to support a change to the planning controls applying to Strathfield Triangle Precinct and facilitate its renewal into a vibrant and sustainable high density residential neighbourhood. Specifically, the new Planning Proposal seeks to:

- support land use zoning changes;
- increase the maximum permissible building heights within the precinct; and
- increase the maximum FSR limits

The revised planning framework for the Strathfield Triangle Precinct aims to establish a viable framework that will continue to support the precinct's transition into a high-density residential precinct, which capitalises on its access to services, jobs and public transport. This will necessitate the creation of a new high amenity urban environment, encompassing:

- a revised road arrangement including road closures, street widening, upgraded intersections, shared zones and through-site links;
- the introduction of a new centrally located open space that is critical to providing amenity for the new and existing communities; and
- delivery of essential service infrastructure in a responsible manner, incorporating environmentally sensitive and sustainable measures, including best practice urban canopy cover.



Figure 1.00 Strathfield Triangle Precinct area outlined in red. (Image: Sixmaps)

Increasingly the community, higher level government agencies and other key stakeholders are recognising the value and importance of urban trees and the canopy cover they provide. This includes organisations such as the:

- United Nations.
- NSW State Government.
- The Greater Sydney Commission.
- The NSW Government Architect.
- Local Governments.

There are many existing and draft urban canopy cover policies and documents that will influence the future pattern and development of streets and our urban tree planting. These include important documents such as:

- Low Carbon Living CRC – Guide to Urban Cooling Strategies (July 2017)
- NSW Government Architects Office –(Draft) Greener Places (Oct 2017)
- NSW OEH - Urban Green Cover in NSW 2012 - Technical guidelines
- NSW Government Architects Office -The Green Grid-creating Sydney's open space network
- National Green Infrastructure Network-Urban Ecology : Theory Policy and Practice in NSW (May 2017)
- City of Melbourne/Victorian Dept. Environment, Land, Water and Planning – How to grow an urban forest
- The Nature Conservancy Washington – Outside our Doors (2016)
- Trees and Design Action Group – No trees, no future : trees in the urban realm (Nov 2008)

Numerous local Councils around Australia have already declared a state of climate emergency and urgent action is required to deal with climate impacts and potential for impacts of urban development on human health and well-being in the future.

The City of Canada Bay has joined over 1,000 local governments and jurisdictions worldwide to declare a climate emergency. The City of Canada Bay is the twelfth local government in Greater Sydney region to declare a climate emergency as part of the global movement. The declaration was endorsed unanimously by Council.

“We have a responsibility to our community and planet to not only reduce our greenhouse gas emissions but implement climate change mitigation and adaptation measures to safeguard the beautiful place we call home,” said Mayor Angelo Tsirekas.

The declaration is consistent with the position of the NSW Government that councils are responsible for many services and assets likely to be affected by climate change and must take steps to prepare for and minimise its effects.

The NSW Premier, herself, has listed the greening of our urban environments as a “Premier’s Priority”. Street trees and tree planting is now increasingly recognised by all levels of government as one of the most crucial areas to address. Council’s across the country need to increase the priority given to achieving quality tree planting and green infrastructure. Councils need to actively avoid placing unjustified ‘road blocks’ to achieving essential greening initiatives and to recognise the nexus between ‘greening’ and ‘water’ and commit to better utilisation of our urban stormwater and wastewater for the betterment and sustainable health of all urban greening.

We are already seeing the impacts of climate change, particularly in our urban areas. Heat records have continued to be broken, with Sydney reaching its highest ever-recorded temperature, and Penrith reaching a staggering 48.9°C during the recent heatwave of 4 January 2020. Sydney had many months with below-average rainfall, but also some very wet months but still its annual total rainfall was in the driest 15% of years.

Canada Bay Council - Urban Forest Strategy

Council has a strategy in place to expand and manage its urban forest and canopy cover. This vision will be underpinned by the principle of “right tree, right place”.

The objectives of the strategy are to grow and protect a resilient and diverse urban forest that characterises the City as a cool, tranquil and connected place to live, work and visit. The urban forest will be a highly valued urban asset that will be managed collaboratively and will strengthen the liveability of the City through supporting the health and well-being of the community, the native biodiversity, and the environment.

The City of Canada Bay will increase its tree canopy cover across the City to at least 25% by 2040, an increase of over 6%.The increase in canopy cover will occur primarily in streets and parks on public land and by working with private land holders.



Figure 1.01 Urban canopy cover policies and documents

1.02 Aims of the Report & Qualifications

To undertake the analysis and assessment of the proposed urban canopy cover the aim of this report has to been:

- to understand and assess the current tree population that occurs on the site.
- undertake and make comparisons with what canopy cover currently exists and what is proposed.
- ascertain whether there are any significant trees that should be considered for retention and the general characteristics of the other trees that may be cleared (many may be weeds, undesirable or substandard specimens).
- Assess and identify what trees are going to be required to achieve desired canopy coverage.
- Outline strategies for how and where the trees will be planted to help define and to influence the urban design and engineering outcomes.
- Specify the most desirable attributes and species that should be considered for the precinct.

Arterra has a long history of working collaboratively with multidisciplinary teams and local Councils to find creative design solutions for large and complex urban projects. As landscape architects, urban designers and consulting arborists Arterra is uniquely placed to provide input and leadership on this topic. We regularly provide similar services to authorities and have very extensive experience in urban greening policy development, streetscape design and upgrades at all levels of complexity. We have a strong focus on the retention of existing trees and the implementation of best-practice new tree planting.

1.03 Context & Location

Strathfield Triangle Precinct is located within the City of Canada Bay Local Government Area (LGA). It is bordered by Leicester Avenue to the east, Parramatta Road (the Great Western Highway) to the north, and the T1 North Shore, Northern & Western Line railway corridor to the west.

The site is located within walking distance to two town centres including train stations. Strathfield Town Centre and Station is a 400m walk south-east of the site and Homebush Town Centre and Station is about a 1km walk to the west via the railway underpass along Parramatta Road.

The northern part of the Strathfield Triangle site features more recently developed high-density residential apartments, while the broader surrounding area consists of mainly lower density residential development with single dwellings.

Currently the site does not provide any public open space. The topography slopes down from approx. RL 22m at the Parramatta Road / Leicester Avenue intersection to the south and west. The site flattens out at the southern end towards Cooper Street, with a low point at approx. RL 11m along the railway line.



Figure 1.02 The site as it stands in 2020. (Image: NearMap)



Figure 1.03 Existing trees within the already developed area to the south west of Parramatta Road (Image: Arterra)



Figure 1.04 Existing areas of large open grass with very little canopy coverage (Image: Arterra)

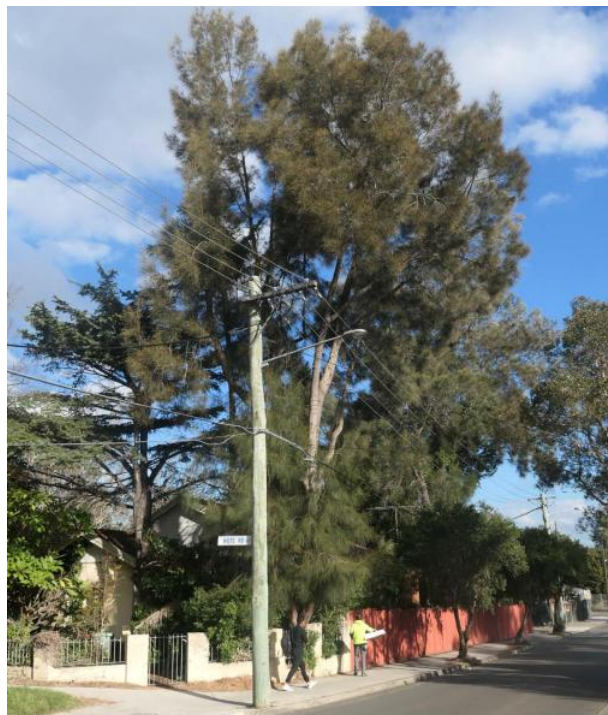


Figure 1.05 One of the larger existing trees within the site (Image: Arterra)



Figure 1.06 Example of the existing trees adjacent the already developed areas of the site (Image: Arterra)



Figure 1.07 The south of the site is predominantly open areas with isolated trees (Image: Arterra)



Figure 1.08 Existing tree planting between the already developed areas and the rail corridor (Image: Arterra)

1.04 Benefits of Trees & Why Urban Canopy Is So Important

The 'urban forest' consists of all trees and vegetation located within a defined urban area, irrespective of the tree species, origin (native, exotic), location (street, park, garden, school) or ownership (public, private, institutional). Green infrastructure is a cities natural life support system, essential for all functions. There is growing realisation, backed by a very rapidly increasing body of research, that green infrastructure also sustains and enhances human health and well-being.

There is a considerable body of research that exists on the benefits that urban trees provide. The urban forest, often most easily measured as a canopy cover percentage of the total land area, is recognised as a primary component of the urban ecosystem (LGA NSW 2003). It is one component of a complex built environment that includes roads, car parks, footpaths, underground services, buildings and other urban structures (North Sydney 2011).

In practice, the 'urban forest' incorporates and encompasses all vegetation within streets, parks, wetlands, balconies, facades and roofs. This document, however, primarily addresses the existing and proposed tree stratum. The vegetation that would not be considered 'trees', such as roof gardens, lower shrubs and groundcovers, and 'rain garden' planting is not specifically addressed within this report.

Trees in urban areas are a major and visible component of the natural resources upon which we rely. They provide a substantial contribution to the "sense of place", and character of an area. They can have historical significance and provide numerous environmental and psychological benefits to visitors and residents. They can also provide important way-finding and 'landmark' statements. Trees of civic scale or with distinctive forms can be important markers in the landscape and help to demarcate the entry or gateways to an area or help to define important areas, improving way-finding and urban legibility.

Examples of the benefits urban canopy provide, both direct and indirect include:

- reducing the urban heat island effect and moderation of other weather extremes and winds
- providing cooling and shading to pedestrians and buildings
- lowering energy use (due to the above)
- increasing longevity of pavements and road surfaces due to shading
- shading of parked cars and reduction in hydrocarbon emissions
- storage of carbon dioxide (CO²)
- interception and storage of rainwater and stormwater via leaves and roots
- filtering of particulate matter and polluting gases
- ameliorating wind
- production of atmospheric oxygen and uptake of carbon dioxide
- provision of habitat for native fauna, birds and insects
- general human health, calming and wellbeing.

Few things can compare with the visual impact and seasonal interest a tree provides. They foster community cohesion, creating a sense of place and local landmarks. Very importantly, trees can have surprising and profound effects on the psychological wellbeing of nearby residents, particularly in urban areas (Ferrini et al, 2017).

Trees remain one of the most cost effective measures of drawing excess CO² from the atmosphere. They also improve air quality by removing and storing a surprising amount of harmful pollutants such as sulfur dioxide, nitrogen oxides, particulate matter, and heavy metals such as cadmium, nickel and lead.

Trees have also been shown to provide direct economic benefits to a region. The attractiveness of an environment is an important factor in attracting inward investment. Values of properties in tree-lined areas may be up to 6% greater than in similar areas without trees (Wolf, 1998). Rental rates are up to 7% higher for commercial office properties having a quality landscape. Furthermore, consumers report being willing to spend up to 12% more in commercial districts having large trees (Wolf 2009).

Trees do have costs associated with planting and maintaining them and many challenges involved in growing healthy trees in otherwise complex and often unnatural, urban environments. Although the urban forest can most definitely be considered an asset, if not properly planned, cared for and managed, it can also become a liability.



Figure 1.09 Tree lined street offering extensive urban canopy over Ashmore Street in Erskineville, Sydney (Image: Arterra)



Figure 1.10 Avenues of trees lining the street and the adjacent park offering shade to both areas (Image: Arterra)



Figure 1.11 Tree lined street providing shading and cooling to pedestrians and buildings (Image: Arterra)

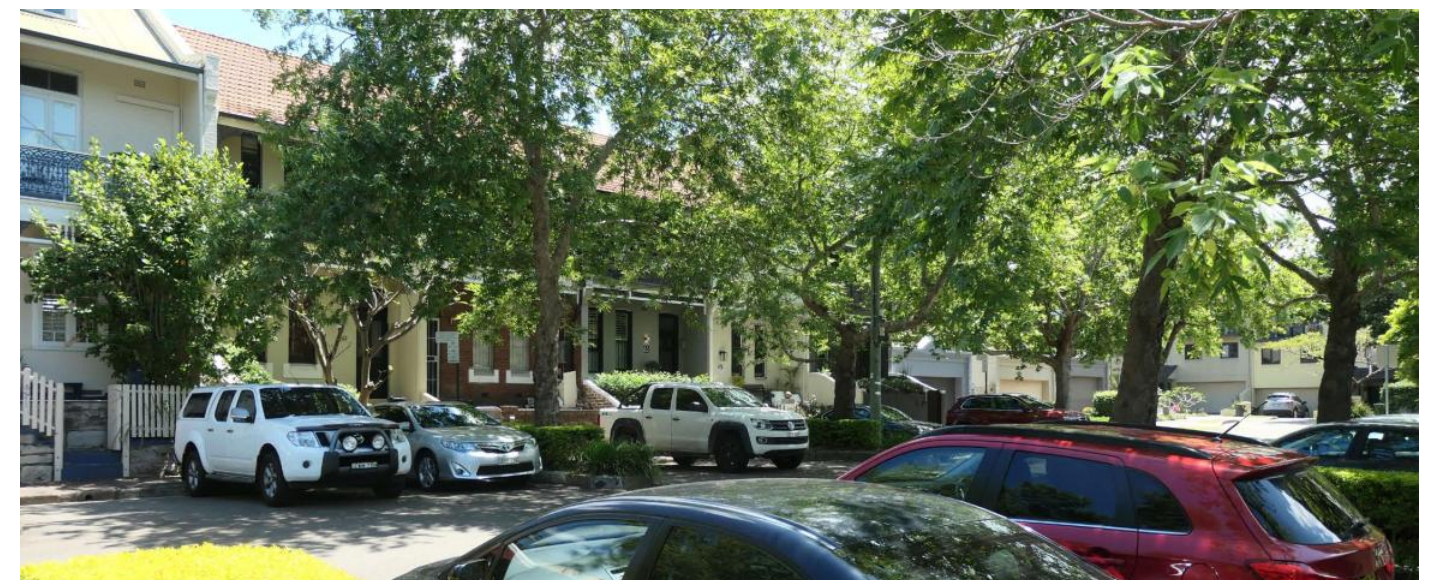


Figure 1.12 Trees reducing the urban heat island effect and creating a more pleasant environment for pedestrians (Image: Arterra)

Trees and Our Health

In 1950, 749 million people lived in urban areas, by 2014 there were 3.9 billion. By 2050 it is forecast that 75 per cent of the world's population will be living in urban areas, which means there will be over 9 billion people living in the world's cities. Australia has one of the highest urbanised populations in the world, with around 90 per cent already living in cities and large towns and increasing. Higher density living comes with many challenges and impacts on our health and well-being.

There is no greater good that can be done for health promotion than the protection and enhancement of greenery on which all humans depend (Coutts, C. and Hahn M. 2015). This also goes especially for mental health. As outlined by the World Health Organisation, "good mental health enables people to realise their potential, cope with the normal stresses of life, work productively and contribute to their communities". Simply being in, nearby, or with a view of green spaces may help build mental health capacity, contribute to our ability to restore depleted cognitive capacities, enhance recovery from stress and increase our optimism. We also prefer to seek out greenery that has a higher density of tree canopy cover rather than simple spaces such as large grassed areas. (Astell-Burt, T., 2019)

The World Health Organisation calls stress the health epidemic of the twenty first century. Mental ill health and suicide are costing Australia up to \$180 billion a year (the Productivity Commission found in October 2019). Anxiety and depression are estimated to cost the European Union 170 billion a year and in the USA over \$210 billion.

Finding a way to manage this is critical to our health and wellbeing and trees and other greenery can help immensely. A 2019 Australian study titled 'Association of Urban Green Space with Mental Health and General Health Among Adults in Australia' by Prof Astell-Burt and Dr Feng found that urban communities with a healthy amount of tree cover - not just grass and green space - were psychologically healthier than those that didn't.

In neighbourhoods with a tree canopy of 30 per cent or more, adults had 31 per cent lower odds of developing psychological distress, and 33 per cent lower odds of rating their general health as fair or poor over six years. Urban green spaces with open grass rather than a tree canopy did not deliver the same benefits. This research, which focused on Sydney, Newcastle and Wollongong, helps provide a solid target to work towards to provide the community with tangible psychologically health outcomes.

Importantly, there are many other health benefits associated with greenery, such as reductions in cardio vascular disease, skin cancer rates, and 22% lower odds of insufficient sleep.

Greening also has massive benefits for our urban areas connectivity and walkability. Walking and cycling are important benchmarks for a liveable city. High levels of walking mean a city is safe, vibrant and easily accessible by everyone.

Another pressing challenge is urban air quality. In most cities, the most damaging air pollutant is particulate matter. Fine particulate matter (less than 2.5 micrograms in diameter) can be deeply inhaled into the lungs and is estimated to cause 3.2 million deaths per year primarily from strokes and heart disease. It also contributes to chronic and acute respiratory diseases, including asthma. One study forecasts that by 2050, fine particulate matter could kill 6.2 million people per year world-wide. (The Nature Conservancy, 2016).

Trees will therefore play an important role in making our air healthier, too. Dozens of studies now show that the tree leaves filter out particulate matter from the atmosphere, along with absorbing many other air pollutants. Air pollution has been found to be often worsened by heat which, in turn, causes increased chemical reactions to occur with other volatile organic compounds. Ground level ozone concentrations are found to radically increase as ambient temperatures increase.

Finally, quality shade provision can also reduce exposure to damaging UV by up to 75 per cent. This can be provided by built structures or trees, but trees also produce numerous other benefits.

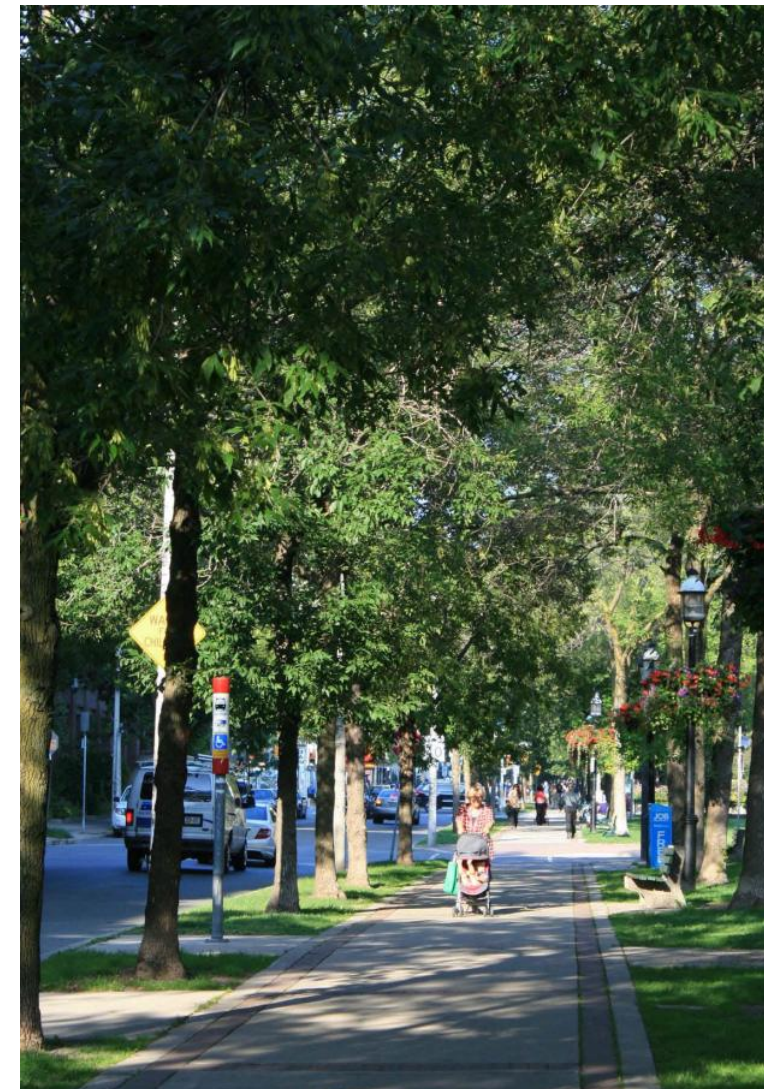


Figure 1.13 Tree lined streets create pleasant environments for pedestrians by enhancing connectivity and walkability (Image: Arterra)

Urban Heat Mitigation

Heatwaves are now Australia's deadliest natural hazard. They now arrive earlier, are hotter, and last longer. Urban temperature extremes can present us with life-or-death situations. When temperatures exceed 25°C there is a reported increase in mortality and strokes.

In Sydney, the heatwave of February 2011 resulted in 595 people needing treatment in hospital emergency departments, and killed 96 people. In 2009, the Black Saturday bushfires killed 173 people, but the heatwave at this same time killed 374 people in Melbourne alone.

Urban heat mitigation through greening can significantly reduce human heat related morbidity and mortality, and can result in substantially decreased demand for energy due to reduced air conditioning use as well as lower water consumption. (Low Carbon Living, 2017)

In addressing extreme heat, numerous research studies outline the benefits that trees and canopy cover provide. These affects have been measured at the individual street level and on a precinct scale.

When addressing the impacts of urban heat, research confirms we need canopy at both the local and precinct scale - ideally with a minimum of 30 per cent canopy cover.

Increased urban greening is now a mainstream technique to mitigate urban heat. Greening facilitates the cooling of our homes and streets and parklands via evapotranspiration, shading and providing cooler surfaces to reduce mean radiant temperature.

Canopy trees help to cool any hot air and hot surfaces around them, through shading and evaporative cooling. Individual trees can make a valuable difference to air temperatures at the scale of individual properties, but recent studies have shown that groups of trees that combine to provide >40% canopy cover at the scale of a city block can reduce local ambient air temperature by more than 1.3°C (Ziter, C. et al 2019). Reducing paved surfaces at the same time also helps to reduce heat that is absorbed and radiated back into the air. Therefore extreme heat is moderated most effectively where there is both more tree canopy cover and less hard paved surfaces.



Figure 1.14 Canopy trees help to cool through shading and evaporative cooling (Image: Arterra)

2.0 EXISTING CONDITIONS & TREES

2.01 Overview

The Precinct has previously been a low density residential area. For many decades the site has been ear-marked for re-development. Over recent times the area has had previous houses and buildings demolished and many other existing dwellings have fallen into dis-repair.

The tree population has in turn been affected by this decline. Many trees are in relatively poor condition and many are now considered weedy or invasive and undesirable species such as Camphor Laurel, Privet and Chinese Hackberry. Refer to figure 2.04 for the existing Tree Retention Value Plan which shows where they occur within the site.

Successive widening and development of Leicester Avenue has also seen a once prominent avenue of impressive street trees dwindle to a shadow of its former glory. Many of the trees on this street are poorly formed and heavily pruned for overhead power line clearances.

New planting has been undertaken in the new apartment developments but this has often been less than well considered. Some are already suffering from poor soil volumes and lack of available water resources. Overshadowing of tall towers and lack of maintenance has also contributed to a fairly average population of trees and general lack of worthwhile urban tree canopy coverage.

2.02 Assessment Methodology

On 24 July 2020, Rob Smart and Chloe Bristow of Arterra attended the study area and carried out an arboricultural assessment, via a visual inspection from the ground only, of the trees throughout all the accessible areas of the Precinct. These were the street trees on Hiltz Road, Leicester Ave, Cooper Street, Clarence Street and Parramatta Road. We also reviewed those trees in the semi-publicly accessible open spaces within the existing apartment sites. The trees within the remaining private dwellings and tenancies were not able to be assessed in detail.

Where those trees could be observed from the street or other semi-public space, the consulting arborist made an educated assumption regarding the species identification and a broad assessment of the general condition of the tree. It must be stressed that the species identification and condition assessment of these trees has been a best guess only, based on years of professional experience but sometimes observations were made from a significant distance as no access was available to these trees for any detailed assessment.



Figure 2.01 Trees on Leicester Avenue have suffered since the widening of this road and the subsequent heavy pruning required for clearance to the overhead powerlines (Image: Arterra)



Figure 2.02 Leicester Avenue - trees heavily pruned for required clearance to overhead powerlines (Image: Arterra)



Figure 2.03 Hiltz Road - trees pruned for required clearances to overhead powerlines (Image: Arterra)



Figure 2.04 Intersection of Leicester Avenue and Parramatta Road. The newly developed parts of Strathfield Triangle contribute very little to the overall canopy coverage (Image: Arterra)



Figure 2.05 Many of the existing trees are to the back of existing properties and contribute little to the public amenity (Image: Arterra)

2.03 Tree Retention Value

In order to help guide the recommendations and assessments made in this report, the proposed retention value of the trees has been determined based on a considered combination of the size, age, condition and suitability of the tree. Each tree has been ranked according to one of 4 retention categories:

- “High” Retention Value – these are trees that are typically in good or very good condition, large and visually prominent, historically or environmentally important. They may also be lesser quality trees, but part of an important grouping of trees. They should represent a serious physical constraint to the development and their removal avoided where possible and feasible.
- “Moderate” Retention Value – these are trees that are in good to reasonable condition and should be retained where possible and feasible to do so. They may also be lesser trees, but part of an important grouping of trees and therefore warrant retention based on the group’s value.
- “Low” Retention Value – these are trees that are in poor condition or have structural defects, are particularly small or commonplace, are not historically, environmentally or socially significant and should not be considered as a constraint to the development. They could be retained only if they are not likely to be impacted by, or constrain potential desirable, development outcomes.
- “Should Remove” / No Retention Value – these are trees that are in very poor health, exhibit poor form, or have serious structural defects, are considered weeds or combination of all these, and therefore should be considered for removal regardless of any development.

Consideration has also been given to the relationship of the trees to one and other and their proximity to the likely development areas on the site. For example, trees that are part of a closely spaced group, or are likely to be significantly misshapen or unstable with the removal of surrounding trees and structures are considered with these factors in mind.

Table 01 Existing Tree Retention Values

Retention Value	Number of Trees	% of Total
High	5	2%
Moderate	88	32%
Low	147	53%
V. Low/Remove	35	13%
Total	275	100%

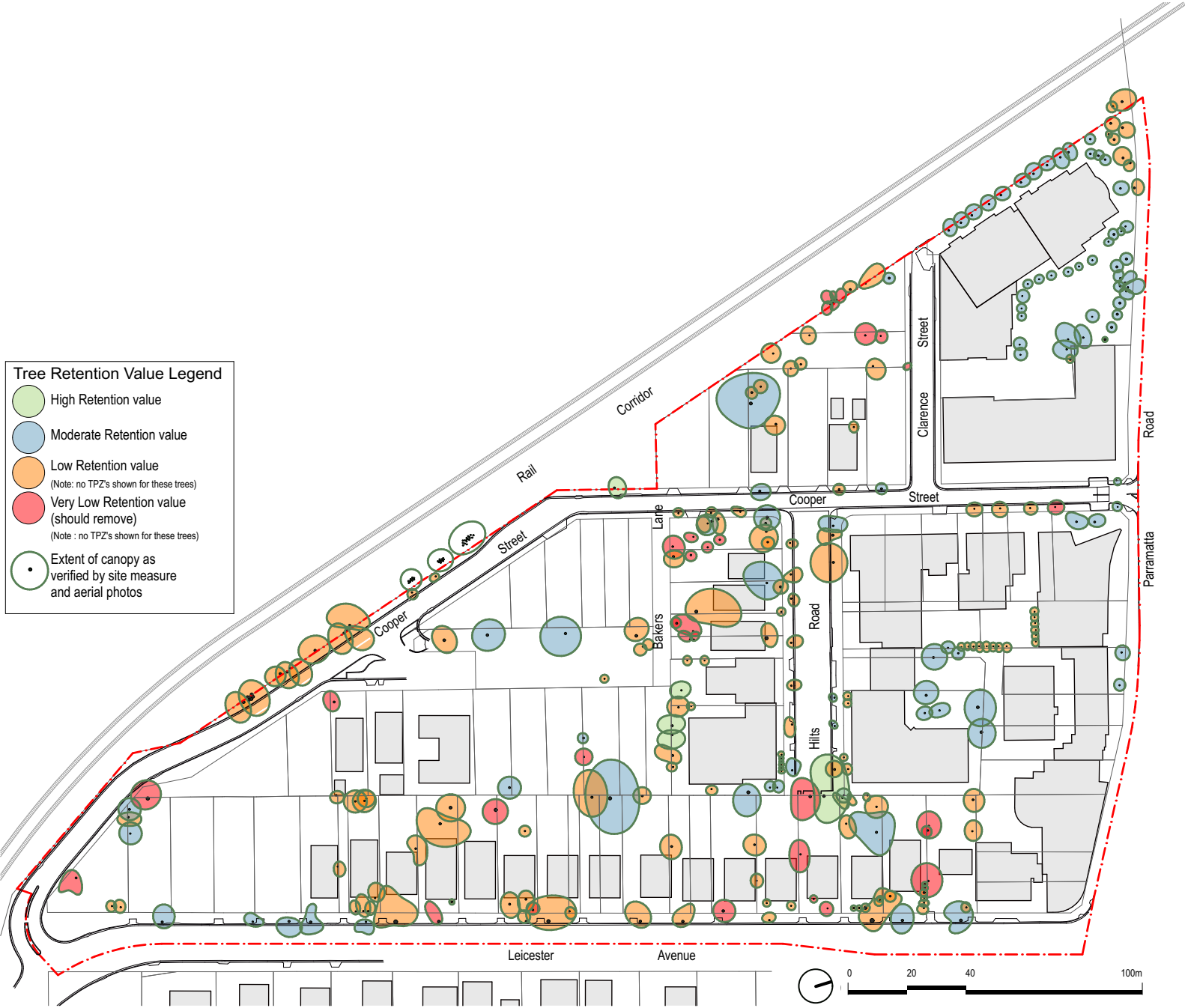


Figure 2.06 Existing Tree Retention Value Plan (Image: Arterra)

2.04 Existing Tree Population

The following section summarises the existing trees found in the Precinct and discusses some other factors relevant to the proposed redevelopment. At present:

- A total of 275 existing trees have been assessed and identified in the precinct.
- Most of the trees (182 or 66%) were rated either Low (147) or Very Low / Remove (35) retention value.
- Only 5 trees were rated with a High retention value (Refer to Figure 2.07). These high value trees were:
 - T107 *Casuarina cunninghamiana* (River She-Oak)
 - T140 *Jacaranda mimosifolia* (Jacaranda)
 - T180 *Waterhousea floribunda* (Weeping Lilly Pilly)
 - 2 x T183 *Syzygium paniculatum* (Magenta Cherry)

These trees have been rated with a high retention value and are recommended to be retained as they are:

- good specimens that are healthy and of good form and vigour
- sized and positioned to fit within the current planning proposal
- already contributing greatly to the existing canopy coverage

It is to be noted, however, that most of the trees that are within the Precinct boundaries:-

- Are relatively small and common place exotic trees.
- Many are what would be considered weeds or invasive species and there removal is not a cause for concern.
- Many have misshapen or asymmetric forms due to them being in very close proximity to each other, or to larger overhanging trees or to the adjoining buildings.
- There are relatively few trees of a high or moderate retention value within the Precinct. It is understood that given the scale of the developments and the need to excavate and redevelop the majority of the apartment sites, many trees, despite their rating will not be able to be retained.

Cinnamomum camphora (Camphor Laurel) are considered an invasive species and typically it has been suggested they are removed, however, some of the larger specimens that offer significant existing canopy coverage have been considered to be retained. It is our recommendation, however, when they decline they should be replaced with a different species that offers a similar character and form (i.e *Waterhousea floribunda*).

Table 02 Existing species analysis table (top 5 species recorded within the precinct)

Species	Common Name	Number of Trees	% of Population
<i>Cinnamomum camphora</i>	Camphor Laurel	28	10.2%
<i>Lagerstroemia indica</i>	Crepe Myrtle	22	8.0%
<i>Grevillea robusta</i>	Silky Oak	18	6.5%
<i>Tristaniaopsis laurina</i>	Water Gum	14	5.1%
<i>Magnolia grandiflora</i>	American Bull Bay Magnolia	14	5.1%



Figure 2.07 Plan illustrating location of high retention value trees (Image: Arterra)

2.05 Existing Canopy Coverage

To gain an understanding of the precinct and its capacity to achieve the desired canopy cover targets it was felt necessary to analyse the pre-existing canopy of the Precinct. This is conveyed in the adjacent Figure 2.11.

In summary:

- The current existing overall canopy cover is only 13% (made up of Streets 13%, Private 12% and Park 0%)
- Existing private areas are only achieving 12% canopy coverage (made up of 16% on existing low density residential housing lots /undeveloped land and 7% on developed land)
- Most significantly, if only looking at the existing apartment developments along Parramatta Road a very unimpressive 7% canopy coverage is achieved. This reinforces the need for more to be done in future development parcels to ensure that private areas actively contribute to the realisation of the Precinct wide canopy coverage.



Figure 2.08 Hilts Road has potential to increase its overall canopy coverage (Image: Arterra)

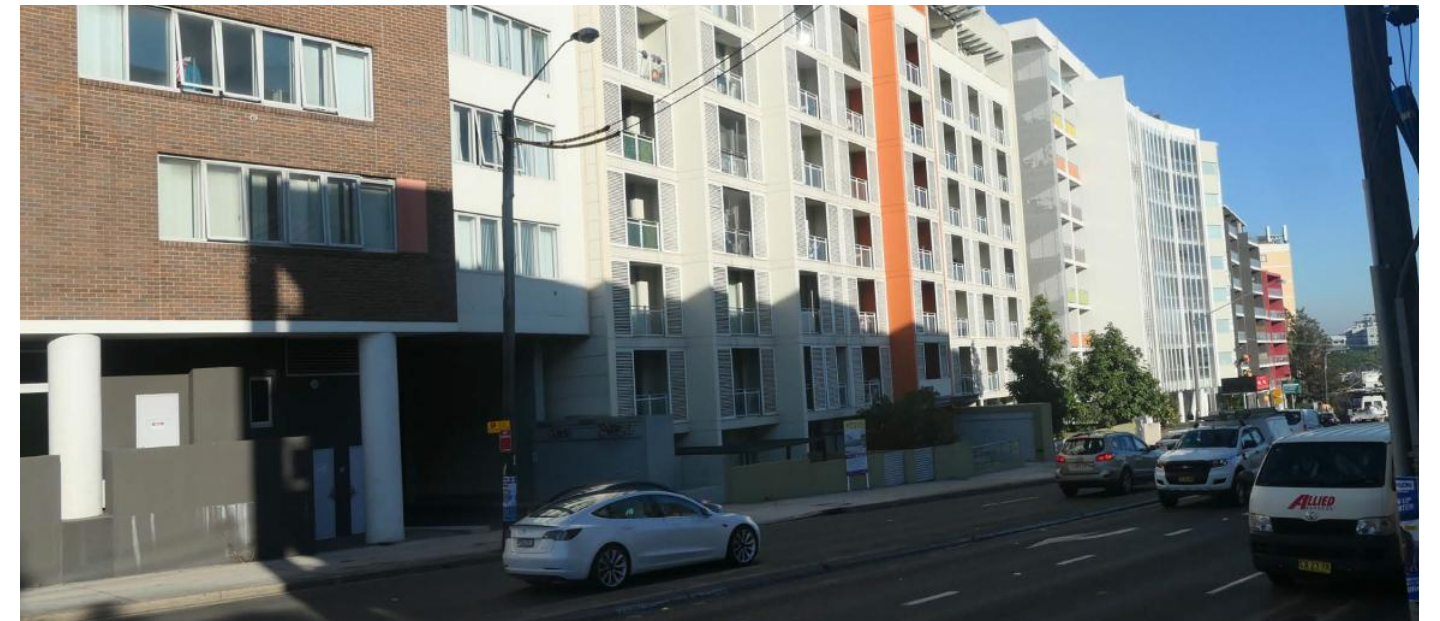


Figure 2.09 Existing apartment developments with very little canopy coverage achieved (Image: Arterra)



Figure 2.10 Leicester Avenue highlighting that the existing canopy coverage is relatively inconsistent (Image: Arterra)

EXISTING CANOPY COVERAGE

	Site Area	Total Area (m ²)
	Street	13,787
	Private	46,249
	Total	60,036

	Site Area	Canopy Coverage (m ²)	% of Area
	Street	1,778	13%
	Private	5,738	12%
	Total	7,516	13%

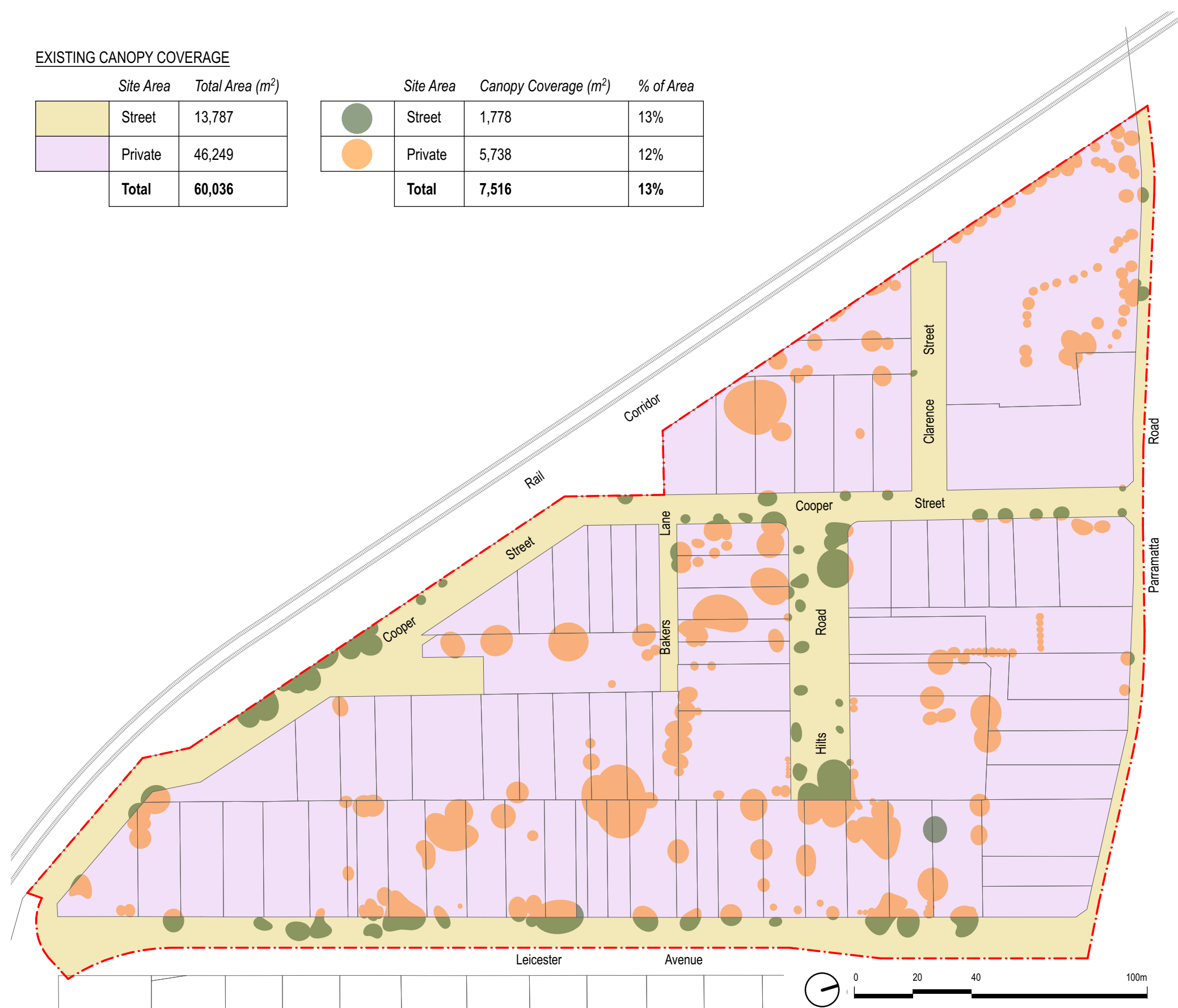


Figure 2.11 Existing Canopy Coverage Analysis Plan (Image: Arterra)

3.0 THE PROPOSAL AND URBAN CANOPY ANALYSIS

3.01 Current Planning Proposal and Public Domain Plan

The current proposed urban domain outcome was chosen as the preferred scenario as the park location provides the best potential for amenity. Refer to Figure 3.01 for the current planning proposal. In summary:

- Open space is consolidated into a Central Park. Easily accessible from the rest of the precinct, the park addresses both existing properties and future development to become an inclusive space. It provides amenity that can be shared by all and stitches the future lots into existing development.
- Moving the park away from privately-owned land (as proposed under the previous DCP) onto land that is partially Council-owned creates an opportunity to deliver the park without needing to acquire land.
- The proposed Cooper Street re-alignment is inherited from the Strathfield Triangle DCP to secure the connectivity and safety benefits of having a signalised intersection at Leicester Avenue. This results in a section of the existing Cooper Street being closed off, unlocking an opportunity to utilise the floorspace potential of this Council-controlled land to improve development feasibility within the wider precinct.
- Permeability and integration with the context is maximised by establishing a connected network of streets, shared zones and through-site links that create clear paths of travel throughout the precinct. This connectivity stitches together the existing and the new. Pedestrians are drawn into the heart of the precinct, through the new park, instead of having to walk along the railway line to get to their destination (as is currently the case).
- Clear sightlines are established across the precinct. This visually links together existing areas to the new, and the precinct as a whole to the wider context. This creates a legible precinct, assisting in reducing the perception of density and avoiding the sense of a gated enclave.
- Proposed urban form is arranged to maximise passive surveillance of streets, open space and pedestrian links to create the conditions for a safe public domain. The distribution of building heights is informed by the following:
 - Taller forms are located along the railway line to minimise overshadowing and amenity impacts on existing and future development.
 - One of the tallest buildings is located at the southern end of the site to establish a landmark that is visible to pedestrians exiting the Strathfield train station.
 - The built edge drops down to four storeys along Leicester Avenue to respect the existing low rise scale opposite



Figure 3.01 Public domain plan by Ethos Urban (Image: Ethos Urban 16/04/20)

3.02 Tree Canopy Coverage Assessment

Any canopy coverage calculation needs to consider the reality of the land use and the ability to place and achieve long term and sustainable tree growth. Not all areas of the precinct can be treated equally.

No allowance or factor has been applied to reduce the calculated canopy coverages based on the density of shade or foliage cover of individual trees or species. It will be our recommendation that tree species typically target reasonably dense foliated trees in order to maximise the shading and canopy cover benefits particularly in summer, when it is most needed.

Based on work by others, most significantly the City of Sydney, we believe a worthwhile analysis of canopy cover is based on a considered application of what can be achieved in various landuse types being;

- Park Areas
- Private Property Areas/ Development Sites
- Street Reserves

Based on the above breakup of the Precinct areas the following theoretic canopy coverage targets have been applied and then tested. If one simply looks at the break up of areas in the current planning proposal and applies reasonable theoretical percentages of canopy coverage, a 24.5% tree canopy coverage can easily be achieved over the precinct. This is demonstrated in the table below.

Table 03 Theoretical Canopy Coverage Targets

Land Use Type	Total Area	Theoretical % of Canopy Targeted	Canopy Coverage Area
Park Areas	2,852m ²	50%	1,426m ²
Private Property Areas	38,276m ²	15%	5,742m ²
Street Reserve Areas	18,905m ²	40%	7,562m ²
	Total <i>(Potentially Achieved)</i>	24.5% <i>(Precinct wide)</i>	14,730m² <i>(Precinct wide)</i>

Canopy coverage has been calculated as a percentage (%). This has been calculated on the m² of ‘projected’ canopy onto the underlying ground surface. Overlapping canopy is not counted twice. Likewise street and park trees that overhang onto private property would contribute to the measurement of the adjoining areas canopy coverage and vice versa.

We have tested the proposed public domain strategy prepared by Urban Ethos (2020), which is demonstrated in Figure 3.02. The current proposal comes close to achieving 25% coverage targets for the overall precinct but falls slightly short. It achieves a total of 22% canopy coverage, with 31% to the streets, 58% to the park, and a notional 15% applied to the private areas. We believe there are numerous opportunities to improve the current public domain and tree planting layout to achieve a better tree canopy coverage and exceed the Councils stated target of 25%.

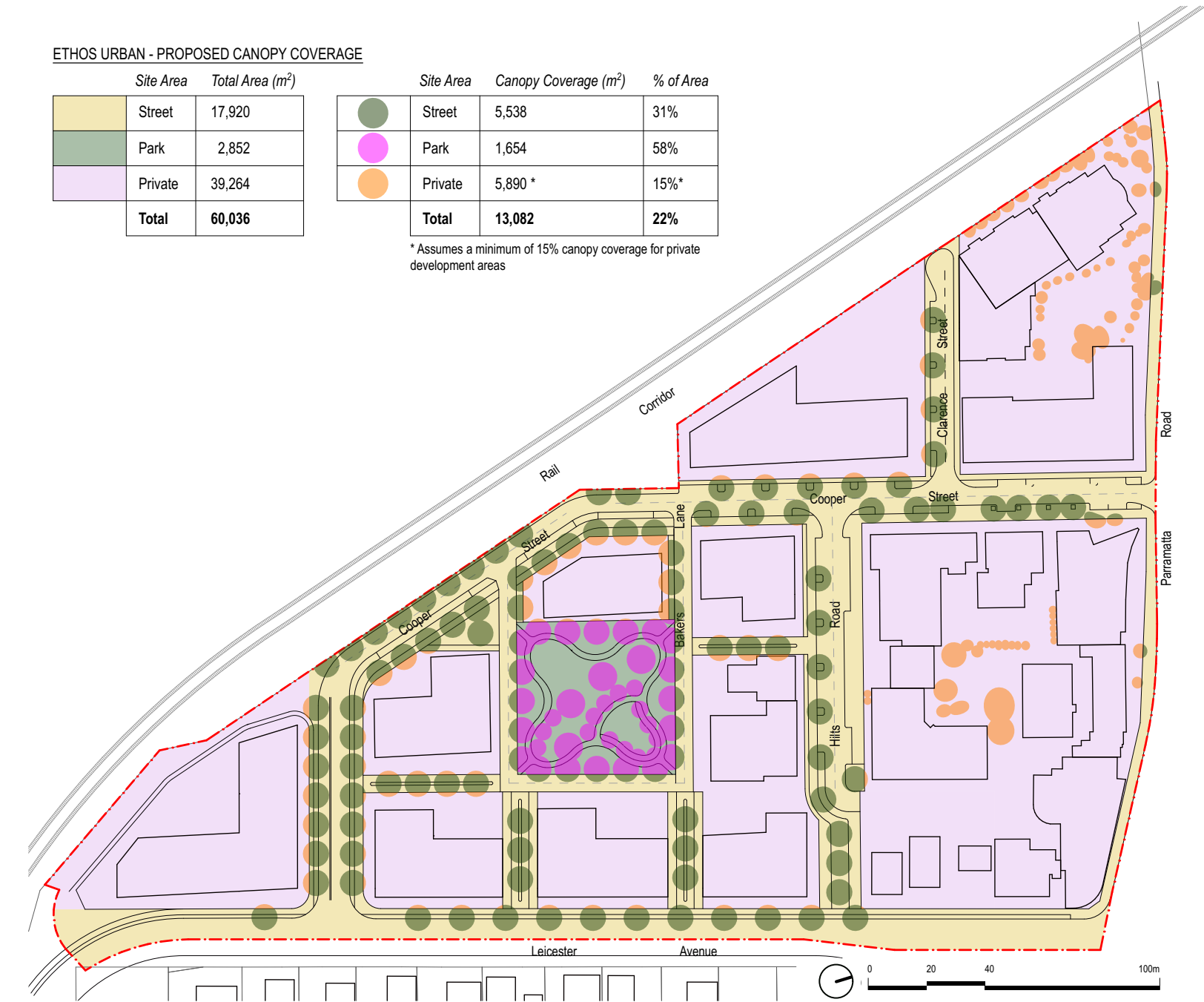


Figure 3.02 Canopy Coverage Analysis of the proposed public domain plan by Ethos Urban (Image: Arterra)

Arterra Proposed Canopy Plan

If the Arterra approaches are adopted we have calculated the precinct wide canopy coverage that should be achievable is closer to 30% which is over the Council's current target figure of 25%.

It is the author's opinion that with appropriate tree selection, DCP controls and road profile detailing at future design stages:

- an overall **28%** canopy coverage can be achieved
- **50%** canopy coverage to streets can be achieved
- the park area can easily reach **75%** canopy coverage
- Given the high density and highly urbanised development that is being proposed it is likely that canopy coverage to private areas will be extremely limited in many instances. At present we have calculated the canopy coverage of private areas based on a notional **15%** canopy coverage in both the Ethos Urban and Arterra modified scheme. This should be calculated on the m² of projected canopy, regardless of whether it is on the ground levels or on more elevated portions of the buildings. If this minimum of 15% canopy is achieved in the private areas, then the overall canopy cover target of 28% can be achieved.
- It is therefore recommended that a minimum of **15%** canopy coverage for private areas be accepted and mandated within relevant DCP provisions. This together with the contribution of green roofs and other shrub and groundcover planting areas on the podium levels of new buildings should further boost the overall urban greening. The extent of this other supplementary planting is currently unknown and therefore cannot be commented on definitively. It is believed that 15% is a reasonable and achievable target
- Although 25% is a good target to achieve numerous studies and other policy documents espouse that 30% canopy is needed to achieve the greatest benefits for the community and this aspirational target should drive the Precincts canopy coverage targets. Figure 3.05 highlights how a more aspirational >28% can be achieved across the Precinct.

The key tree planting recommendations to help to achieve the desired 28% canopy coverage include:

Park

- Use and position of large scale trees which make use of the open space and can thrive with little conflict from surrounding infrastructure and services.
- Use large scale deciduous trees to the north, east and western sides of the park to allow for summer shade and winter sun
- Limit use of small scale trees where possible

Private

- Where possible retain existing high retention value trees
- Enforce a 15% canopy coverage which can be achieved in setbacks, on podiums and within courtyards.
- Provide large shade trees at the corner of Parramatta Road adjacent the rail corridor

Streets

- Use large scale trees in 'through site links'. These short areas are to be considered as achieving almost 100% covered canopy with large trees in the centre and smaller trees staggered and scattered either side of these central avenues of trees.
- Use large scale trees on Leicester Avenue but set back from the road to make use of the development setbacks for future growth potential both above and below ground and limit vehicle impacts to the trees.
- Extend street tree planting to the north and south ends of Leicester Avenue from that proposed in the Ethos Urban plan.
- Reinstate trees on both sides of Hilts Road
- Utilise large scale trees in 'landmark' locations to establish canopy and to implement a sense of character and identity for the precinct.
- Install trees to the north west of Cooper Street
- Underground all power and utility services

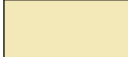


Figure 3.03 Where space permits, large scale trees should be planted to achieve optimum canopy coverage (Image: Arterra)



Figure 3.04 Large scale trees can thrive when given the space. Park trees are one of the most efficient and effective ways to achieve canopy coverage within a precinct (Image: Arterra)

ARTERRA - PROPOSED CANOPY COVERAGE

	Site Area	Total Area (m ²)
	Street	17,920
	Park	2,852
	Private	39,264
	Total	60,036

	Site Area	Canopy Coverage (m ²)	% of Area
	Street	9,296	52%
	Park	2,222	78%
	Private	5,890 *	15%*
	Total	17,408	29%

* Assumes a minimum of 15% canopy coverage for private development areas



Figure 3.05 Arterra Proposed Canopy Coverage Plan (Image: Arterra)

3.03 Key Recommendations and Actions

The following summarises the key opportunities and initiatives to achieve and increase the canopy coverage within the Strathfield Triangle precinct.

- Ideally exceed, the currently targeted 25% canopy coverage within the precinct in favour for a more aspirational 28% coverage which is likely to achieve a greater health and environmental benefit.
- This can be done by setting and achieving the following targets of:
 - 50% canopy to streets
 - at least 75% to parks and other open public spaces,
 - and at least a 15% cover to private property (which should be mandated under a suitable DCP landscaping control).
- Retain and protect the most significant trees in the precinct where feasible, and incorporate them as mature elements within the proposed landscape. They can provide an excellent framework for the future park and other green spaces.
- Recognise that mature trees require space around them to protect their root plates and therefore it will be necessary to minimise buildings, level changes or service trenching through any areas retaining large trees.
- Take an holistic view to new street profile design to work new and existing trees in as one of the core elements of the design, not an after-thought. Space above and below ground is the key. Consider final sizes of the root plate, trunks, trunk flares and canopy, particularly around any existing or new large or civic scale trees.
- Incorporate new and existing trees into verge gardens and lawn areas, wherever possible, to allow the maximum space for the trees trunks and structural roots to expand and allow infiltration of air and water into the root zones. Direct surface water and runoff towards the existing and new trees to passively irrigate the trees in an ever-warming climate.
- Utilise trees for supplementing wind amelioration, by understanding the most desirable forms, sizes and densities of tree canopy in any given location. From experience and wind modelling, medium to large trees with a dense canopy are probably more important than small trees for wind amelioration.

3.04 DCP Provisions

The following are proposed specific Urban Canopy Cover DCP provisions that should be adopted for the Strathfield Precinct. Many of these will also contribute to the realisation of other objectives and requirements.

1. Any existing trees identified and proposed to be retained are to be assessed and then protected as per the requirements outlined in the Australian Standard 4970 – Protection of Trees on Development Sites.
2. Overhead power lines and communication cables are to be undergrounded within all streets servicing the Precinct to remove the current conflict between overhead cabling and existing and proposed trees. If existing trees occur within the planned undergrounding routes then mitigation measures shall be employed to avoid incursions into the tree(s) calculated Tree Protection Zones, as defined under Australian Standard 4970 – Protection of Trees on Development Sites. Where this cannot be reasonably accommodated, alternative methods of construction should be used such as under-boring, directional drilling or non-destructive trenching to install the cabling without impact to the trees' health or stability.
3. A minimum of 15% projected canopy coverage shall be achieved for all private land (non-public) developments. This shall be measured as the projected square metre canopy from the trees using reasonable estimates of the mature size of the chosen trees. Coverage may include trees planted at ground level as well as any trees planted in upper levels of buildings, such as podiums. It may also include any canopy overhanging from an adjoining public domain area. A tree shall be as defined by City of Canada Bay's LEP.
4. A minimum of 50% projected canopy coverage shall be achieved for all streets and laneways, unless it can be clearly demonstrated that it is unreasonable to meet this requirement from an urban design outcome and only in a specific instance.
5. A minimum of 75% projected canopy coverage shall be achieved for all parks.
6. Tree species selection for the public domain shall be as per the proposed tree species list prepared by Council. Small trees shall only be used where it is unreasonable to install a larger tree. This is to avoid the use of small trees where the space clearly exists for a larger tree to be planted.

7. Planting throughout the Precinct shall typically aim for a balance of tree sizes with the following proportion of trees, by number:
 - 10% civic (extra large trees) (ie. greater than 25m in spread and/or height)
 - 25% large trees (ie. greater than 15m in spread and height)
 - 45% medium trees (ie. greater than 10m in spread and height)
 - 20% small trees (ie. less than 10m in spread and height)
8. When planted within a potentially constrained soil environment (eg. on-structure or where other subsurface conditions would be expected to constrain root development and available rooting volumes) all trees are to be planted in accordance with the soil volume requirements below. If planted within a paved area, the tree should be planted within a well-designed and designated tree pit with sufficient soil volumes and drainage to prevent excessive infrastructure damage or premature tree failure and poor conditions in the future. When planting new trees within pavement areas or restricted areas the soil volume should be sufficient to enable the tree to reach its mature size in a healthy full state. To survive indefinitely a mature tree requires a minimum of 0.6m³ of soil for every m² of projected canopy area. As a guide, for trees that are likely to achieve the following canopy spreads, they should be provided with the following soil volumes as a minimum:-
 - 4m spread needs approx. 8-10m³ of soil
 - 6m spread needs approx. 20-25m³ of soil
 - 8m spread needs approx. 30-40m³ of soil
 - 10m+ spread needs approx. 50-70m³ of soil
9. The above guidance is in a normal street / landscape setting. The needs per tree can be marginally reduced if the trees can share soil volume with other adjoining trees or if the soil is subject to regular irrigation. In order to provide these volumes it may be necessary to consider the following strategies:-
 - Use of expanded sized tree pits / planting areas
 - Use of structural soil systems (structural soils or plastic support mechanisms)
 - Use of 'vaulted' soil pits with pavement bridging over the root zones
10. All new street trees to be planted where possible are to be located a minimum of 800mm from the face of adjoining road kerbs or parking lanes with a distance of 1000-1200mm preferred.



Figure 3.06 Dense canopy coverage to be achieved within the proposed central park. Civil scale trees to be used (Image: Arterra)

3.05 Power Line Management

One of the greatest challenges with creating urban canopy coverage is the competition for space with other forms of infrastructure. Overhead power lines and the need for clearance pruning significantly effects the trees that can be planted and often results in misshapen, unhealthy and significantly damaged trees.

It is important, as part of the new development, that all power is undergrounded to allow for larger canopy trees to establish without the need for future clearance pruning. As shown in Figure 3.07 and 3.08 below, this precinct has many examples of trees that have been heavily pruned for powerline clearance, including the trees planted as part of the most recent apartment developments.



Figure 3.07 Example of a tree that has been planted in Cooper Street as part of the new apartment developments that has been heavily pruned for power line clearances (Image: Arterra)



Figure 3.08 Example of a tree on Leicester Avenue that has been heavily pruned for power line clearances (Image: Arterra)



Figure 3.09 Example of street tree planting with no overhead powerlines that creates an overarching canopy over the street and mitigates the scale of the adjacent urban large scale development (Image: Arterra)

4.0 IMPLEMENTATION AND OTHER TREE MANAGEMENT RECOMMENDATIONS

4.01 Overview – Trees are a Long Term Commitment / Living Things

Trees are long term assets and investments that normally live for between 50 to 150 years, so species selection is vitally important. In contrast, most residents will only occupy their houses or units, on average, for a 5-15 year period. We must consider ourselves long term stewards of the trees and not bow to short term pressures or individual whims.

Trees are one of the most prominent, visible and longest lasting items in the final Precinct development. If designed and installed correctly they should last 80-100 years and have the potential to provide a lasting character to the Precinct. Some of the other important things to consider are the urban uses of the spaces and the benefits that trees have to offer. Trees are:

- what people see and one of the things residents and business people interact with the most,
- what people want to see within the Precinct,
- are vital for micro-climate control, comfort, health and business economics,
- elements that set the design and aesthetic character of the Precinct, and
- one of the only living and, time changeable, things within the project.

A key part of the urban canopy initiatives being proposed is to:

- Retain and protect the few existing good value trees that are present
- Implement and maintain a diversity of species, sizes and age classes
- Implement smart collection, storage and use of the water resources and prioritise its use in sustaining the green infrastructure and tree canopy.
- Ensure soil volumes are always provided to support healthy trees and sustainable greening generally.
- Utilise proven, hardy and dependable species selection and that are climate change ready
- Utilise species that continue and transpire during heat waves to maximise tree cooling benefits



Figure 4.01 Trees are a long term asset and if cared for appropriately can offer the precinct many benefits for residents (Image: Arterra)

4.02 Climate Change

The United Nations describes climate change as the defining issue of our time. Climate change poses a serious risk to the people of Strathfield and should be treated as a national emergency. Average global temperatures have increased by 1°C above pre-industrial levels, with significant consequences and impacts. Any rise above 2°C would have devastating impacts on Australia, including;

- more extreme weather events
- reduced rainfall
- longer, hotter and more frequent heatwaves
- water scarcity
- more extreme bushfires
- increased risks to food production
- reduced biodiversity
- inundation of coastal areas.

As Australia's climate changes over the next 50-100 years, the species of trees and plants used in our city today may not be suited to the range of conditions presented by the new climate. Research has found that Sydney's climate would be more like Grafton by 2050.

Some species are more vulnerable than others to our future climate and trees that we have used in the past may not be the best selection moving forward. Exact tree choices will also depend greatly on microclimatic influences and the amount of soil and water that is available to the plants.

It is expected that potential water use restrictions and lower than average rainfalls that Sydney has previously periodically experienced will continue and potentially worsen into the longer term. Street and other trees that are selected will need to be capable of surviving an average drought period, in reasonable condition, without reliance on potable water supplies.

Passive irrigation through the use of Water Sensitive Urban Design must be designed into many of the new tree planting areas and will assist with additional water being available to trees in times of drought and during normal times.

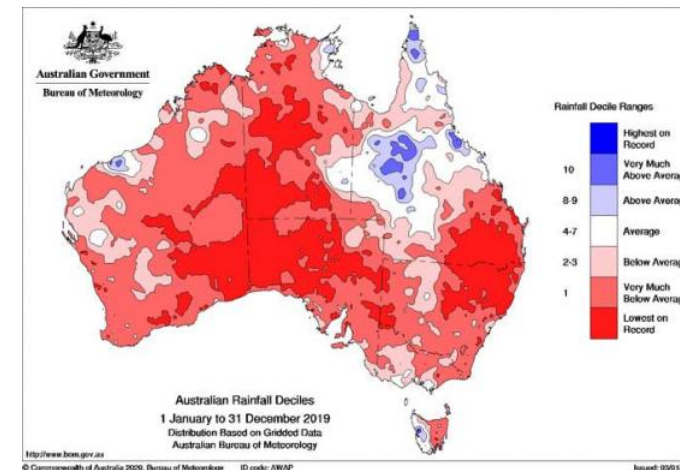


Figure 4.02 Australian rainfall decline map - 2019 (Image: Australian Bureau Meteorology - 30/01/20)

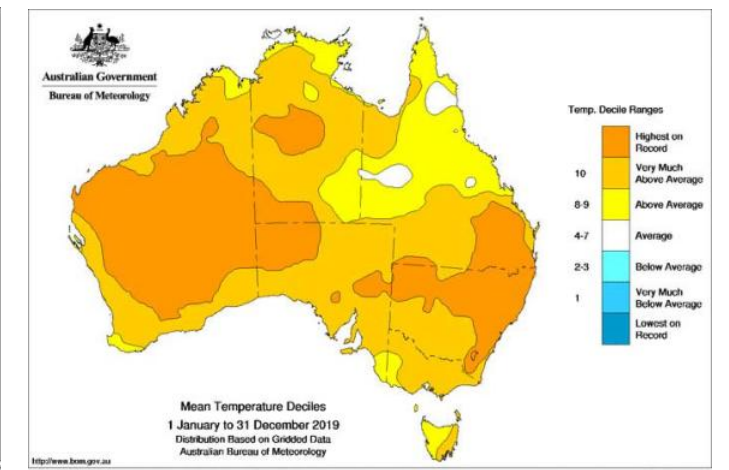


Figure 4.03 Australian mean temperature decline map - 2019 (Image: Australian Bureau Meteorology - 30/01/20)

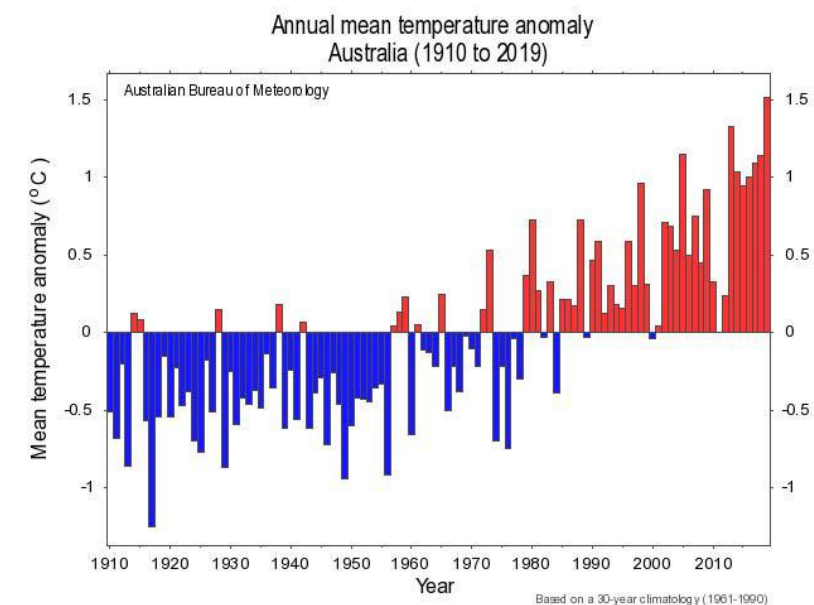


Figure 4.04 Australian annual mean temperature anomaly - 2010-2019 (Image: Australian Bureau Meteorology - 30/01/20)

4.03 Species Selection & Diversity

Selection of appropriate trees means finding the right tree species, for the right location with the right space and growing conditions.

A key principle of a sustainable urban forest is an appropriately diverse mix of species – both native and exotic. This reduces the risk of loss should one species be susceptible to a new pest or disease. Diversity of tree species also provides benefits for biodiversity, aesthetic reasons, improves resilience and the provision of summer shade and winter sun. As we move into more uncertain times with regard to climate it is vital that any new tree planting considers proven past performances and potential resilience to the rigours of urban existence, climate change and a changing landscape of pests and diseases. Unfortunately trees are living things and can grow in unexpected ways in response to their environment and also be susceptible to environmental stresses, pests and diseases and extreme weather events. They will progress through stages; semi-mature to mature and then eventually decline and have to be replaced. In an urban context, it is also reasonable to expect that trees will be effectively and actively managed.

As they are living things, trees have to grow to survive. In doing so, all trees will have to, at various times, shed fruit, leaves, bark and even occasional branches. This is part of normal tree growth and must be accepted for all the other intrinsic benefits that they provide.

Ultimately the selection of trees for a complex urban space is notoriously difficult, but it is also one of the most critical components of the project. There are many competing interests, personal opinions, political interference, desired characters and design challenges.

Proper selection of trees is most dependent on the physical environment that is able to be provided for the trees, which includes the:

- intrinsic climate;
- consideration of the microclimatic conditions (eg. overshadowing, wind funneling, radiated heat);
- soil type and the volumes that can be provided;
- provision or ability to supply supplementary watering and passive irrigation;
- expected longevity of the trees;
- proposed maintenance regime that may be applied to the tree and their surroundings.

Trees are also living things and will not always behave or grow the way we often expect them to. Most, however, will have an intrinsic genetic predisposition to a certain size, shape and habit. Then there are the influences outside anyone's real control such as:

- the occurrence of unexpected pest, disease or insect attack;
- soil borne problems such as fungal and other pathogens;
- failure of drainage systems or the irrigation infrastructure; and
- climate change considerations.

Most times, the selection is always a compromise between numerous competing issues and there is no absolute correct or wrong selection. Knowing your tree and what it will do in the future will help to reduce future problems.

As we have indicated, the design and specification of appropriate soil infrastructure is very important for the success of any tree planting. The ideal species for planting may be selected, but without appropriate soil volumes, available water and nutrition the tree's success may be very limited.

The capacity of trees to establish and grow successfully must also depend on the environmental conditions at the planting location being within the tolerance range of the species selected. We must remember, unlike any other street infrastructure, trees are living organisms. They need to grow to survive and their behaviour is not always completely predictable or consistent. Being a living thing they:-

- will typically all need to shed leaves, bark, fruit, and flowers;
- can be easily damaged and vandalised (particularly when young);
- will, respond in various ways to the natural prevailing conditions; and
- can be severely affected by unexpected pests and diseases that can kill, disfigure or increase the stress on the trees.

No tree can be perfect. It will always be necessary to find the "best" fit for certain circumstances and to come to a compromise between the needs of the tree, the desires of the community, the design intent and the way in which the tree interacts with the urban environment over its life time.

The following are the most desirable tree characteristics for the different objectives of the Strathfield Triangle Precinct:

Landmark and Civic Trees

- Need to be relatively unique.
- Need to be relatively large and visually prominent.
- Need to be commercially available and long lived and ideally relate to Strathfield's sense of place.

Street Trees

- Need to be naturally high branching and 'vase' shaped to provide views and clearances.
- They should be naturally attractive and offer some features that the average citizen can relate to and appreciate.
- Provide a good level of shading during hotter months.
- Facilitate some winter sunlight (hence there needs to be some deciduous trees)
- It is our recommendation that the precinct develops a multi-species, but aesthetically complementary street tree selection.

This will:

- Improve resilience and diversity.
- Spread the risks of climate or pest related failures.
- Allow for better and more suitable supply options and stock quality.
- Provide varying and seasonal interest at various times throughout the year.
- Appeal to a wider cross-section of the community.

Park Trees

- Need to be large scale civic trees to make use of open space areas with no infrastructure and services conflicts
- Should avoid the use of small trees where possible to maximise large tree planting
- Facilitate some winter sunlight with the planting of deciduous trees to the north and west of the park

The following is an indicative species plan for the Strathfield Triangle Precinct.

ARTERRA - INDICATIVE SPECIES SELECTION

- 

Existing Trees to be Retained
- 

Ficus rubiginosa (Port Jackson Fig)
- 

Syncarpia glomulifera (Turpentine)
- 

Refer to species schedule for recommended park trees
- 

Lophostemon confertus (Brush Box)
- 

Waterhousea floribunda 'Green Avenue' (Weeping Lilly Pilly)
- 

Ulmus parvifolia 'Todd' (Chinese Elm)
- 

Syzygium paniculatum (Brush Cherry)
- 

Harpullia pendula (Tulipwood)
- 

Zelkova serrata 'Green Vase' (Japanese Zelkova)
- 

Corymbia eximia (Yellow Bloodwood)
- 

Acmena smithii (Creek Lilly-Pilly)
- 

Fraxinus pennsylvanica 'Urbanite' (Red Ash)
- 

Glochidion ferdinandi (Cheese Tree)
- 

Pyrus calleryana 'Chanticleer' (Callery Pear)
- 

Prunus cerasifera 'Nigra' (Purple-leaf Cherry Plum)



Indicative Park Species

Tree Species	Common Name	Size Class
<i>Angophora costata</i>	Smooth-barked Apple	Large
<i>Corymbia maculata</i>	Spotted Gum	Large
<i>Eucalyptus paniculata</i>	Grey Ironbark	Large
<i>Ficus rubiginosa</i>	Port Jackson Fig	Large
<i>Syncarpia glomulifera</i>	Turpentine	Large
<i>Quercus cerris</i>	Turkey Oak	Large
<i>Quercus phellos</i>	Willow leafed Oak	Large
<i>Brachychiton discolor</i>	Queensland Lacebark	Medium
<i>Glochidion ferdinandi</i>	Cheese Tree	Medium
<i>Melaleuca styphelioides</i>	Prickly Paperbark	Medium
<i>Tabebuia impetiginosa</i> (syn. <i>T. palmeri</i>)	Pink Trumpet Tree	Medium
<i>Waterhousea floribunda</i> 'Green Avenue'	Weeping Lilly Pilly	Medium
<i>Zelkova serrata</i> 'Green Vase'	Japanese Zelkova	Medium
<i>Backhousia myrtifolia</i>	Grey Myrtle	Small
<i>Callistemon salignus</i>	Willow Bottlebrush	Small
<i>Elaeocarpus eumundi</i>	Eumundi Quandong	Small
<i>Elaeocarpus reticulatus</i>	Blue Berry Ash	Small
<i>Lagerstroemia indica</i> cv.	Crepe Myrtle	Small

Figure 4.05 Indicative Proposed Tree Species Plan (Image: Arterra)

4.04 Transpiration & Shade

To achieve the greatest urban canopy benefits the trees that are proposed need to be selected for their positive contribution to shade provision and evapotranspiration.

Ideally, virtually all the trees that are chosen need to provide a very positive contribution to summer shading. This will usually require the trees to have very good canopy spread and relatively dense foliage. Conversely, it means that very high branching trees or trees with naturally less dense foliage should be avoided. For example trees such as *Corymbia citriodora* (Lemon-scented gums), *Eucalyptus pilularis* (Blackbutt) or *Eucalyptus punctata* (Grey Gum) would not be the most suitable choices of trees. Experience in similar environments has also shown that these trees typically perform poorly due to inadequate soil conditions, overshadowing and winds. They are also species commonly susceptible to sudden limb failures when they age.

Similarly, it is important that the trees chosen provide very good transpiration rates, particularly during summer and prolonged heatwaves. Some Australian native trees such as most Eucalypts (as noted above) are not very good in this respect. They survive heatwaves and drought conditions by essentially 'shutting down' their photosynthetic processes during the heat of the day, and thereby conserving moisture. This means that they are able to survive in very dry conditions but do not contribute to urban cooling. Our recommendation is to favour trees from more littoral rainforest conditions and exotic deciduous trees that actively continue to transpire during hot conditions and therefore make maximum contribution to keeping the area cool during heatwaves. Such species include Figs, Syzygium, Waterhousea, Harpullia and Quercus. In doing so, however, it becomes essential that good soil conditions and passive irrigation is achieved.

4.05 Winter Sun – Deciduous Trees are Needed

Choosing trees with good foliage density and shade provision will also be important to ensure that the streets, park areas and residential developments also receive adequate sunlight and light during the cooler months. For this reason it is also very appropriate to include exotic deciduous trees within the species used. These trees often provide excellent shade during the summer and then lose their foliage in winter and allow sunlight to the ground level and adjoining residential apartments. We have suggested an alternating pattern of deciduous and evergreen trees to most of the streets. This allows winter sun while still keeping a green character and visual softening to the adjoining apartments and built forms. This means that the street and parks will be more desirable and usable during the cooler winter months.

In the park design, some large scale deciduous trees should be located on the northern, eastern and western side of the park, utilising species of a size and scale not usually available to be used in smaller streets and road verges.

The use of deciduous trees also allows the community to engage with and understand the passing seasons.

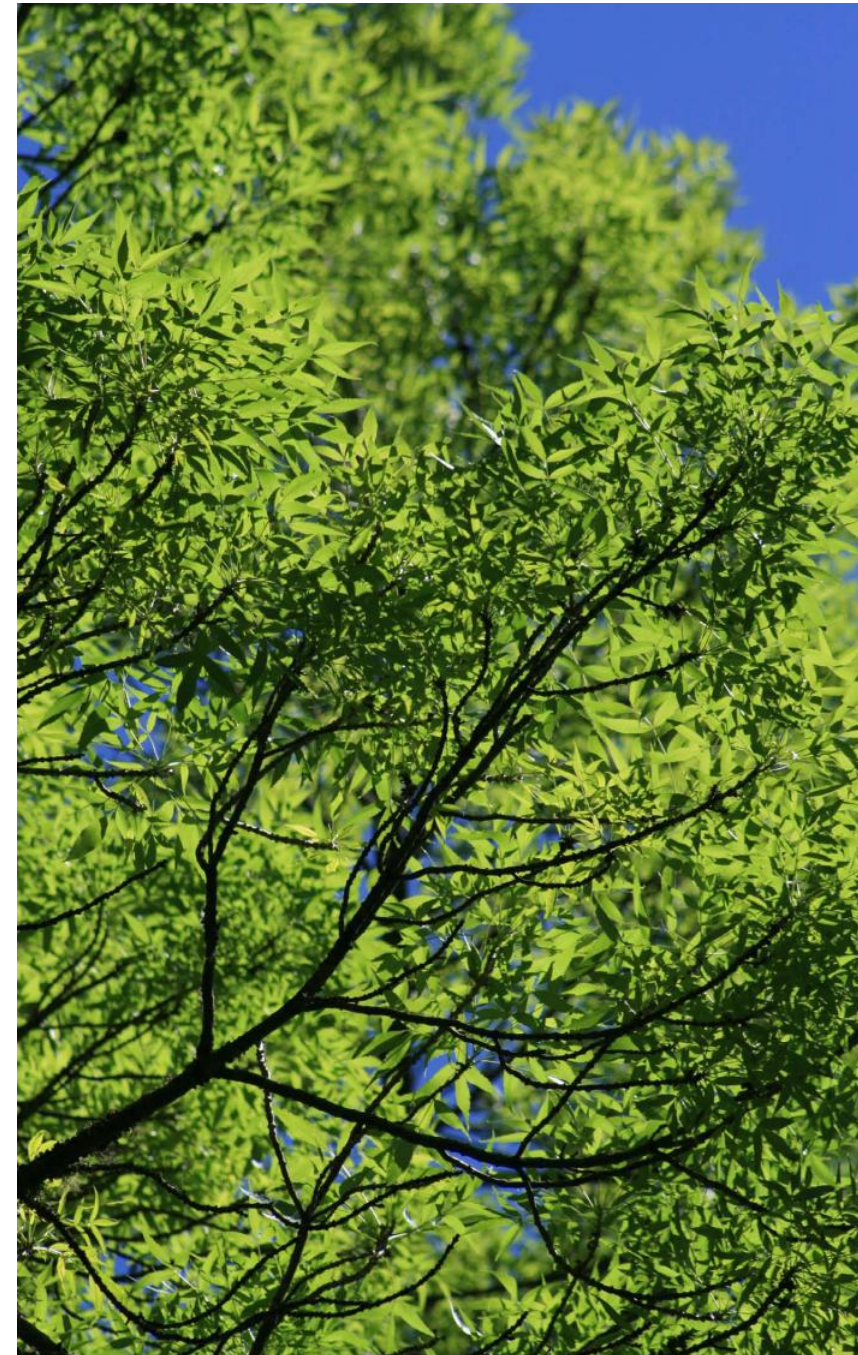


Figure 4.06 Deciduous trees offer winter sun and summer shade (Image: Arterra)

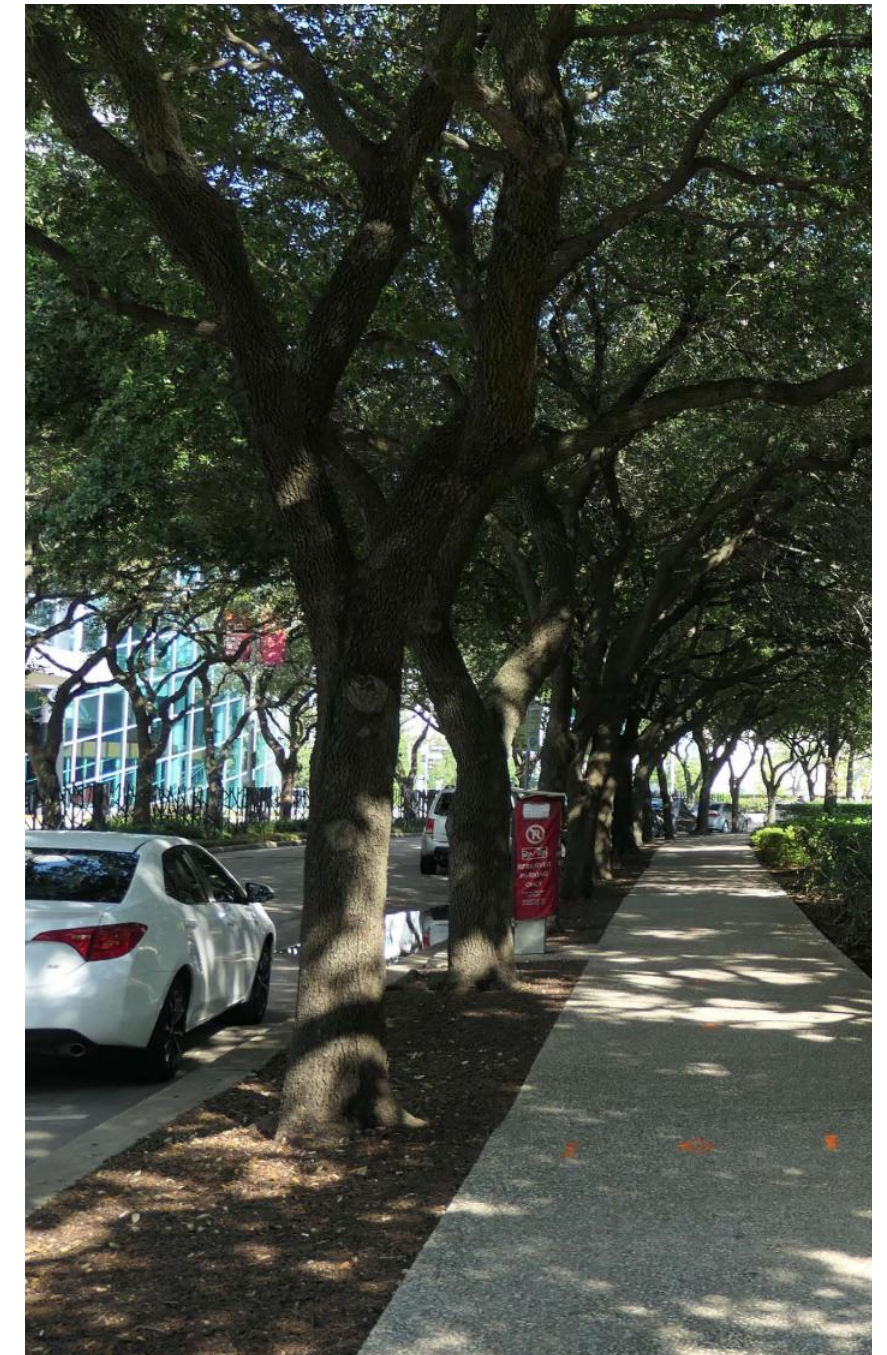


Figure 4.07 Shade provision and evapotranspiration offers significant cooling to surrounding environments (Image: Arterra)

4.06 Proven Performers

The suggested trees proposed for Strathfield Triangle precinct also need to be reliable street and urban trees. They need to be available and able to be grown by commercial nurseries in numbers to achieve the desired outcomes and allow developers and Council to secure them when needed. The listing and proposed tree planting master plan provided within this report is believed to be a balanced list that contributes to the achievement of the numerous objectives while also utilising hardy and well proven tree species.

It also contains species that are believed appropriate for a changing and warming climate into the future.

4.07 Form and Scale

The changes proposed for Strathfield Triangle precinct will result in some large and tall built forms. It is important that the tree population appropriately responds and addresses this new outcome.

We recommend the selective use of some larger and tall growing tree species. This will help screen and soften the built forms and reduce the feeling of being overshadowed by large buildings. Selective use of these types of trees will help to mitigate the scale of the apartments and will help to provide views of greenery even many storeys above street level. They can also provide very useful landmarks and signature trees that help way finding and legibility within the landscape.

Similarly appropriately spaced and positioned civic trees such as Figs and large Oak trees can provide useful and wonderful landmarks, legacies and long term canopy cover for all to enjoy well into the next century. These again help to counteract the scale of the adjoining developments while creating human scaled spaces and enclosure at ground level.



Figure 4.08 Civic and large scale trees should be implemented to help reduce the scale of the surrounding large scale developments (Image: Arterra)

4.08 Wind and Overshadowing Impacts on Trees

It is important to note that this report is addressing a broad scale planning proposal and detailed design and consideration about the exact tree species and their positioning is yet to be resolved. The following broad comments and observations, however, are made about wind impacts and overshadowing in high density residential environments.

Obviously extreme wind tunnelling and downdrafts, particularly when it is relatively constant, can have a great affect on the ability to install and establish good trees. The smaller and the more fragile the tree species the more it may struggle. The following points should be considered during detailed designs of the precinct.

- Focus on appropriate tower and building designs and use of higher level awnings and other deflection devices that will help deflect and mitigate the impacts of wind on trees, particularly of downdrafts.
- Give preference to use of hardy evergreen trees that naturally grow in littoral rainforest and/or frontline coastal environments that are more tolerant of exposure to winds and overshadowing by other plants (for example *Glochidion ferdinandi*, *Harpullia pendula*, *Waterhousea floribunda* 'Green Avenue', *Elaeocarpus eumundi*, *Syzygium paniculatum* are tolerant of such environmental conditions).
- Give preference to use of other trees that have proven to survive in CBD wind tunnelled streets in Sydney (e.g. *Livistona australis*, and *Pyrus calleryana*)
- Install trees at very advanced sizes (ie. minimum 400-800L) so that they have some inherent strength, age and rigidity to mitigate and deal with more adverse environmental conditions.
- Where wind or overshadowing is expected, avoid trees with very fine or very broad foliage or long brittle branching structures or that are not good at tolerating deep shade or excessive winds (e.g. *Eucalyptus sp.*, *Corymbia sp.* *Caesalpinia sp.* and *Gleditsia sp.*)
- Provide excellent soil and subsurface growing conditions so that the trees that are planted are provided with optimum conditions and therefore are more resilient and not as susceptible to being stressed by other factors, other than the wind impacts and/or lower than average light levels.
- Provide a diversity of species in very tough locations, so that if one species struggles, others may still prevail and then provide greater protection for the ones not performing. These may then improve with the increased shelter.

It is important to note that most trees develop in environments that are exposed variously to winds. All trees will generally respond to various environmental factors, including wind. Wind is an important aspect for all trees and they are usually well placed to deal with even strong winds. Typically wind action induces developmental changes in a trees' physiology - generally resulting in a more compact form, with increased stem taper, shorter branches and smaller leaves. It also induces changes in root morphology, as often root mass and root branching are increased on the windward sides to improve anchorage. There is no significant physiological change in plants with wind speeds less than 1-2m/s. Affects from wind on trees, however, will increase in magnitude and severity the greater the wind velocity that is regularly experienced by the tree.

In practice there is no precise wind speed limits or targets that can be realistically and definitively applied to the tree planting. The following points, however, outline some guiding principles.

- Trees are naturally adapted to wind prone environments.
- Some exposure to wind can actually be good for trees, changing their morphology to create more stability and greater root development.

- In particularly wind prone areas, designers should avoid choosing trees with large or easily-damaged leaves or those are known to have brittle branch structures.
- Trees should be planted in appropriately considered and spaced groupings, with a variety of ages and sizes to maximise dispersion of wind and creation of multi-directional turbulence.
- Good soils and root environments often greatly help trees survive better if they are placed under artificially windy conditions.
- Attempts should be made to protect smaller and younger trees from excessive winds using existing larger trees or other architectural devices or deflectors.

Trees that often respond well to windy conditions typically have:

- Naturally stronger and dense wood production.
- Strong, and well attached, but flexible branches.
- Good spreading root systems or a 'tap root' oriented system with lateral and sinker roots. (eg. *Araucaria*)

Some of the species specifically mentioned in current literature that are good at dealing with windy environments, and that are relevant to this precinct may include:

- *Lagerstroemia sp.* (Crepe Myrtle)
- *Ficus rubiginosa* (Port Jackson Fig)
- *Banksia integrifolia* (Coastal Banksia)
- *Tristaniopsis laurina* (Water Gum) (the straight species, not the 'Luscious' cultivar)

A list of the preferred proposed tree species is provided in Table 4. It is considered that enough scope exists within that listing to choose suitable urban trees that will tolerate the variety of conditions likely to be faced in Strathfield Triangle precinct.

Table 04 - Recommended New Tree Selection Schedule - Strathfield Triangle

Family	Genus	Species	Common Name	Potential Height Reached in Street	Ultimate Size Class	Typical Ultimate Canopy Extent (Canopy Cover)	Native/ Exotic/ Indigenous	Evergreen/ Deciduous	Comment or Usage
MYRTACEAE	<i>Angophora</i>	<i>costata</i>	Smooth-barked Apple	12-20m	Large	175m2	Indigenous	Evergreen	Only where above and below ground space permits
MYRTACEAE	<i>Angophora</i>	<i>floribunda</i>	Rough-barked Apple	12-20m	Large	175m2	Indigenous	Evergreen	Only where above and below ground space permits
MYRTACEAE	<i>Corymbia</i>	<i>maculata</i>	Spotted Gum	18-25m	Large	175m2	Native	Evergreen	Only where above and below ground space permits
MYRTACEAE	<i>Eucalyptus</i>	<i>botryoides</i>	Bangalay	18-25m	Large	175m2	Indigenous	Evergreen	Only where above and below ground space permits
MYRTACEAE	<i>Eucalyptus</i>	<i>globoides</i>	White Stringybark	15-20m	Large	175m2	Indigenous	Evergreen	Only where above and below ground space permits
MYRTACEAE	<i>Eucalyptus</i>	<i>paniculata</i>	Grey Ironbark	20-25m	Large	175m2	Indigenous	Evergreen	Only where above and below ground space permits
MYRTACEAE	<i>Eucalyptus</i>	<i>resinifera</i>	Red Mahogany	15-20m	Large	175m2	Indigenous	Evergreen	Only where above and below ground space permits
MORACEAE	<i>Ficus</i>	<i>rubiginosa</i>	Port Jackson Fig	15-20m	Large	175m2	Indigenous	Evergreen	Highly recommended for this site-within Park and Landmark locations
FAGACEAE	<i>Quercus</i>	<i>cerris</i>	Turkey Oak	10-12m	Large	175m2	Exotic	Deciduous	Highly recommended for this site-within Park
FAGACEAE	<i>Quercus</i>	<i>phellos</i>	Willow leafed Oak	10-12m	Large	175m2	Exotic	Deciduous	Highly recommended for this site-within Park
MYRTACEAE	<i>Syncarpia</i>	<i>glomulifera</i>	Turpentine	20-25m	Large	175m2	Indigenous	Evergreen	Highly recommended for this site-within Park and Landmark locations
ULMACEAE	<i>Ulmus</i>	<i>parvifolia</i> 'Todd'	Chinese Elm	10-12m	Large	175m2	Exotic	Deciduous	Highly recommended for this site - Only where above and below ground space permits
MYRTACEAE	<i>Acmena</i>	<i>smithii</i>	Creek Lilly-Pilly	10-15m	Medium	78m2	Indigenous	Evergreen	Highly recommended for this site
SAPINDACEAE	<i>Alectryon</i>	<i>tomentosus</i>	Woolly Rambutan	10-15m	Medium	78m2	Native	Evergreen	
CASUARINACEAE	<i>Allocasuarina</i>	<i>littoralis</i>	Black She-Oak	8-12m	Medium	78m2	Indigenous	Evergreen	Highly recommended for this site
MALVACEAE	<i>Brachychiton</i>	<i>acerifolius</i>	Illawarra Flame Tree	15-20m	Medium	78m2	Native	Deciduous	
MALVACEAE	<i>Brachychiton</i>	<i>discolor</i>	Queensland Lacebark	15-20m	Medium	78m2	Native	Deciduous	Highly recommended for this site
ULMACEAE	<i>Celtis</i>	<i>australis</i>	European Nettle Tree	10-15m	Medium	78m2	Exotic	Deciduous	
MYRTACEAE	<i>Corymbia</i>	<i>eximia</i>	Yellow Bloodwood	10-18m	Medium	78m2	Indigenous	Evergreen	Highly recommended for this site
MYRTACEAE	<i>Corymbia</i>	<i>gummifera</i>	Red Bloodwood	10-18m	Medium	78m2	Indigenous	Evergreen	
MYRTACEAE	<i>Eucalyptus</i>	<i>robusta</i>	Swamp Mahogany	10-15m	Medium	78m2	Indigenous	Evergreen	
RUTACEAE	<i>Flindersia</i>	<i>australis</i>	Crows Ash	15-20m	Medium	78m2	Native	Evergreen	
OLEACEAE	<i>Fraxinus</i>	<i>pennsylvanica</i> 'Urbanite'	Red Ash	12-18m	Medium	78m2	Exotic	Deciduous	Highly recommended for this site
EUPHORBIACEAE	<i>Glochidion</i>	<i>ferdinandi</i>	Cheese Tree	8-12m	Medium	78m2	Indigenous	Evergreen	Highly recommended for this site
SAPINDACEAE	<i>Guioa</i>	<i>semiglauc</i>	Wild Quince	10-18m	Medium	78m2	Native	Evergreen	Highly recommended for this site
SAPINDACEAE	<i>Harpullia</i>	<i>pendula</i>	Tulipwood	8-12m	Medium	78m2	Native	Evergreen	Highly recommended for this site
MYRTACEAE	<i>Lophostemon</i>	<i>confertus</i>	Brush Box	20-25m	Medium	78m2	Native	Evergreen	Highly recommended for this site
ANACARDIACEAE	<i>Pistacia</i>	<i>chinensis</i>	Chinese Pistachio	7-12m	Medium	78m2	Exotic	Deciduous	
PODOCARPACEAE	<i>Podocarpus</i>	<i>elatus</i>	Brown Pine, Illawarra Pine	15-20m	Medium	78m2	Native	Deciduous	
SALICACEAE	<i>Populus</i>	<i>simonii</i>	Simons Poplar	15-20m	Medium	78m2	Exotic	Deciduous	
ROSACEAE	<i>Pyrus</i>	<i>ussuriensis</i>	Machurian Pear	8-12m	Medium	78m2	Exotic	Deciduous	
FAGACEAE	<i>Quercus</i>	<i>ilex</i>	Holm Oak	12-15m	Medium	78m2	Exotic	Evergreen	
MYRTACEAE	<i>Syzygium</i>	<i>paniculatum</i>	Brush Cherry	8-12m	Medium	78m2	Indigenous	Evergreen	Highly recommended for this site
BIGNONIACEAE	<i>Tabebuia</i>	<i>impeliginosa</i> (syn. <i>T. palmeri</i>)	Pink Trumpet Tree	10-15m	Medium	78m2	Exotic	Deciduous	Highly recommended for this site
MYRTACEAE	<i>Waterhousea</i>	<i>floribunda</i> 'Green Avenue'	Weeping Lilly Pilly	18-25m	Medium	78m2	Native	Evergreen	Highly recommended for this site
ULMACEAE	<i>Zelkova</i>	<i>serrata</i> 'Green Vase'	Japanese Zelkova	10-12m	Medium	78m2	Exotic	Deciduous	Highly recommended for this site
ACERACEAE	<i>Acer</i>	<i>buergerianum</i>	Trident Maple	8-12m	Small	38m2	Exotic	Deciduous	
MYRTACEAE	<i>Angophora</i>	<i>hispida</i>	Dwarf Apple	5-7m	Small	38m2	Indigenous	Evergreen	
MYRTACEAE	<i>Backhousia</i>	<i>citriodora</i>	Lemon-scented Myrtle	7-10m	Small	38m2	Native	Evergreen	
MYRTACEAE	<i>Backhousia</i>	<i>myrtifolia</i>	Grey Myrtle	5-8m	Small	38m2	Indigenous	Evergreen	Highly recommended for this site
PROTEACEAE	<i>Banksia</i>	<i>integrifolia</i>	Coast Banksia	7-10m	Small	38m2	Indigenous	Evergreen	Highly recommended for this site
MYRTACEAE	<i>Callistemon</i>	<i>salignus</i>	Willow Bottlebrush	7-10m	Small	38m2	Native	Evergreen	
MYRTACEAE	<i>Callistemon</i>	<i>viminialis</i> cv.	Bottlebrush	7-10m	Small	38m2	Native	Evergreen	
ELAEOCARPACEAE	<i>Elaeocarpus</i>	<i>eumundi</i>	Eumundi Quondong	10-18m	Small	38m2	Native	Evergreen	Highly recommended for this site
ELAEOCARPACEAE	<i>Elaeocarpus</i>	<i>reticulatus</i>	Blue Berry Ash	8-12m	Small	38m2	Indigenous	Evergreen	Highly recommended for this site
THEACEAE	<i>Gordonia</i>	<i>axillaris</i>	Gordonia	5-8m	Small	38m2	Exotic	Evergreen	
MALVACEAE	<i>Hibiscus</i>	<i>tiliaceus</i>	Coast Cottonwood	8-10m	Small	38m2	Native	Evergreen	
LYTHRACEAE	<i>Lagerstroemia</i>	<i>indica</i> cv.	Crepe Myrtle	8-10m	Small	38m2	Exotic	Deciduous	
ARECACEAE	<i>Livistona</i>	<i>australis</i>	Cabbage Tree Palm	15-20m	Small	38m2	Indigenous	Evergreen	Highly recommended for this site
MYRTACEAE	<i>Melaleuca</i>	<i>linariifolia</i>	Narrow-leaved Paperbark	8-10m	Small	38m2	Indigenous	Evergreen	Highly recommended for this site
MYRTACEAE	<i>Melaleuca</i>	<i>styphelioides</i>	Prickly Paperbark	8-12m	Small	38m2	Indigenous	Evergreen	
ROSACEAE	<i>Prunus</i>	<i>cerasifera</i> 'Nigra'	Purple-leaf Cherry Plum	6-8m	Small	38m2	Exotic	Deciduous	
ROSACEAE	<i>Pyrus</i>	<i>calleryana</i> 'Chanticleer'	Callery Pear	6-8m	Small	38m2	Exotic	Deciduous	
PROTEACEAE	<i>Stenocarpus</i>	<i>sinuatus</i>	Firewheel Tree	8-12m	Small	38m2	Native	Evergreen	
MYRTACEAE	<i>Synoum</i>	<i>glandulosum</i>	Scentless Rosewood	8-12m	Small	38m2	Native	Evergreen	
MYRTACEAE	<i>Syzygium</i>	<i>leuhammii</i>	Riberry	8-12m	Small	38m2	Native	Evergreen	
MYRTACEAE	<i>Tristania</i>	<i>laurina</i>	Water Gum	7-10m	Small	38m2	Native	Evergreen	Highly recommended for this site
MYRTACEAE	<i>Tristania</i>	<i>laurina</i> 'Luscious'	Glossy-Leaved Water Gum	7-10m	Small	38m2	Native	Evergreen	Highly recommended for this site
ARECACEAE	<i>Washingtonia</i>	<i>robusta</i>	Mexican Fan Palm	20-25m	Small	38m2	Exotic	Evergreen	
SALICACEAE	<i>Yulopema</i>	<i>confertus</i>	Yulopema	8-10m	Small	38m2	Exotic	Evergreen	Highly recommended for this site

4.09 Designing For Trees as a Priority

Any tree selection will be directly dictated by the intrinsic climate and soil conditions in which it is to be installed. Critical to this assessment and the associated species recommendations are that the development of the Precinct allows for the creation of a tailored and extremely adequate root zone and quality soils for the proposed trees. Very importantly, this design approach needs to provide for:

- adequate soil volumes for the proposed trees, if numbers and spacing is appropriately considered.
- adequate soil depths and space for roots to grow and develop without excessive interaction or displacement of pavements in the future.
- adequate soil moisture for greater resilience through heat waves and drought periods in our changing climate.
- adequate drainage so trees won't be affected by waterlogging or over irrigation.
- adequate soil quality and soil types to maximise tree root development and assist in the maintenance of healthy trees and retention of nutrients and moisture.

All of the above helps to ensure the proposed trees will be healthy, long lived and resilient to climate impacts and provide the maximum benefits to the development. No one can guarantee that a tree won't be affected by unforeseen climatic extremes or pest and diseases, but healthy trees are certainly better placed to deal with this than trees that have not been provided with optimum growing conditions.

Trees must be given the necessary requirements to sustain life - that is, space, air, water, nutrients, light and soil. To survive all trees must grow, and in doing so will inevitably shed leaves, bark, fruit, flowers and even branches. Their roots will grow and their trunks will expand. The challenge is to select the right tree for the right location within the urban context that maximises the benefits and minimises the negative impacts to residents, infrastructure and road users. Careful planning, innovative design solutions and compromise are always needed when considering trees in a busy and densely populated, urban environment.

Don't over plant for only short term or instant effects. A measured approach to planting should always be adopted to allow future trees to mature with full and symmetrical canopies wherever possible. This generally makes the trees easier to manage in the long term, with better health and the ability to replace them more easily when the time comes. Such forethought often gives the trees more ability to seek adequate resources rather than unnecessarily competing with each other, above and below ground.

One of the key roles of streets is to convey vehicles, pedestrians and utility services throughout the community. While there is often opportunity for tree planting as well, this is not so in all cases. It must be remembered that poor and or inappropriate tree planting may actually detract from a street's function and residents' enjoyment, and potentially create a serious burden on tree management resources both now, and well into the future.

Tree species must be selected so that the ultimate mature size of the tree canopy is appropriate to the particular street or space available and gives appropriate consideration to the site constraints, such as verge width, building and awning alignments and vehicle clearances.

Some of the key considerations will be:

- Street profile designs that accommodate and focus on trees as a key component of the infrastructure.
- Street orientations with care to allow solar access to nearby residents and parks using exotic deciduous trees where appropriate.
- Street hierarchy that utilises species selections and signature trees to define key nodes and help define street hierarchy and way-finding.
- Increased verges and reduced carriage way widths to help reduce the perceived width of road carriage ways to slow and calm traffic through appropriate and measured use of median and blister positioned tree planting.
- Integration of trees within parking lanes.
- Integration of tree planting areas and tree pit design within the bio-retention (rain-garden) and other water quality treatment strategies.
- Undergrounding of power lines to avoid the need for any future clearance pruning.
- Building, basement and street setbacks and provision of deep soil areas. This provides the space for large trees particularly between tall buildings and within the semi public areas. This will help alleviate the visual impact and de-humanising influence of very tall towers.
- Street level gardens to provide interest and delight at street level but also accommodating the provision of wider and longer trees pits and spaces for tree trunks to grow and expand without damage to surrounding infrastructure.

Blister planting can allow tree planting to occur where verges are otherwise too narrow and where there would otherwise be no trees at all in a street. In such instances, they may not have to be regularly or closely spaced, as even a few trees can make a huge difference to how a narrow street or laneway looks and feels, reducing the apparent width of the road carriageway, calming traffic and providing a more aesthetically pleasing and 'liveable' street. This also allows trees to be planted further away from nearby urban developments and residential apartments.



Figure 4.09 Deciduous street trees offering good summer shade and winter sun (i.e. *Ulmus parvifolia*) (Image: Arterra)



Figure 4.10 Large scale civic trees in a park setting to provide extensive canopy coverage (Image: Arterra)

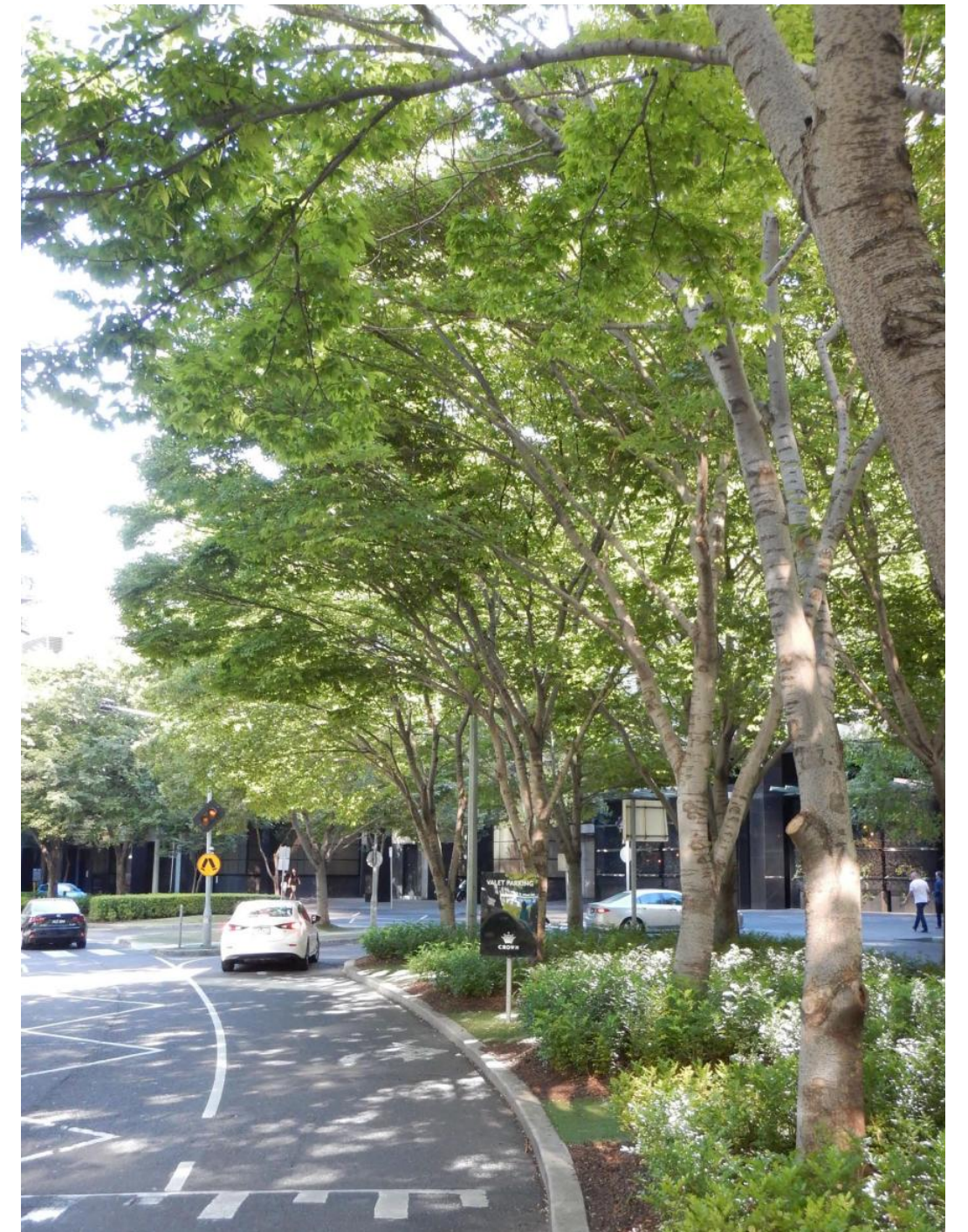


Figure 4.11 Deciduous trees offering good summer shade and winter sun (i.e. *Zelkova serrata*) (Image: Arterra)

4.10 Space & Soil

Tree growth and soil fertility are strongly influenced by intrinsic soil properties, texture and structure. Well constructed and quality soils function like reservoirs, enabling trees to access water, nutrients and oxygen and provide room for roots to readily grow and propagate (Carpani, 2016, Lindsey and Bassuk, 1991). It is also vital that the volume of soil is sufficient to sustain a trees' ultimate needs when fully grown and on a hot summer week. Lindsey and Bassuk have provided a method for calculating tree soil volumes which account for longer term outcomes and resilience, which many other methods do not include in their calculations.

Tree roots typically grow in a shallow and wide plate-like arrangement. They do this to maintain appropriate access to water, nutrients and most importantly oxygen. Roots are microscopic and highly opportunistic and will grow where the conditions are most favourable. If poor conditions arise they will go in search for better environments and resources. It is typically more appropriate to provide wider and shallower rooting areas for new trees. Tree pits with depths greater than 1.2m will typically be wasted as the tree roots will rarely access soils at lower depths. We recommend any new tree pit designs be typically required to achieve soil volumes suitable for the mature tree and have available minimum soil depths of 0.7m-0.8m and no greater depth than 1.2m.

The typical methods to achieve the necessary tree soil volumes in an urban setting include systems such as:

- Vaulted soil pits where the pavements surrounding the trees are suspended above the tree pit soils via suspended and reinforced concrete sub-pavements with supporting isolated piers.
- Structurally supportive plastic matrix systems such as Strata Vault and Strata Cells.
- Gap graded and structurally supportive soils (ie. specifically designed and manufactured aggregate and soil mixes).

The opportunity exists for these systems to be utilised during detailed design of the precinct. Any new trees should ideally be located within planting areas with sufficient space around the base of the trunk to allow for the proper and ultimate expansion of the trunk, root flare and their structural root zones. Soil type, structure and volume are best considered in the design phase, as soils that are placed, once under the pavement, are difficult, if not impossible, to access.

Trees should be planted within a well designed and designated tree planting area with sufficient soil volumes and drainage to prevent excessive infrastructure damage or premature tree failure and poor tree conditions in the future. To survive indefinitely, a mature tree typically requires a minimum of 0.6m³ of soil for every m² of projected canopy area.

Proper spacing of trees and good soil volumes ultimately results in:

- space for the trees (both above and below ground)
- more resilient and healthier trees
- less competition with adjoining trees
- easier tree maintenance and replacement if needed in the future.



Figure 4.12 Structurally supportive plastic matrix systems such as Strata Vault and Strata Cells. (Image: Arterra)

4.11 Tree Supply

Considerable effort and resources can be spent in planting new trees. This considerable effort can be wasted if the tree dies shortly after planting, or if the tree is supplied in a substandard form or condition that may ultimately lead to poor performance or the later development of serious structural defects and poor health. As outlined by authors such as Gilman (Gilman 2012), most tree defects that occur in mature trees were present and identifiable at the time a tree was initially planted. It is therefore essential that the tree and its roots be in optimal condition when delivered and planted.

An important aspect of the implementation of the Strathfield Precinct will be the procurement and specification of suitable nursery stock. Large trees can take 4-8 years to be produced to order. Likewise, as the trees become larger, the numbers that are typically available within nurseries reduces.

All trees should be sourced and supplied as part of suitable plant supply contract and they should conform to the NATSPEC "Guide for assessing the quality of and purchasing of landscape trees" by Ross Clark 2003 and/or AS AS2303 – 2015 Tree Stock For Landscape Use, as a minimum.

4.12 Tree Protection Measures

Existing trees that are large, mature and in good condition can be an important part of the urban tree canopy strategy. It doesn't make sense to remove existing trees and then spend potentially large amounts of money to reinstate the canopy and the resources they already provide. Retaining some large trees also provides instant screening and scale to the new tower developments. For these important reasons alone we have suggested retaining some of the better existing trees within the precinct. In order to do that it is vital that the needs of the trees are respected and that everyone understands the requirements and difficulties in retaining large and mature trees on development sites. Below is a very brief summary of the needs of trees and tree roots.

Space

Large trees will need suitable space left around them to facilitate the retention of their roots and facilitate their ongoing growth and expansion both above and below ground. This is typically known as a Tree Protection Zone and is usually a factor of the size of the trees trunk diameter. To protect a large and mature tree a suitably large tree protection zone radius needs to be demarcated and protected during any development. Typically no level changes, trenching or building should be allowed within this zone. It is also important to consider the impacts of piling equipment clearances and construction period scaffolding around buildings to avoid pruning the canopy and leaving misshapen and impacted trees. Some form of building setback may need to be applied to site that has or adjoins an existing tree to be retained.

Services

One of the hardest things to manage in an urban context with regard to existing trees is services. Traditional trenching to lay or upgrade services such as water, electricity, gas, sewer or telecommunications can have a devastating affect on a trees' roots and lead to its decline. If existing trees are to be retained, then alternative solutions such re-routing services away from the tree may be required or alternatively non-destructive techniques such as underboring may need to be mandated to install services past the trees.

Levels

If existing trees are to be retained, it will be important to ensure the designs around them maintains and protects the existing levels around the tree. Some limited development such as walkways and driveways, and in limited conditions even roads, may be tolerated around an existing tree as long as very considered and detailed level analysis is carried out and suitable ground protection is applied during construction.



Figure 4.13 Important to select tree stock that is of a suitable quality (Image: Arterra)

5.0 CONCLUSION AND SUMMARY

If the urban forest and canopy cover initiatives outlined within this report are supported and implemented, most importantly it will contribute to many worthwhile initiatives:

- Increasing canopy coverage wherever possible thereby reducing greenhouse gas emissions by shading buildings, cars and pavements.
- Mitigating urban heat island effects by reducing ambient temperatures at ground level and improved cooling during extreme heatwave through evapotranspiration.
- Creating more comfortable and walkable streetscapes, thereby promoting liveability and activity.
- Utilising trees to capture and reduce gaseous and particulate pollutants to improve air quality
- Intercepting, storing and ameliorating rainfall runoff and storm water flows.
- Improving biodiversity by advocating an appropriate and diverse mix of tree species throughout the wider precinct and utilising, where sensible, native tree species that provide beneficial habitat and linkages.
- Adapting to climate change by recognising that a gradual change and adoption of potential species that may be better suited to warmer climates and increased heatwave extremes is needed. Also by promoting and readily adopting the use of water sensitive design strategies that will passively irrigate trees wherever possible to allow them to better deal with extremes and future drought conditions.



Figure 5.01 Increasing canopy coverage wherever possible thereby reducing greenhouse gas emissions by shading buildings, cars and pavements. (Image: Arterra)

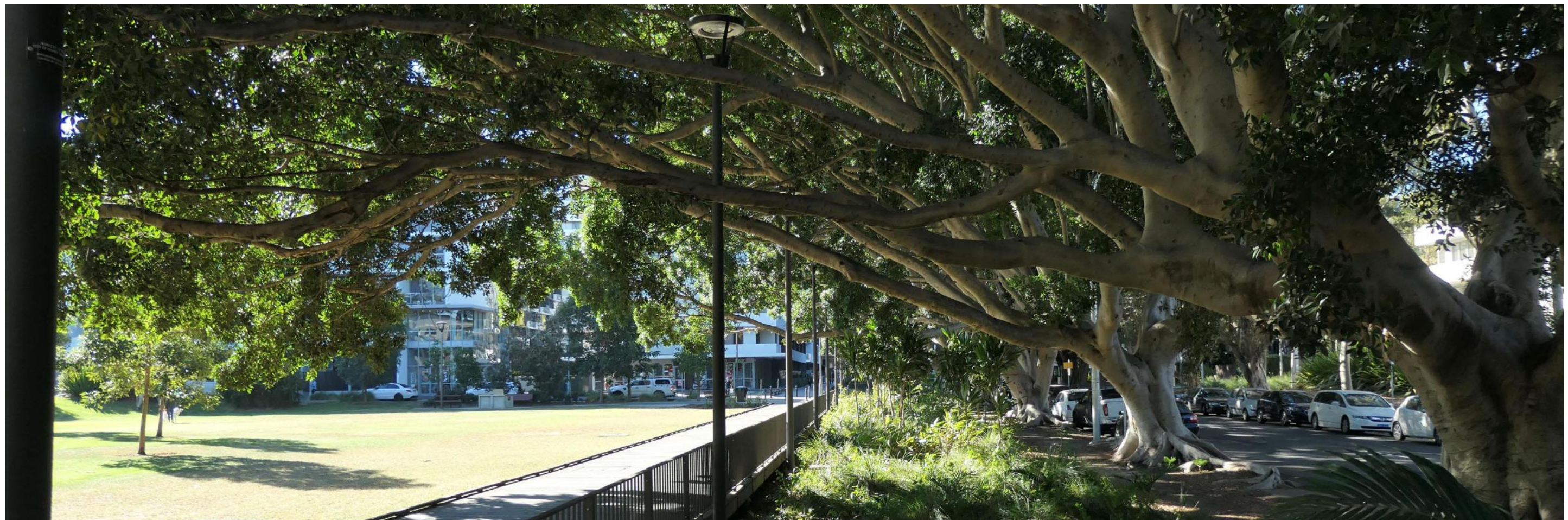


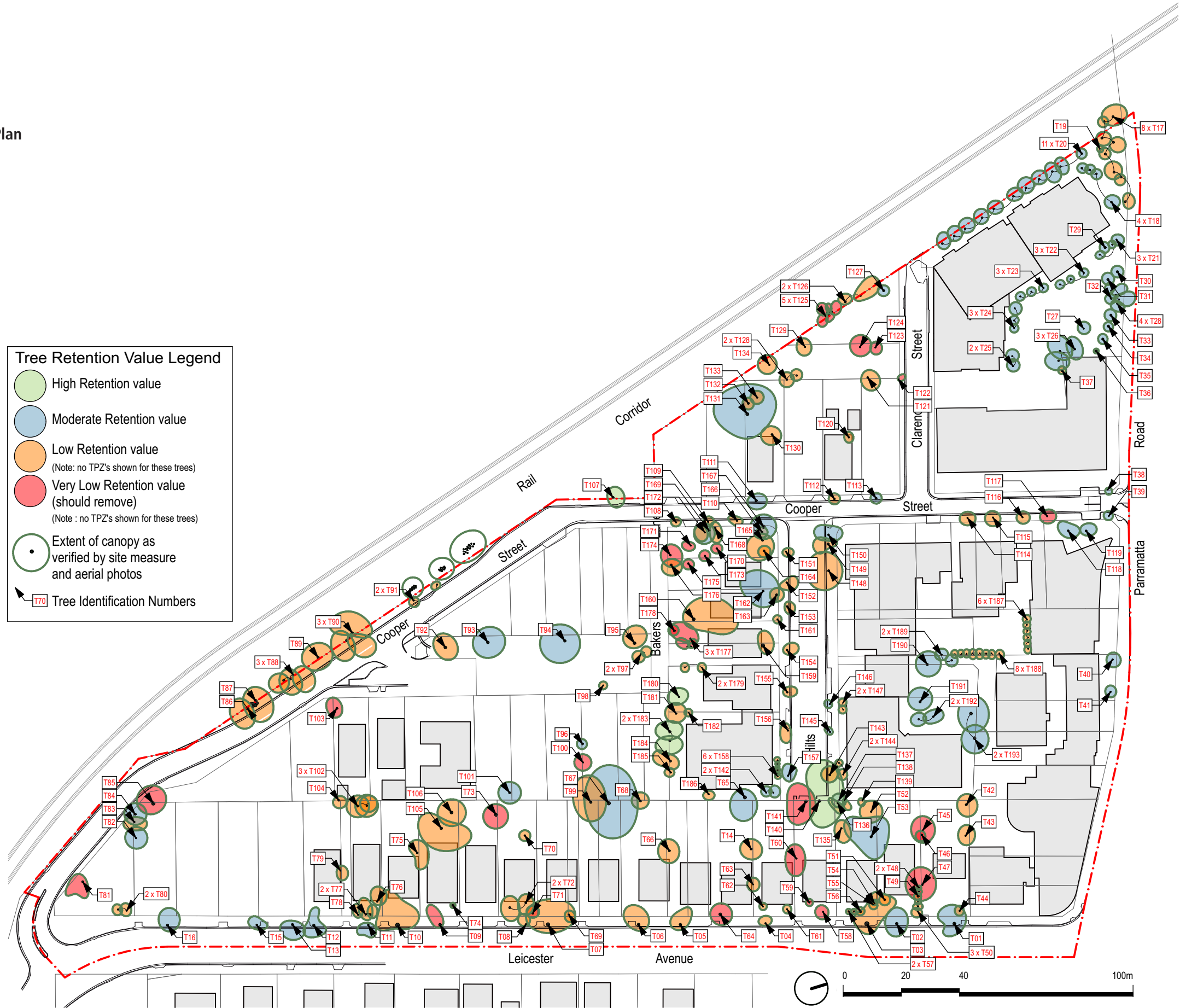
Figure 5.02 Civic scale trees offering extensive shade and canopy coverage to the adjacent open space (Image: Arterra)

6.0 APPENDICES

6.01 References

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6.02 Existing Tree Retention Value Plan



6.03 Existing Tree Assessment Schedule

Strathfield Triangle - Existing Tree Assessment Schedule																					
Tree ID	No. Trees in Group	Tree Species	Common Name	Family	Height (m)	Trunk Diameter at Breast Height (dbh) (m)	Trunk Diameter at base (dgl) (m)	Nominal TPZ radius (m) 12xdbh (AS 4970)	Nominal SRZ radius (m) (AS 4970)	Age Class	Current Vigour	Current Form	Noted Major Defects	SULE Rating	Retention Value	General Comments and Notes	Tree Origin	Ultimate Tree Size	Tree Type	Street/Location	Planning Proposal Recommendation
1	1	<i>Lophostemon confertus</i>	Brush Box	Myrtaceae	9.0	0.70	0.75	8.40	2.93	Mature	Good	Average		Long (>40 years)	Moderate		Native	Medium	Evergreen	Leicester Avenue	Retain
2	1	<i>Lophostemon confertus</i>	Brush Box	Myrtaceae	8.0	0.55	0.60	6.60	2.67	Mature	Good	Average		Long (>40 years)	Moderate		Native	Medium	Evergreen	Leicester Avenue	Retain
3	1	<i>Cinnamomum camphora</i>	Camphor Laurel	Lauraceae	9.0	0.80	1.20	9.60	3.57	Mature	Fair	Poor	Excessively Pruned	Medium (15-40 years)	Low	Extensive epicormic and suckering, massive root flare/bole.	Invasive	Large	Evergreen	Leicester Avenue	Remove
4	1	<i>Tristanopsis laurina</i>	Water Gum	Myrtaceae	8.0	0.20	0.30	2.40	2.00	Mature	Good	Average	Excessively Pruned	Long (>40 years)	Low		Native	Small	Evergreen	Leicester Avenue	Remove
5	1	<i>Lophostemon confertus</i>	Brush Box	Myrtaceae	11.0	0.50	0.60	6.00	2.67	Mature	Good	Poor	Excessively Pruned	Long (>40 years)	Low		Native	Medium	Evergreen	Leicester Avenue	Retain
6	1	<i>Lophostemon confertus</i>	Brush Box	Myrtaceae	9.0	0.50	0.60	6.00	2.67	Mature	Good	Poor	Excessively Pruned	Long (>40 years)	Low		Native	Medium	Evergreen	Leicester Avenue	Retain
7	1	<i>Cinnamomum camphora</i>	Camphor Laurel	Lauraceae	11.0	0.85	0.90	10.20	3.17	Mature	Good	Average	Excessively Pruned	Long (>40 years)	Low	Extensive epicormic. Large pruning wounds.	Invasive	Large	Evergreen	Leicester Avenue	Retain
8	1	<i>Lophostemon confertus</i>	Brush Box	Myrtaceae	8.0	0.40	0.45	4.80	2.37	Mature	Fair	Poor	Excessively Pruned Very Asymmetric Canopy	Medium (15-40 years)	Low		Native	Medium	Evergreen	Leicester Avenue	Retain
9	1	<i>Cinnamomum camphora</i>	Camphor Laurel	Lauraceae	8.0	0.60	0.65	7.20	2.76	Mature	Poor	Poor	Excessively Pruned Very Asymmetric Canopy	Short (5-15 years)	V Low / Remove	Extensive epicormic. Large pruning wounds, dieback.	Invasive	Large	Evergreen	Leicester Avenue	Remove
10	1	<i>Cinnamomum camphora</i>	Camphor Laurel	Lauraceae	13.0	0.90	1.10	10.80	3.44	Mature	Fair	Average	Excessively Pruned	Long (>40 years)	Low	Extensive epicormic. Large pruning wounds.	Invasive	Large	Evergreen	Leicester Avenue	Remove
11	1	<i>Lophostemon confertus</i>	Brush Box	Myrtaceae	10.0	0.28	0.32	3.36	2.05	Mature	Good	Average		Long (>40 years)	Moderate		Native	Medium	Evergreen	Leicester Avenue	Retain
12	1	<i>Lophostemon confertus</i>	Brush Box	Myrtaceae	8.0	0.50	0.55	6.00	2.57	Mature	Good	Average		Long (>40 years)	Moderate		Native	Medium	Evergreen	Leicester Avenue	Retain
13	1	<i>Lophostemon confertus</i>	Brush Box	Myrtaceae	9.5	0.45	0.50	5.40	2.47	Mature	Fair	Average		Long (>40 years)	Moderate		Native	Medium	Evergreen	Leicester Avenue	Retain
14	1	<i>Viburnum odoratissimum</i>	Sweet Viburnum	Adoxaceae	6.0	0.35	0.40	4.20	2.25	Mature	Good	Average		Medium (15-40 years)	Low	Tree viewed and identified remotely.	Exotic	Medium	Evergreen		Remove
15	1	<i>Lophostemon confertus</i>	Brush Box	Myrtaceae	6.0	0.30	0.32	3.60	2.05	Mature	Good	Average		Long (>40 years)	Moderate		Native	Medium	Evergreen	Leicester Avenue	Retain
16	1	<i>Lophostemon confertus</i>	Brush Box	Myrtaceae	7.0	0.42	0.50	5.04	2.47	Mature	Good	Average		Long (>40 years)	Moderate	Significant mechanical damage to trunk on road side.	Native	Medium	Evergreen	Leicester Avenue	Retain
17	8	<i>Melia azedarach</i>	White Cedar	Meliaceae	8.5	0.35	0.45	4.20	2.37	Mature	Fair	Average		Long (>40 years)	Low	Self sown group along road/railway embankment. Largest one measured. Typically poorly positioned with regard to infrastructure and other trees. Numerous weeds surrounding.	Native	Medium	Deciduous	Paramatta Road	Remove
18	4	<i>Sapium sebiferum</i>	Chinese Tallow Tree	Euphorbiaceae	8.0	0.30	0.35	3.60	2.13	Mature	Good	Average		Long (>40 years)	Moderate	Group in private courtyards on top of large wall. Largest one recorded.	Exotic	Medium	Deciduous	Private Property	Retain
19	1	<i>Melaleuca linariifolia</i>	Flax Leaved Paperbark	Myrtaceae	4.5	0.20	0.25	2.40	1.85	Semi-mature	Fair	Average		Long (>40 years)	Low		Endemic	Small	Evergreen	Paramatta Road	Retain
20	11	<i>Grevillea robusta</i>	Silky Oak	Proteaceae	8.0	0.30	0.35	3.60	2.13	Semi-mature	Good	Average		Long (>40 years)	Moderate	Row planting along rail corridor boundary. Largest one recorded.	Native	Large	Evergreen	Private Property	Retain
21	3	<i>Lagerstroemia indica</i>	Crepe Myrtle	Lythraceae	5.0	0.12	0.18	2.00	1.61	Semi-mature	Good	Average		Long (>40 years)	Moderate	Row planting in semi-public courtyard in unit block. Largest one recorded.	Exotic	Small	Deciduous	Private Property	Retain
22	3	<i>Lagerstroemia indica</i>	Crepe Myrtle	Lythraceae	5.0	0.12	0.18	2.00	1.61	Semi-mature	Good	Average		Long (>40 years)	Moderate	Row planting in semi-public courtyard in unit block. Largest one recorded.	Exotic	Small	Deciduous	Private Property	Retain
23	3	<i>Lagerstroemia indica</i>	Crepe Myrtle	Lythraceae	6.0	0.12	0.18	2.00	1.61	Semi-mature	Good	Average		Long (>40 years)	Moderate	Row planting in semi-public courtyard in unit block. Largest one recorded.	Exotic	Small	Deciduous	Private Property	Retain
24	3	<i>Lagerstroemia indica</i>	Crepe Myrtle	Lythraceae	6.0	0.12	0.18	2.00	1.61	Semi-mature	Good	Average		Long (>40 years)	Moderate	Row planting in semi-public courtyard in unit block. Largest one recorded.	Exotic	Small	Deciduous	Private Property	Retain
25	2	<i>Lagerstroemia indica</i>	Crepe Myrtle	Lythraceae	7.0	0.12	0.18	2.00	1.61	Semi-mature	Good	Average		Long (>40 years)	Moderate	Row planting in semi-public courtyard in unit block. Largest one recorded.	Exotic	Small	Deciduous	Private Property	Retain
26	3	<i>Citharexylum spinosum</i>	Fiddlewood	Verbenaceae	7.0	0.22	0.30	2.64	2.00	Mature	Good	Good		Long (>40 years)	Moderate	In semi-public courtyard in unit block. Largest one recorded.	Exotic	Small	Deciduous	Private Property	Retain
27	1	<i>Lagerstroemia indica</i>	Crepe Myrtle	Lythraceae	6.0	0.12	0.18	2.00	1.61	Semi-mature	Good	Average		Long (>40 years)	Moderate	In semi-public courtyard in unit block.	Exotic	Small	Deciduous	Private Property	Retain
28	4	<i>Grevillea robusta</i>	Silky Oak	Proteaceae	7.0	0.22	0.30	2.64	2.00	Mature	Fair	Average		Long (>40 years)	Moderate	Group in semi-public courtyard in unit block. Largest one recorded. Very closely spaced.	Exotic	Large	Evergreen	Private Property	Retain
29	1	<i>Washingtonia robusta</i>	Washington Palm	Arecaceae	8.0	0.35	0.50	4.20	2.47	Mature	Good	Average		Long (>40 years)	Moderate	Group in semi-public courtyard in unit block.	Exotic	Small	Palm-SingleStem	Private Property	Retain
30	1	<i>Washingtonia robusta</i>	Washington Palm	Arecaceae	9.0	0.35	0.50	4.20	2.47	Mature	Good	Average		Long (>40 years)	Moderate	Group in semi-public courtyard in unit block.	Exotic	Small	Palm-SingleStem	Private Property	Retain
31	1	<i>Washingtonia robusta</i>	Washington Palm	Arecaceae	9.0	0.35	0.50	4.20	2.47	Mature	Good	Average		Long (>40 years)	Moderate	Group in semi-public courtyard in unit block.	Exotic	Small	Palm-SingleStem	Private Property	Retain
32	1	<i>Washingtonia robusta</i>	Washington Palm	Arecaceae	9.0	0.35	0.50	4.20	2.47	Mature	Good	Average		Long (>40 years)	Moderate	Group in semi-public courtyard in unit block.	Exotic	Small	Palm-SingleStem	Private Property	Retain
33	1	<i>Washingtonia robusta</i>	Washington Palm	Arecaceae	9.0	0.35	0.50	4.20	2.47	Mature	Good	Average		Long (>40 years)	Moderate	Group in semi-public courtyard in unit block.	Exotic	Small	Palm-SingleStem	Private Property	Retain
34	1	<i>Washingtonia robusta</i>	Washington Palm	Arecaceae	10.0	0.35	0.50	4.20	2.47	Mature	Good	Average		Long (>40 years)	Moderate	Group in semi-public courtyard in unit block.	Exotic	Small	Palm-SingleStem	Private Property	Retain
35	1	<i>Washingtonia robusta</i>	Washington Palm	Arecaceae	8.0	0.35	0.50	4.20	2.47	Mature	Good	Average		Long (>40 years)	Moderate	Group in semi-public courtyard in unit block.	Exotic	Small	Palm-SingleStem	Private Property	Retain
36	1	<i>Washingtonia robusta</i>	Washington Palm	Arecaceae	7.0	0.35	0.50	4.20	2.47	Mature	Fair	Average		Long (>40 years)	Low	Group in semi-public courtyard in unit block.	Exotic	Small	Palm-SingleStem	Private Property	Retain
37	1	<i>Washingtonia robusta</i>	Washington Palm	Arecaceae	5.0	0.35	0.50	4.20	2.47	Mature	Fair	Average		Long (>40 years)	Low	Group in semi-public courtyard in unit block.	Exotic	Small	Palm-SingleStem	Private Property	Retain
38	1	<i>Cupaniopsis anacardioides</i>	Tuckeroo	Sapindaceae	4.0	0.09	0.10	2.00	1.26	Semi-mature	Good	Average		Long (>40 years)	Moderate		Native	Medium	Evergreen	Paramatta Road	Retain
39	1	<i>Cupaniopsis anacardioides</i>	Tuckeroo	Sapindaceae	6.5	0.11	0.13	2.00	1.40	Semi-mature	Good	Average		Long (>40 years)	Moderate		Native	Medium	Evergreen	Paramatta Road	Retain
40	1	<i>Brachychiton acerifolius</i>	Illawarra Flame Tree	Malvaceae	8.0	0.23	0.28	2.76	1.94	Mature	Good	Average		Long (>40 years)	Moderate		Native	Medium	Deciduous	Paramatta Road	Retain
41	1	<i>Brachychiton acerifolius</i>	Illawarra Flame Tree	Malvaceae	9.0	0.22	0.25	2.64	1.85	Mature	Good	Average		Long (>40 years)	Moderate		Native	Medium	Deciduous	Paramatta Road	Retain
42	1	<i>Harpophyllum calfrum</i>	Kaffir Plum	Anacardiaceae	10.0	0.35	0.45	4.20	2.37	Mature	Good	Average		Long (>40 years)	Low		Exotic	Large	Evergreen	Private Property	Remove
43	1	<i>Eriobotrya japonica</i>	Loquat	Rosaceae	7.0	0.20	0.25	2.40	1.85	Mature	Good	Average		Long (>40 years)	Low		Exotic	Small	Evergreen	Private Property	Remove
44	1	<i>Ceratopetalum gummiferum</i>	New South Wales Christmas	Cunoniaceae	5.0	0.18	0.22	2.16	1.75	Mature	Good	Average		Long (>40 years)	Low		Endemic	Small	Evergreen	Private Property	Remove
45	1	<i>Cinnamomum camphora</i>	Camphor Laurel	Lauraceae	9.0	0.22	0.25	2.64	1.85	Mature	Fair	Average		Long (>40 years)	V Low / Remove		Invasive	Large	Evergreen	Private Property	Remove

Tree ID	No. Trees in Group	Tree Species	Common Name	Family	Height (m)	Trunk Diameter at Breast Height (dbh) (m)	Trunk Diameter at base (dgl) (m)	Nominal TPZ radius (m) 12xdbh (AS 4970)	Nominal SRZ radius (m) (AS 4970)	Age Class	Current Vigour	Current Form	Noted Major Defects	SULE Rating	Retention Value	General Comments and Notes	Tree Origin	Ultimate Tree Size	Tree Type	Street/Location	Planning Proposal Recommendation
46	1	<i>Morus nigra</i>	Mulberry	Moraceae	6.0	0.25	0.35	3.00	2.13	Mature	Fair	Poor		Medium (15-40 years)	V Low / Remove		Exotic	Medium	Deciduous	Private Property	Remove
47	1	<i>Cinnamomum camphora</i>	Camphor Laurel	Lauraceae	11.0	0.32	0.38	3.84	2.20	Mature	Good	Average		Long (>40 years)	V Low / Remove		Invasive	Large	Evergreen	Private Property	Remove
48	2	<i>Eriobotrya japonica</i>	Loquat	Rosaceae	7.0	0.15	0.18	2.00	1.61	Mature	Fair	Poor		Long (>40 years)	V Low / Remove		Exotic	Small	Evergreen	Private Property	Remove
49	1	<i>Beaucamea recuvata</i>	Pony Tail Palm	Asparagaceae	4.0	0.18	0.50	2.16	2.47	Mature	Fair	Average		Long (>40 years)	Low		Exotic	Small	Evergreen	Private Property	Remove
50	3	<i>Callistemon citrinus</i> cv.	Crimson Bottlebrush	Myrtaceae	5.5	0.18	0.20	2.16	1.68	Mature	Fair	Poor		Long (>40 years)	Low		Exotic	Small	Evergreen	Private Property	Remove
51	1	<i>Jubaea chilensis</i>	Chilean Wine Palm	Arecaceae	4.0	0.28	0.38	3.36	2.20	Mature	Fair	Average		Long (>40 years)	Low		Exotic	Small	Palm-SingleStem	Private Property	Remove
52	1	<i>Lagerstroemia indica</i>	Crepe Myrtle	Lythraceae	8.0	0.25	0.30	3.00	2.00	Mature	Fair	Poor		Long (>40 years)	Low	Surrounded and engulfed by Celtics.	Exotic	Small	Deciduous	Private Property	Remove
53	1	<i>Liquidambar styraciflua</i>	Liquidambar	Altingiaceae	12.0	0.40	0.50	4.80	2.47	Mature	Good	Average		Long (>40 years)	Moderate		Exotic	Large	Deciduous	Private Property	Remove
54	1	<i>Tibouchina lepidota</i>	Lasiandra	Melastomaceae	6.0	0.07	0.08	2.00	1.15	Mature	Fair	Poor	Very Asymmetric Canopy	Medium (15-40 years)	Low	Suppressed.	Exotic	Small	Evergreen	Private Property	Remove
55	1	<i>Photinia x fraseri</i> 'Robusta'	Photinia	Rosaceae	6.0	0.12	0.15	2.00	1.49	Mature	Fair	Poor		Medium (15-40 years)	Low		Exotic	Small	Evergreen	Private Property	Remove
56	1	<i>Phoenix canariensis</i>	Canary Island Date Palm	Arecaceae	2.0	0.90	0.90	10.80	3.17	Mature	Fair	Poor		Long (>40 years)	Low		Exotic	Small	Palm-SingleStem	Private Property	Remove
57	2	<i>Archontophoenix cunninghamiana</i>	Bangalow Palm	Arecaceae	6.0	0.20	0.30	2.40	2.00	Mature	Fair	Poor		Long (>40 years)	Low		Exotic	Small	Palm-SingleStem	Private Property	Remove
58	1	<i>Cinnamomum camphora</i>	Camphor Laurel	Lauraceae	7.0	0.16	0.18	2.00	1.61	Young	Good	Poor		Long (>40 years)	V Low / Remove		Invasive	Large	Evergreen	Private Property	Remove
59	1	<i>Eriobotrya japonica</i>	Loquat	Rosaceae	5.0	0.15	0.18	2.00	1.61	Mature	Fair	Average		Long (>40 years)	V Low / Remove		Exotic	Small	Evergreen	Private Property	Remove
60	1	<i>Cinnamomum camphora</i>	Camphor Laurel	Lauraceae	9.0	0.23	0.29	2.76	1.97	Semi-mature	Good	Average		Long (>40 years)	V Low / Remove		Invasive	Large	Evergreen	Private Property	Remove
61	1	<i>Psidium guajava</i>	Guava	Myrtaceae	5.0	0.18	0.18	2.16	1.61	Mature	Good	Average		Long (>40 years)	Low		Exotic	Small	Evergreen	Private Property	Remove
62	1	<i>Eriobotrya japonica</i>	Loquat	Rosaceae	5.0	0.15	0.18	2.00	1.61	Mature	Fair	Average		Long (>40 years)	Low		Exotic	Small	Evergreen	Private Property	Remove
63	1	<i>Prunus</i> sp.	Plum	Rosaceae	8.0	0.15	0.18	2.00	1.61	Mature	Fair	Poor		Long (>40 years)	Low	Multi stemmed from base.	Exotic	Small	Deciduous	Private Property	Remove
64	1	<i>Cinnamomum camphora</i>	Camphor Laurel	Lauraceae	9.0	0.60	0.65	7.20	2.76	Semi-mature	Good	Poor	Excessively Pruned	Long (>40 years)	V Low / Remove	Multistemmed from base	Invasive	Large	Evergreen	Private Property	Remove
65	1	<i>Cinnamomum camphora</i>	Camphor Laurel	Lauraceae	15.0	0.65	0.80	7.80	3.01	Mature	Good	Good		Long (>40 years)	Moderate	Very large tree providing valuable screen to apartments.	Invasive	Large	Evergreen	Private Property	Retain
66	1	<i>Morus nigra</i>	Mulberry	Moraceae	9.0	0.40	0.45	4.80	2.37	Mature	Fair	Average	Excessively Pruned	Medium (15-40 years)	Low		Exotic	Medium	Deciduous	Private Property	Remove
67	1	<i>Cinnamomum camphora</i>	Camphor Laurel	Lauraceae	15.0	0.80	0.90	9.60	3.17	Mature	Good	Good		Long (>40 years)	Moderate	Large tree, potentially may provide good screen to future development.	Invasive	Large	Evergreen	Private Property	Retain
68	1	<i>Morus nigra</i>	Mulberry	Moraceae	9.0	0.40	0.45	4.80	2.37	Mature	Fair	Poor	Excessively Pruned	Medium (15-40 years)	Low		Exotic	Medium	Deciduous	Private Property	Remove
69	1	<i>Lagerstroemia indica</i>	Crepe Myrtle	Lythraceae	9.0	0.28	0.30	3.36	2.00	Mature	Good	Average		Long (>40 years)	Low		Exotic	Small	Deciduous	Private Property	Remove
70	1	<i>Archontophoenix alexandrae</i>	Alexandra Palm	Arecaceae	9.0	0.20	0.30	2.40	2.00	Mature	Good	Average		Long (>40 years)	Low		Exotic	Small	Palm-SingleStem	Private Property	Remove
71	1	<i>Cinnamomum camphora</i>	Camphor Laurel	Lauraceae	9.0	0.32	0.38	3.84	2.20	Mature	Good	Poor	Excessively Pruned	Long (>40 years)	V Low / Remove		Invasive	Large	Evergreen	Private Property	Remove
72	2	<i>Cupressus macrocarpa</i>	Monterey Cypress	Cupressaceae	10.0	0.45	0.45	5.40	2.37	Mature	Good	Average		Long (>40 years)	Low		Exotic	Large	Conifer	Private Property	Remove
73	1	<i>Cinnamomum camphora</i>	Camphor Laurel	Lauraceae	13.0	0.80	0.90	9.60	3.17	Mature	Fair	Good	Excessively Pruned	Long (>40 years)	V Low / Remove		Invasive	Large	Evergreen	Private Property	Remove
74	1	<i>Cupressus sempervirens</i> 'Stricta'	Pencil Pine	Cupressaceae	10.0	0.45	0.45	5.40	2.37	Mature	Good	Poor	Excessively Pruned	Long (>40 years)	Low		Exotic	Small	Conifer	Private Property	Remove
75	1	<i>Grevillea robusta</i>	Silky Oak	Proteaceae	13.0	0.35	0.38	4.20	2.20	Mature	Good	Good	Excessively Pruned	Long (>40 years)	Low		Native	Large	Evergreen	Private Property	Remove
76	1	<i>Morus nigra</i>	Mulberry	Moraceae	9.0	0.20	0.28	2.40	1.94	Mature	Fair	Average		Medium (15-40 years)	Low		Exotic	Medium	Deciduous	Private Property	Remove
77	2	<i>Jacaranda mimosifolia</i>	Jacaranda	Bignoniaceae	9.0	0.20	0.28	2.40	1.94	Semi-mature	Fair	Poor		Long (>40 years)	Low		Exotic	Medium	Deciduous	Private Property	Remove
78	1	<i>Callistemon viminalis</i> cv.	Weeping Bottlebrush	Myrtaceae	8.0	0.22	0.25	2.64	1.85	Semi-mature	Good	Average	Very Asymmetric Canopy	Medium (15-40 years)	Low		Native	Medium	Evergreen	Private Property	Remove
79	1	<i>Morus nigra</i>	Mulberry	Moraceae	7.0	0.15	0.20	2.00	1.68	Mature	Fair	Average		Medium (15-40 years)	Low		Exotic	Medium	Deciduous	Private Property	Remove
80	2	<i>Thuja orientalis</i> cv.	Chinese Arborvitae	Cupressaceae	10.0	0.21	0.25	2.52	1.85	Mature	Fair	Average	Excessively Pruned	Medium (15-40 years)	Low		Exotic	Small	Conifer	Private Property	Remove
81	1	<i>Eucalyptus nicholii</i>	Narrow-leaved Black Pepper	Myrtaceae	10.0	0.32	0.42	3.84	2.30	Mature	Fair	Average	Major Tip Dieback Significant Decay	Short (5-15 years)	V Low / Remove		Native	Medium	Evergreen	Private Property	Remove
82	1	<i>Jacaranda mimosifolia</i>	Jacaranda	Bignoniaceae	9.0	0.27	0.29	3.24	1.97	Mature	Good	Good		Long (>40 years)	Moderate		Exotic	Medium	Deciduous	Private Property	Remove
83	1	<i>Jacaranda mimosifolia</i>	Jacaranda	Bignoniaceae	9.0	0.28	0.37	3.36	2.18	Mature	Fair	Poor	Very Asymmetric Canopy	Long (>40 years)	Low		Exotic	Medium	Deciduous	Private Property	Remove
84	1	<i>Casuarina glauca</i>	Swamp She-Oak	Casuarinaceae	13.5	0.38	0.49	4.56	2.45	Mature	Fair	Average		Long (>40 years)	Moderate		Native	Medium	Evergreen	Private Property	Remove
85	1	<i>Grevillea robusta</i>	Silky Oak	Proteaceae	13.5	0.78	0.92	9.36	3.20	Over-mature	Poor	Average	Major Tip Dieback Major Inclusions Major Deadwood	Short (5-15 years)	V Low / Remove		Native	Large	Evergreen	Private Property	Remove
86	1	<i>Cinnamomum camphora</i>	Camphor Laurel	Lauraceae	11.0	0.47	0.75	5.64	2.93	Mature	Fair	Average	Very Asymmetric Canopy	Long (>40 years)	Low	Valuable screen to railway land.	Invasive	Large	Evergreen	Cooper St	Retain
87	1	<i>Cinnamomum camphora</i>	Camphor Laurel	Lauraceae	11.0	0.42	0.75	5.04	2.93	Mature	Fair	Average	Very Asymmetric Canopy	Long (>40 years)	Low	Multistemmed copse. Valuable screen to railway land.	Invasive	Large	Evergreen	Cooper St	Retain
88	3	<i>Cinnamomum camphora</i>	Camphor Laurel	Lauraceae	10.0	0.45	0.55	5.40	2.57	Mature	Fair	Average	Very Asymmetric Canopy Excessively Pruned	Long (>40 years)	Low	Multistemmed. Valuable screen to railway land.	Invasive	Large	Evergreen	Cooper St	Retain
89	1	<i>Cinnamomum camphora</i>	Camphor Laurel	Lauraceae	10.0	0.50	0.60	6.00	2.67	Mature	Fair	Average	Excessively Pruned	Long (>40 years)	Low	Multistemmed. Valuable screen to railway land.	Invasive	Large	Evergreen	Cooper St	Retain
90	3	<i>Cinnamomum camphora</i>	Camphor Laurel	Lauraceae	10.0	0.45	0.55	5.40	2.57	Mature	Fair	Average	Very Asymmetric Canopy Excessively Pruned	Long (>40 years)	Low	Multistemmed. Valuable screen to railway land.	Invasive	Large	Evergreen	Cooper St	Retain
91	2	<i>Tristanopsis laurina</i>	Water Gum	Myrtaceae	6.0	0.28	0.28	3.36	1.94	Mature	Fair	Average		Long (>40 years)	Low	Multistemmed.	Native	Small	Evergreen	Cooper Street	Remove
92	1	<i>Eucalyptus scoparia</i>	Wallangarra White Gum	Myrtaceae	13.0	0.65	0.69	7.80	2.83	Mature	Fair	Average	Major Tip Dieback	Medium (15-40 years)	Low		Native	Medium	Evergreen	Private Property	Remove
93	1	<i>Eucalyptus scoparia</i>	Wallangarra White Gum	Myrtaceae	13.0	0.59	0.65	7.08	2.76	Mature	Fair	Average		Medium (15-40 years)	Moderate	Habitat hollow. Bark grawed by wildlife. Borers suspected.	Native	Medium	Evergreen	Private Property	Remove
94	1	<i>Eucalyptus scoparia</i>	Wallangarra White Gum	Myrtaceae	11.0	0.55	0.58	6.60	2.63	Mature	Good	Average		Long (>40 years)	Moderate		Native	Medium	Evergreen	Private Property	Remove

Tree ID	No. Trees in Group	Tree Species	Common Name	Family	Height (m)	Trunk Diameter at Breast Height (dbh) (m)	Trunk Diameter at base (dg) (m)	Nominal TPZ radius (m) 12xdbh (AS 4970)	Nominal SRZ radius (m) (AS 4970)	Age Class	Current Vigour	Current Form	Noted Major Defects	SULE Rating	Retention Value	General Comments and Notes	Tree Origin	Ultimate Tree Size	Tree Type	Street/Location	Planning Proposal Recommendation
95	1	<i>Eucalyptus scoparia</i>	Wallangarra White Gum	Myrtaceae	13.0	0.65	0.69	7.80	2.83	Mature	Fair	Average	Major Tip Dieback Major Deadwood	Medium (15-40 years)	Low		Native	Medium	Evergreen	Private Property	Remove
96	1	<i>Washingtonia robusta</i>	Washington Palm	Arecaceae	11.0	0.30	0.45	3.60	2.37	Mature	Good	Good		Long (>40 years)	Moderate		Exotic	Small	Palm-SingleStem	Private Property	Remove
97	2	<i>Casuarina glauca</i>	Swamp She-Oak	Casuarinaceae	9.0	0.15	0.18	2.00	1.61	Semi-mature	Fair	Average		Long (>40 years)	Low	Self sown, growing out of old road surface.	Native	Medium	Evergreen	Private Property	Remove
98	1	<i>Tristanopsis laurina</i>	Water Gum	Myrtaceae	4.0	0.15	0.20	2.00	1.68	Semi-mature	Good	Average		Long (>40 years)	Low		Native	Small	Evergreen	Private Property	Remove
99	1	<i>Cinnamomum camphora</i>	Camphor Laurel	Lauraceae	14.0	0.45	0.53	5.40	2.53	Mature	Fair	Poor	Very Asymmetric Canopy	Long (>40 years)	Low	Considered moderate in group with T67	Invasive	Large	Evergreen	Private Property	Remove
100	1	<i>Grevillea robusta</i>	Silky Oak	Proteaceae	11.0	0.22	0.25	2.64	1.85	Mature	Monibund	Average	Major Tip Dieback Major Deadwood	Remove (<5 years)	V Low / Remove		Native	Large	Evergreen	Private Property	Remove
101	1	<i>Araucaria heterophylla</i>	Norfolk Island Pine	Araucariaceae	16.0	0.36	0.45	4.32	2.37	Mature	Fair	Good		Long (>40 years)	Moderate		Exotic	Large	Conifer	Private Property	Remove
102	3	<i>Jacaranda mimosifolia</i>	Jacaranda	Bignoniaceae	10.0	0.25	0.30	3.00	2.00	Mature	Fair	Average		Long (>40 years)	Low		Exotic	Medium	Deciduous	Private Property	Remove
103	1	<i>Cotoneaster glaucophyllus</i>	Cotoneaster	Rosaceae	4.5	0.30	0.45	3.60	2.37	Mature	Good	Average		Medium (15-40 years)	V Low / Remove		Invasive	Medium	Evergreen	Private Property	Remove
104	1	<i>Archontophoenix alexandrae</i>	Alexandra Palm	Arecaceae	6.5	0.28	0.35	3.36	2.13	Mature	Good	Average		Long (>40 years)	Low		Exotic	Small	Palm-SingleStem	Private Property	Remove
105	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	Myrtaceae	17.0	0.45	0.60	5.40	2.67	Mature	Fair	Average		Medium (15-40 years)	Low		Native	Civic	Evergreen	Private Property	Remove
106	1	<i>Araucaria heterophylla</i>	Norfolk Island Pine	Araucariaceae	15.0	0.58	0.75	6.96	2.93	Mature	Fair	Average		Long (>40 years)	Low	Tip dieback.	Exotic	Civic	Conifer	Private Property	Remove
107	1	<i>Casuarina cunninghamiana</i>	River She-Oak	Casuarinaceae	12.0	0.38	0.49	4.56	2.45	Mature	Good	Average		Long (>40 years)	High		Native	Large	Evergreen	Cooper Street	Retain
108	1	<i>Callistemon viminalis cv.</i>	Weeping Bottlebrush	Myrtaceae	7.0	0.18	0.22	2.16	1.75	Mature	Good	Average		Medium (15-40 years)	Low		Native	Small	Evergreen	Cooper Street	Remove
109	1	<i>Callistemon viminalis cv.</i>	Weeping Bottlebrush	Myrtaceae	7.0	0.18	0.22	2.16	1.75	Mature	Good	Average		Medium (15-40 years)	Low		Native	Small	Evergreen	Cooper Street	Remove
110	1	<i>Callistemon viminalis cv.</i>	Weeping Bottlebrush	Myrtaceae	7.0	0.18	0.22	2.16	1.75	Mature	Good	Average		Medium (15-40 years)	Low	Mechanical damage.	Native	Small	Evergreen	Cooper Street	Remove
111	1	<i>Melaleuca quinquenervia</i>	Broad Leafed Paperbark	Myrtaceae	10.5	0.39	0.52	4.68	2.51	Mature	Good	Average		Long (>40 years)	Moderate	Mechanical damage.	Native	Medium	Evergreen	Cooper Street	Remove
112	1	<i>Callistemon viminalis cv.</i>	Weeping Bottlebrush	Myrtaceae	9.0	0.27	0.38	3.24	2.20	Mature	Good	Average	Very Asymmetric Canopy	Medium (15-40 years)	Low	Mechanical damage.	Native	Small	Evergreen	Cooper Street	Remove
113	1	<i>Melaleuca quinquenervia</i>	Broad Leafed Paperbark	Myrtaceae	7.5	0.23	0.43	2.76	2.32	Mature	Good	Average		Long (>40 years)	Moderate	Mechanical damage.	Native	Medium	Evergreen	Cooper Street	Remove
114	1	<i>Platanus x acerifolia</i>	London Plane	Platanaceae	7.5	0.16	0.18	2.00	1.61	Semi-mature	Fair	Poor	Excessively Pruned	Long (>40 years)	Low	Excessively pruned. Fully paved surrounds.	Exotic	Large	Deciduous	Cooper Street	Remove
115	1	<i>Platanus x acerifolia</i>	London Plane	Platanaceae	7.5	0.19	0.22	2.28	1.75	Semi-mature	Fair	Poor	Excessively Pruned	Long (>40 years)	Low	Excessively pruned. Fully paved surrounds.	Exotic	Large	Deciduous	Cooper Street	Remove
116	1	<i>Platanus x acerifolia</i>	London Plane	Platanaceae	7.5	0.17	0.19	2.04	1.65	Semi-mature	Fair	Poor	Excessively Pruned	Long (>40 years)	Low	Excessively pruned. Fully paved surrounds.	Exotic	Large	Deciduous	Cooper Street	Remove
117	1	<i>Platanus x acerifolia</i>	London Plane	Platanaceae	7.5	0.17	0.19	2.04	1.65	Semi-mature	Fair	Poor	Excessively Pruned Trunk Cracks/Splits	Long (>40 years)	V Low / Remove	Excessively pruned. Fully paved surrounds. Significant trunk crack.	Exotic	Large	Deciduous	Cooper Street	Remove
118	1	<i>Sapium sebiferum</i>	Chinese Tallow Tree	Euphorbiaceae	11.0	0.27	0.35	3.24	2.13	Mature	Good	Average		Long (>40 years)	Moderate		Exotic	Large	Deciduous	Cooper Street	Remove
119	1	<i>Sapium sebiferum</i>	Chinese Tallow Tree	Euphorbiaceae	14.0	0.28	0.43	3.36	2.32	Mature	Good	Average		Long (>40 years)	Moderate		Exotic	Large	Deciduous	Cooper Street	Remove
120	1	<i>Camellia japonica</i>	Japanese Camellia	Theaceae	4.5	0.20	0.25	2.40	1.85	Mature	Poor	Poor		Short (5-15 years)	Low		Exotic	Small	Evergreen	Cooper Street	Remove
121	1	<i>Morus nigra</i>	Mulberry	Moraceae	8.0	0.28	0.35	3.36	2.13	Mature	Good	Average		Medium (15-40 years)	Low		Exotic	Medium	Deciduous	Cooper Street	Remove
122	1	<i>Lagerstroemia indica</i>	Crepe Myrtle	Lythraceae	6.0	0.13	0.15	2.00	1.49	Semi-mature	Poor	Poor	Very Asymmetric Canopy	Short (5-15 years)	V Low / Remove	Very suppressed below large Privet.	Exotic	Small	Deciduous	Cooper Street	Remove
123	1	<i>Acacia saligna</i>	WA Golden Wattle	Leguminosae	7.5	0.13	0.18	2.00	1.61	Mature	Good	Average	Very Asymmetric Canopy	Short (5-15 years)	V Low / Remove		Native	Small	Evergreen	Cooper Street	Remove
124	1	<i>Cinnamomum camphora</i>	Camphor Laurel	Lauraceae	9.0	0.23	0.28	2.76	1.94	Mature	Good	Average		Long (>40 years)	V Low / Remove		Invasive	Large	Evergreen	Private Property	Remove
125	5	<i>Acacia saligna</i>	WA Golden Wattle	Leguminosae	8.0	0.25	0.30	3.00	2.00	Mature	Good	Average		Short (5-15 years)	V Low / Remove		Native	Small	Evergreen	Cooper Street	Remove
126	2	<i>Morus nigra</i>	Mulberry	Moraceae	8.0	0.35	0.45	4.20	2.37	Mature	Good	Poor	Lean-Major Very Asymmetric Canopy	Medium (15-40 years)	Low		Exotic	Medium	Deciduous	Cooper Street	Remove
127	1	<i>Ceratopetalum gummiferum</i>	New South Wales Christmas	Cunoniaceae	8.0	0.35	0.49	4.20	2.45	Mature	Good	Average	Excessively Pruned	Medium (15-40 years)	Moderate		Endemic	Small	Evergreen	Cooper Street	Remove
128	2	<i>Prunus sp.</i>	Plum	Rosaceae	5.0	0.25	0.30	3.00	2.00	Mature	Fair	Average		Medium (15-40 years)	Low		Exotic	Small	Deciduous	Cooper Street	Remove
129	1	<i>Pittosporum undulatum</i>	Sweet Pittosporum	Pittosporaceae	7.0	0.15	0.20	2.00	1.68	Mature	Good	Average		Long (>40 years)	Low		Native	Small	Evergreen	Cooper Street	Remove
130	1	<i>Eucalyptus robusta</i>	Swamp Mahogany	Myrtaceae	10.0	0.28	0.42	3.36	2.30	Mature	Fair	Poor	Major Tip Dieback Excessively Pruned	Long (>40 years)	Low		Endemic	Medium	Evergreen	Cooper Street	Remove
131	1	<i>Eucalyptus saligna</i>	Sydney Blue Gum	Myrtaceae	18.0	0.65	0.78	7.80	2.98	Mature	Fair	Poor		Long (>40 years)	Moderate		Endemic	Civic	Evergreen	Cooper Street	Remove
132	1	<i>Livistona chinensis</i>	Cabbage Palm	Arecaceae	4.0	0.35	0.45	4.20	2.37	Mature	Fair	Average		Long (>40 years)	Low		Exotic	Small	Palm-SingleStem	Private Property	Remove
133	1	<i>Cupressus torulosa</i>	Bhutan Cypress	Cupressaceae	7.0	0.20	0.25	2.40	1.85	Mature	Fair	Poor		Long (>40 years)	Low		Exotic	Small	Conifer	Private Property	Remove
134	1	Unidentified Deciduous Tree		Rosaceae	7.0	0.20	0.25	2.40	1.85	Mature	Fair	Poor		Medium (15-40 years)	Low		Exotic	Small	Deciduous	Private Property	Remove
135	1	<i>Robinia pseudacacia 'Frisia'</i>	Black Locust	Leguminosae	9.5	0.25	0.29	3.00	1.97	Mature	Fair	Average		Medium (15-40 years)	Low		Exotic	Medium	Deciduous	Private Property	Remove
136	1	<i>Morus nigra</i>	Mulberry	Moraceae	6.0	0.18	0.24	2.16	1.82	Semi-mature	Fair	Poor		Medium (15-40 years)	Low		Exotic	Medium	Deciduous	Private Property	Remove
137	1	<i>Brachychiton acerifolius</i>	Illawarra Flame Tree	Malvaceae	10.5	0.17	0.23	2.04	1.79	Mature	Good	Good		Long (>40 years)	Moderate		Native	Medium	Deciduous	Private Property	Remove
138	1	<i>Jacaranda mimosifolia</i>	Jacaranda	Bignoniaceae	9.0	0.13	0.18	2.00	1.61	Mature	Fair	Poor		Long (>40 years)	Low		Exotic	Medium	Deciduous	Private Property	Remove
139	1	<i>Morus nigra</i>	Mulberry	Moraceae	10.0	0.24	0.30	2.88	2.00	Mature	Fair	Poor		Medium (15-40 years)	Low		Exotic	Medium	Deciduous	Private Property	Remove
140	1	<i>Jacaranda mimosifolia</i>	Jacaranda	Bignoniaceae	13.0	0.58	0.69	6.96	2.83	Mature	Good	Good		Long (>40 years)	High	Good tree.	Exotic	Medium	Deciduous	Hilt Street	Retain
141	1	<i>Cinnamomum camphora</i>	Camphor Laurel	Lauraceae	11.5	0.58	0.69	6.96	2.83	Mature	Fair	Average	Major Tip Dieback	Medium (15-40 years)	V Low / Remove		Invasive	Medium	Evergreen	Hilt Street	Remove
142	2	<i>Syzygium australe</i>	Brush Cherry	Myrtaceae	9.0	0.15	0.18	2.00	1.61	Mature	Good	Average		Long (>40 years)	Moderate		Native	Medium	Evergreen	Private Property	Retain
143	1	<i>Tristanopsis laurina</i>	Water Gum	Myrtaceae	9.0	0.45	0.45	5.40	2.37	Mature	Fair	Average	Major Deadwood Major Tip Dieback	Long (>40 years)	Low		Native	Small	Evergreen	Hilt Street	Remove
144	2	<i>Lagerstroemia indica</i>	Crepe Myrtle	Myrtaceae	8.0	0.18	0.18	2.16	1.61	Mature	Fair	Average	Major Deadwood Major Tip Dieback	Long (>40 years)	Low		Exotic	Small	Deciduous	Hilt Street	Remove
145	1	<i>Tristanopsis laurina</i>	Water Gum	Myrtaceae	7.0	0.20	0.22	2.40	1.75	Mature	Good	Good		Long (>40 years)	Moderate		Native	Small	Evergreen	Hilt Street	Remove
146	1	<i>Tristanopsis laurina</i>	Water Gum	Myrtaceae	7.0	0.20	0.22	2.40	1.75	Mature	Good	Good		Long (>40 years)	Moderate		Native	Small	Evergreen	Hilt Street	Remove
147	2	<i>Magnolia grandiflora</i>	American Bull Bay Magnolia	Magnoliaceae	6.0	0.10	0.12	2.00	1.36	Semi-mature	Fair	Average		Long (>40 years)	Low	Small trees in raised planter. Sparse canopy.	Exotic	Small	Evergreen	Private Property	Retain

Tree ID	No. Trees in Group	Tree Species	Common Name	Family	Height (m)	Trunk Diameter at Breast Height (dbh) (m)	Trunk Diameter at base (dgl) (m)	Nominal TPZ radius (m) 12xdbh (AS 4970)	Nominal SRZ radius (m) (AS 4970)	Age Class	Current Vigour	Current Form	Noted Major Defects	SULE Rating	Retention Value	General Comments and Notes	Tree Origin	Ultimate Tree Size	Tree Type	Street/Location	Planning Proposal Recommendation
148	1	<i>Fraxinus oxycarpa</i> 'Raywood'	Claret Ash	Oleaceae	9.5	0.37	0.49	4.44	2.45	Mature	Fair	Average		Medium (15-40 years)	Low		Exotic	Medium	Deciduous	Hilt Street	Remove
149	1	<i>Sapum sebiferum</i>	Chinese Tallow Tree	Euphorbiaceae	9.5	0.33	0.55	3.96	2.57	Mature	Fair	Average		Long (>40 years)	Low		Exotic	Medium	Deciduous	Hilt Street	Remove
150	1	<i>Jacaranda mimosifolia</i>	Jacaranda	Bignoniaceae	9.0	0.30	0.35	3.60	2.13	Mature	Fair	Average		Long (>40 years)	Moderate		Exotic	Medium	Deciduous	Hilt Street	Remove
151	1	<i>Tristanopsis laurina</i>	Water Gum	Myrtaceae	7.0	0.11	0.22	2.00	1.75	Mature	Fair	Average		Long (>40 years)	Low		Native	Small	Evergreen	Hilt Street	Remove
152	1	<i>Tristanopsis laurina</i>	Water Gum	Myrtaceae	8.5	0.25	0.32	3.00	2.05	Mature	Fair	Average	Excessively Pruned	Long (>40 years)	Low		Native	Small	Evergreen	Hilt Street	Remove
153	1	<i>Tristanopsis laurina</i>	Water Gum	Myrtaceae	5.5	0.23	0.30	2.76	2.00	Mature	Good	Average	Excessively Pruned	Long (>40 years)	Low		Native	Small	Evergreen	Hilt Street	Remove
154	1	<i>Tristanopsis laurina</i>	Water Gum	Myrtaceae	7.5	0.25	0.30	3.00	2.00	Mature	Good	Average	Excessively Pruned	Long (>40 years)	Low		Native	Small	Evergreen	Hilt Street	Remove
155	1	<i>Tristanopsis laurina</i>	Water Gum	Myrtaceae	7.5	0.21	0.30	2.52	2.00	Mature	Good	Average	Excessively Pruned	Long (>40 years)	Low		Native	Small	Evergreen	Hilt Street	Remove
156	1	<i>Tristanopsis laurina</i>	Water Gum	Myrtaceae	8.0	0.23	0.30	2.76	2.00	Mature	Fair	Average	Excessively Pruned Major Tip Dieback	Long (>40 years)	Low		Native	Small	Evergreen	Hilt Street	Remove
157	1	<i>Tristanopsis laurina</i>	Water Gum	Myrtaceae	8.5	0.23	0.30	2.76	2.00	Mature	Good	Good		Long (>40 years)	Moderate		Native	Small	Evergreen	Hilt Street	Remove
158	6	<i>Magnolia grandiflora</i>	American Bull Bay Magnolia	Magnoliaceae	5.0	0.07	0.10	2.00	1.26	Semi-mature	Fair	Average		Long (>40 years)	Low	Small trees planted as a hedge. Sparse canopies.	Exotic	Small	Evergreen	Private Property	Retain
159	1	<i>Radermachera sinica</i>	China Doll Tree	Bignoniaceae	12.0	0.41	0.70	4.92	2.85	Mature	Good	Average	Excessively Pruned	Long (>40 years)	Low		Exotic	Small	Evergreen	Private Property	Remove
160	1	<i>Liquidambar styraciflua</i>	Liquidambar	Altingiaceae	13.0	0.68	0.78	8.16	2.98	Mature	Good	Average	Major Deadwood	Long (>40 years)	Low		Exotic	Large	Deciduous	Private Property	Remove
161	1	<i>Morus nigra</i>	Mulberry	Moraceae	6.0	0.15	0.16	2.00	1.53	Mature	Good	Average		Medium (15-40 years)	Low		Exotic	Medium	Deciduous	Private Property	Remove
162	1	<i>Liquidambar styraciflua</i>	Liquidambar	Altingiaceae	12.0	0.34	0.36	4.08	2.15	Mature	Good	Good		Long (>40 years)	Moderate		Native	Medium	Deciduous	Private Property	Remove
163	1	<i>Cupressus macrocarpa</i>	Monterey Cypress	Cupressaceae	12.0	0.58	0.50	6.96	2.47	Mature	Good	Good		Long (>40 years)	Low		Exotic	Medium	Conifer	Private Property	Remove
164	1	<i>Plumeria rubra</i>	Frangipani	Apocynaceae	7.5	0.35	0.35	4.20	2.13	Mature	Fair	Average		Long (>40 years)	Low		Exotic	Small	Deciduous	Private Property	Remove
165	1	<i>Cedrus atlantica</i> 'Glauc'	Blue Atlas Cedar	Pinaceae	11.0	0.40	0.47	4.80	2.41	Mature	Fair	Poor		Long (>40 years)	Low		Exotic	Medium	Conifer	Private Property	Remove
166	1	<i>Archontophoenix alexandrae</i>	Alexandra Palm	Arecaceae	10.5	0.22	0.40	2.64	2.25	Mature	Good	Average		Long (>40 years)	Low		Exotic	Medium	Palm-SingleStem	Private Property	Remove
167	1	<i>Casuarina glauca</i>	Swamp She-Oak	Casuarinaceae	18.0	0.61	0.89	7.32	3.15	Mature	Good	Average		Long (>40 years)	Moderate		Native	Large	Evergreen	Private Property	Remove
168	1	<i>Casuarina glauca</i>	Swamp She-Oak	Casuarinaceae	14.0	0.50	0.55	6.00	2.57	Mature	Fair	Poor	Very Asymmetric Canopy	Long (>40 years)	Low	Vine covered	Native	Large	Evergreen	Private Property	Remove
169	1	<i>Casuarina glauca</i>	Swamp She-Oak	Casuarinaceae	14.0	0.60	0.70	7.20	2.85	Mature	Fair	Average		Long (>40 years)	Moderate	Vine covered	Native	Large	Evergreen	Private Property	Remove
170	1	<i>Dracaena marginata</i>	Dragon tree	Casuarinaceae	7.0	0.19	0.28	2.28	1.94	Mature	Poor	Poor		Medium (15-40 years)	V Low / Remove	Vine covered	Exotic	Small	Evergreen	Private Property	Remove
171	1	<i>Eriobotrya japonica</i>	Loquat	Rosaceae	7.0	0.10	0.15	2.00	1.49	Mature	Poor	Poor		Medium (15-40 years)	V Low / Remove	Vine covered	Exotic	Small	Evergreen	Private Property	Remove
172	1	<i>Pittosporum undulatum</i>	Sweet Pittosporum	Pittosporaceae	8.0	0.16	0.18	2.00	1.61	Mature	Poor	Poor		Medium (15-40 years)	Low		Native	Small	Evergreen	Private Property	Remove
173	1	<i>Cupressus sempervirens</i> 'Stricta'	Pencil Pine	Cupressaceae	12.0	0.22	0.25	2.64	1.85	Mature	Poor	Poor		Short (5-15 years)	V Low / Remove	Vine covered	Exotic	Small	Conifer	Private Property	Remove
174	1	<i>Liquidambar styraciflua</i>	Liquidambar	Altingiaceae	10.0	0.28	0.35	3.36	2.13	Mature	Poor	Poor		Medium (15-40 years)	V Low / Remove	Vine covered	Exotic	Large	Deciduous	Private Property	Remove
175	1	<i>Lagerstroemia indica</i>	Crepe Myrtle	Lythraceae	9.0	0.28	0.35	3.36	2.13	Mature	Poor	Poor		Medium (15-40 years)	V Low / Remove	Vine covered	Exotic	Small	Deciduous	Private Property	Remove
176	1	<i>Cupressus sempervirens</i>	Italian Cypress	Cupressaceae	12.0	0.45	0.55	5.40	2.57	Mature	Fair	Average		Long (>40 years)	Low		Exotic	Small	Conifer	Private Property	Remove
177	3	<i>Cinnamomum camphora</i>	Camphor Laurel	Lauraceae	12.0	0.22	0.25	2.64	1.85	Mature	Fair	Average	Very Asymmetric Canopy	Medium (15-40 years)	V Low / Remove		Invasive	Large	Evergreen	Private Property	Remove
178	1	<i>Lagerstroemia indica</i>	Crepe Myrtle	Lythraceae	4.0	0.40	0.45	4.80	2.37	Mature	Poor	Poor		Short (5-15 years)	V Low / Remove		Exotic	Small	Deciduous	Private Property	Remove
179	2	<i>Callistemon citrinus</i> cv.	Crimson Bottlebrush	Myrtaceae	6.5	0.10	0.10	2.00	1.26	Mature	Poor	Poor		Short (5-15 years)	Low		Exotic	Small	Deciduous	Private Property	Remove
180	1	<i>Waterhousea floribunda</i>	Weeping Lilly Pilly	Myrtaceae	10.0	0.25	0.30	3.00	2.00	Mature	Good	Average		Long (>40 years)	High		Native	Medium	Evergreen	Private Property	Retain
181	1	<i>Casuarina glauca</i>	Swamp She-Oak	Casuarinaceae	17.0	0.29	0.30	3.48	2.00	Mature	Fair	Average		Long (>40 years)	Low		Native	Medium	Evergreen	Private Property	Retain
182	1	<i>Leptospermum petersonii</i>	Lemon Scented Tea Tree	Myrtaceae	9.5	0.10	0.10	2.00	1.26	Mature	Poor	Poor		Medium (15-40 years)	Low		Native	Small	Evergreen	Private Property	Retain
183	2	<i>Syzygium paniculatum</i>	Magenta Cherry	Myrtaceae	16.0	0.48	0.55	5.76	2.57	Mature	Good	Good		Long (>40 years)	High		Native	Large	Evergreen	Private Property	Retain
184	1	<i>Prunus cerasifera</i>	Purple-leaved Cherry-plum	Rosaceae	12.0	0.40	0.50	4.80	2.47	Mature	Fair	Average		Long (>40 years)	Low		Exotic	Medium	Deciduous	Private Property	Retain
185	1	<i>Hymenosporum flavum</i>	Native Frangipani	Pittosporaceae	9.0	0.26	0.28	3.12	1.94	Mature	Fair	Poor		Medium (15-40 years)	Low	Historically broken main leader. Poor form.	Native	Small	Evergreen	Private Property	Retain
186	1	<i>Pyrus calleryana</i> cv.	Callery Pear	Rosaceae	9.0	0.20	0.24	2.40	1.82	Mature	Fair	Average		Medium (15-40 years)	Low		Exotic	Small	Deciduous	Private Property	Retain
187	6	<i>Magnolia grandiflora</i>	American Bull Bay Magnolia	Magnoliaceae	6.0	0.15	0.20	2.00	1.68	Young	Fair	Average		Medium (15-40 years)	Low	Trees within internal courtyard of unit building east of Cooper Street. Growing in close proximity to adjacent building. Assessed remotely.	Exotic	Small	Evergreen	Private Property	Retain
188	8	<i>Elaeocarpus reticulatus</i>	Blueberry Ash	Elaeocarpaceae	7.5	0.15	0.20	2.00	1.68	Semi-mature	Fair	Average		Medium (15-40 years)	Low	Trees within internal courtyard of unit building east of Cooper Street. Assessed remotely.	Native	Small	Evergreen	Private Property	Retain
189	2	<i>Elaeocarpus reticulatus</i>	Blueberry Ash	Elaeocarpaceae	9.0	0.28	0.30	3.36	2.00	Semi-mature	Good	Average		Long (>40 years)	Moderate	Trees within internal courtyard of unit building east of Cooper Street. Assessed remotely.	Native	Small	Evergreen	Private Property	Retain
190	1	<i>Eucalyptus</i> sp.	Eucalyptus sp.	Myrtaceae	10.5	0.45	0.50	5.40	2.47	Semi-mature	Good	Average		Long (>40 years)	Moderate	Trees within internal courtyard of unit building east of Cooper Street. Assessed remotely.	Native	Medium	Evergreen	Private Property	Retain
191	1	<i>Melaleuca quinquenervia</i>	Broad Leafed Paperbark	Myrtaceae	11.0	0.45	0.50	5.40	2.47	Semi-mature	Good	Average		Long (>40 years)	Moderate	Trees within internal courtyard of unit building east of Cooper Street. Assessed remotely.	Native	Medium	Evergreen	Private Property	Retain
192	2	<i>Melaleuca quinquenervia</i>	Broad Leafed Paperbark	Myrtaceae	10.5	0.25	0.30	3.00	2.00	Semi-mature	Good	Average		Long (>40 years)	Moderate	Trees within internal courtyard of unit building east of Cooper Street. Assessed remotely.	Native	Medium	Evergreen	Private Property	Retain
193	2	<i>Casuarina glauca</i>	Swamp She-Oak	Casuarinaceae	15.0	0.65	0.70	7.80	2.85	Mature	Good	Average		Long (>40 years)	Moderate	Trees within internal courtyard of unit building east of Cooper Street. Assessed remotely.	Native	Medium	Evergreen	Private Property	Retain