OUR URBAN FOREST

Urban forest strategy

Town of Walkerville

TOWN OF WALKERVILLE

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TOWN OF WALKERVILLE

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FROM THE MAYOR

From the Mayor of Walkerville

Our glorious urban forest defines the character and appeal of the Town of Walkerville.

This priceless asset, enhances our environmental, economic, social and community wellbeing. The health benefits of urban forests are well-established, along with their ability to create and enhance social interactions.

Council's *Urban forest strategy* sets out a plan for the future management of our shared urban forest on both public and private land. The distinction between public and private land is an important one to make. The small land area of our Council means we cannot increase the size of our 'tree canopy' on our own. Every tree in the Town of Walkerville is part of our urban forest and every tree owner has a role to play in ensuring it continues to thrive for future generations. Our urban forest covers approximately 25% of the Township and that includes private and public land. Furthermore, 80% of the Council area is privately owned. Hence, this *Strategy* addresses the need for Council to engage with the community and to ensure residents, schools, businesses and other stakeholders are encouraged to care for and protect our shared urban forest.

The *Strategy* will guide and shape tree management decisions in alignment with the aspirations and targets of Council's overall strategic framework (refer page 8). This is the first-time Council has produced a strategic document dedicated to the preservation, management and promotion of our urban forest. This reflects the feedback we have consistently received from residents in our Town-wide community survey on the importance of open spaces, parks, gardens, visual presentation (beautification) and lots of trees.

More broadly, the *Strategy* also connects with State and Local Government strategic plans including:

- The *Resilient East Regional Climate Change Adaptation Plan,* which aims to increase urban greening as a way of addressing the impacts of current and future projected temperature increases.
- The *30 Year Plan for Greater Adelaide's* target of increasing tree canopy cover by 2045.

I hope you will be part of this important community conversation by sharing your views and feedback through the process of public consultation.

The *Urban forest strategy* was formally endorsed by Coucil on the 15th July 2019 as per resolution CNC5/19-20.

Elizabeth Fricker | **Mayor**

TOWN OF WALKERVILLE

SUMMARY

Trees are an essential part of cities and shape how we live and work. They provide a multitude of benefits for the community, economy and environment. Collectively, the trees on public and private land form what is called the urban forest.

The Town of Walkerville has a well established and extensive network of trees on public and private land. However, like many parts of Australia, our urban forest faces challenges on multiple fronts:

- urban development and infill is contributing to the loss of green space and trees on private land
- climate change is creating hotter and drier conditions that will make a healthy urban forest more difficult to maintain
- the interaction between trees and infrastructure means that some trees are in locations that can lead to management challenges for residents and Council alike
- insufficient water availability can lead to stressed trees and a need for greater investment in responses such as water sensitive urban design.

This *Urban forest strategy* has been developed to:

- inform how the Town of Walkerville's urban forest can be maintained and expanded
- help the Township adapt to climate change
- mitigate the urban heat island effect by bringing temperatures down
- create healthier ecosystems
- engage and involve the community.

Walkerville's urban forest

The Town of Walkerville's urban forest covers approximately 25% of the Council area. More than half of the remaining area is covered by impervious surfaces (e.g. building roofs and roads), and only about 15% has the potential to support new plantings of trees. At the suburb level, Gilberton has the highest proportion of urban forest cover (28%) and also the lowest amount of impervious cover (53%).In contrast, Vale Park has the lowest proportion of urban forest cover(23%), but the highest area of potential plantable space. Medindie and Walkerville have 25% and 26% canopy cover, respectively.

Street trees are a key component of the urban forest and are estimated to provide more than $12,131 worth of annual ecosystem services, $22,258 worth of total carbon storage value, and have a like-for-like replacement value of more than $12.3 million.

Trees in the urban forest are a mixture of native and introduced species of varying ages and condition. A 2017 audit of the Council's 4,130 street trees, for example, reported that although 62% of the street trees were considered mature, the overall health of the trees was very good, with two thirds having a useful life expectancy of more than 20 years.

Public land covers approximately 17% of the Council area, of which 8% could support further tree plantings. In contrast, 19% of the private land could support more plantings.

Future direction

To meet the target set for Metropolitan Adelaide in the *30 Year Plan for Greater Adelaide* the Township will need a 20% increase in canopy cover. To achieve this target requires an increase of approximately 9.5 Adelaide Ovals of tree canopy. This will require significant plantings on both public and private land, which will be difficult given the limited plantable area. As such, other forms of greening can be explored such as green roofs and green walls. Without the support of residents, maintaining the existing level of canopy cover will be difficult to achieve.

To meet the vision for the Town of Walkerville's future urban forest, the following goals will be used to guide strategies and actions for on-ground works:

GROW

Grow the urban forest through new plantings to maximise the social, economic and environmental benefits of trees and urban greening.

PROTECT

Protect the urban forest from threats and loss by preserving the Town's existing street trees and maintaining established trees on public and private land.

ENGAGE

Engage with the community, businesses and government to care for the urban forest and broaden the understanding of the benefits it provides.

MANAGE

Manage the urban forest through coordinated planning, design and maintenance to ensure its long-term health and sustainability.

FUND

Continue to develop funding mechanisms that enable further investment into onground actions, that manage and grow the urban forest.

1 INTRODUCTION

Trees are an essential part of cities and the urban environment. They shape the character of our cities and how we live. Collectively, the trees on public and private land form what is called the urban forest.

For individuals and the community, the urban forest can decrease the impact of heatwaves, increase longevity, reduce stress, and increase productivity. Economically trees reduce energy costs to buildings by creating shade and cooling and there are increased property values for residential houses on leafy tree lined streets. Trees provide resources for native wildlife, mitigate climate change through absorbing and storing carbon, and clean the air of pollutants.

The Town of Walkerville has a well established and extensive network of trees on public and private land. The mix of native and non-native trees creates an urban forest that underpins the character of the Township and the open space supports an increasingly dynamic and vibrant community.

Many cities in Australia are working to increase the size of their urban forest to harness the broad range of benefits. This requires addressing a range of issues and challenges including:

- responding to urban development and infill
- climate change
- urban heat islands
- the interaction between trees and infrastructure
- water availability
- ageing tree populations.

The purpose of this *Strategy* is to help guide and shape future tree management across the Town of Walkerville and to inform how the urban forest is maintained and expanded.

The *Strategy* describes:

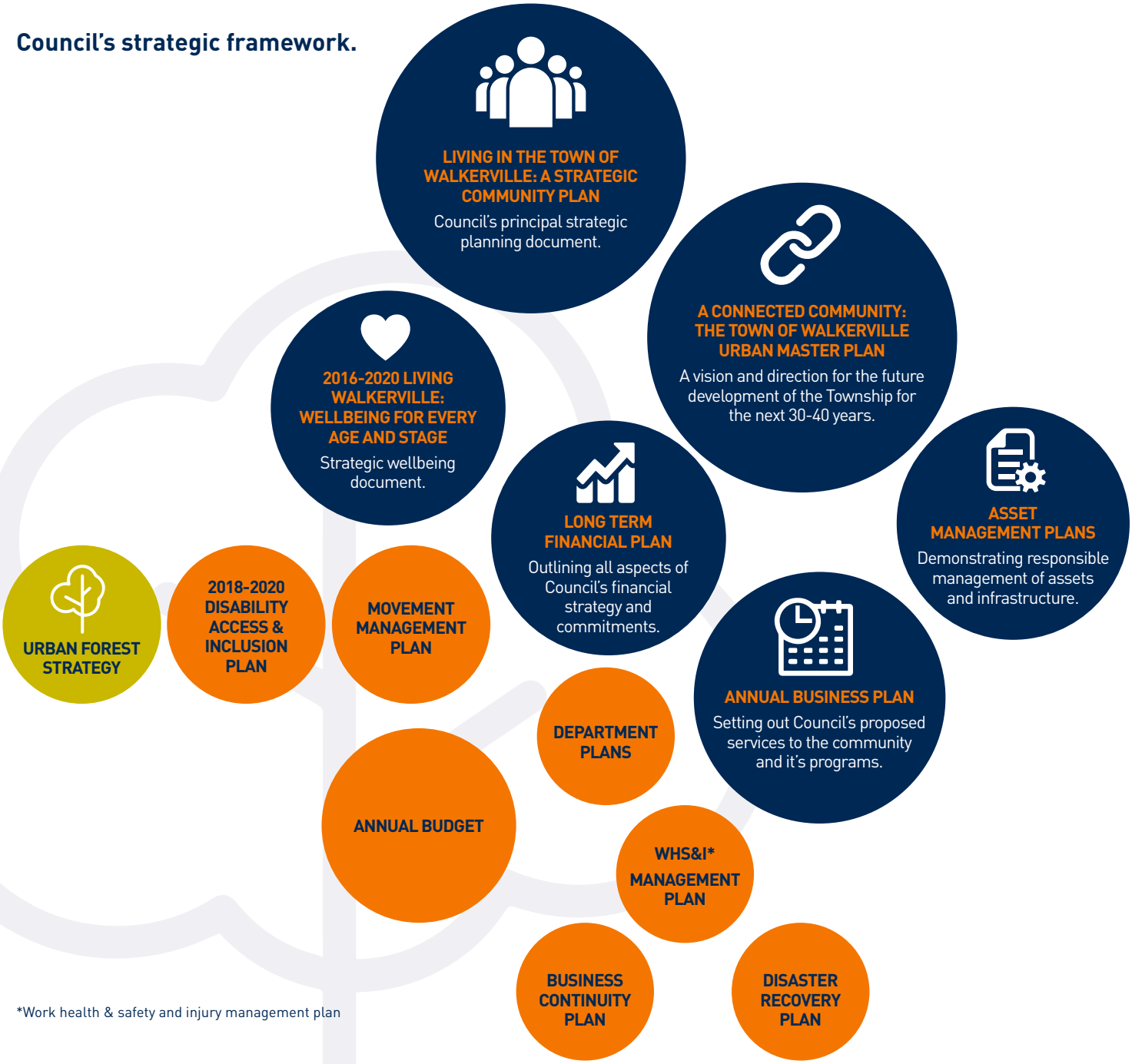
- why the urban forest matters
- key characteristics of the Town of Walkerville's urban forest
- issues and challenges
- current and future targets for tree canopy coverage
- goals and strategies.

The development of the *Urban forest strategy* was informed by face-to-face and online consultation with the community. It was also informed by technical analyses of tree canopy cover and ecosystem services evaluations.

2 STRATEGIC CONTEXT

This *Urban forest strategy* will guide and shape future tree management decisions in a way that aligns with Council's overall strategic framework (see below). The *Strategy* provides the broad direction for Council's Street *Tree Management Policy and Procedures Manual*, which collectively inform on-ground management of Walkerville's urban forest. Together, the *Strategy,* Policy and Manual will inform the development of the annual business plan and budget as it relates to the maintenance and re-establishment of trees on public land. The *Strategy* also sets the direction for how Council will work with residents to manage trees on private land.

Council's strategic framework.



*Work health & safety and injury management plan

3 WHY THE URBAN FOREST MATTERS?

The urban forest includes all trees growing within a town or city boundary on public and private land. Although other plants like shrubs and grasses are found in the urban forest, trees are the most iconic element and provide the most benefits.

The benefits provided by trees are wide and varied, spanning environmental, social, and economic benefits and many are interrelated (Figure 1, see page 11). It is this range of benefits that this *Strategy* aims to maintain and grow to ensure a sustainable, resilient and liveable Town in the future.

The following provides a summary of key benefits provided by urban trees. For further details, refer to the suggested further reading list at the end of this *Strategy*.

3.1 Environmental benefits

Environmental benefits are often the most well recognised by the community, with shade and wildlife benefits being the most commonly acknowledged. Trees, however, provide a range of other direct and indirect benefits to the environment, including:

- Cooling through shading and transpiration, including increased resilience to climate change related temperature increases.
- Mitigate climate change through absorbing and storing carbon and also through shading houses which results in reduced energy usage for heating and cooling, leading to reduced demand on electricity supplies and so lower greenhouse gas emissions.
- Manage stormwater through filtering rainwater and slowing runoff, which improves water quality.
- Absorbing odors and air pollutants (e.g. nitrogen oxides, ammonia, sulphur dioxide) and filtering particulates out of the air by trapping them on their leaves and bark.
- Provide wildlife resources, particularly habitat and foraging resources, such as nesting sites, hollows, flowers/nectar, fruit, and insects; all of which are increasingly important as native habitats continue to be cleared. In addition, all trees provide many native wildlife species potential refuge sites, which can be critical in urban areas for animals to escape threats such as dogs and cats.
- Connect habitats and facilitate movements, for many native species. This "corridor" creation through the built environment can be critical for some native species who are unable, or unwilling, to move through built urban areas. Providing tree-lined and vegetated corridors between key habitats can be critical for supporting wildlife conservation efforts, particularly under climate change.

3.2 Community benefits

Benefits provided by urban trees make cities healthier and more pleasurable places to live, with an increasing number of scientific studies showing that trees help people lead longer, healthier, and happier lives. The benefits to individuals and the community are both direct and indirect, ranging from physical, to mental, to cultural, including:

- Decreased morbidity and mortality rates for children, adults and senior citizens, including decreased heat-related deaths, alleviated respiratory system and cardiovascular related deaths, decreased sun (UV) exposure), improved immune system functioning, and increased physical exercise and sleep quality.
- Enhanced motor skill development for children able to play in trees and forest-like environments.
- Faster recovery rates and increased pain thresholds for hospital patients able to view trees and green spaces.
- Reduced stress and anxiety for people able to spend time amongst trees and workers able to view trees and nature from office buildings.
- Increased happiness and productivity with interactions with trees acting as a natural antidepressant, making us feel happier, improving overall mood and mental well-being, and enhancing workplace productive.
- Increased social interaction and decreased mental illness with access to treed streets and green spaces encouraging people into public open spaces and increasing community connectedness.
- Improved focus and reduced ADHD for children living in greener urban areas.
- Improved social confidence and problem solving for children able to climb trees, traits which lay the foundations for adults who are more socially and mentally balanced, confident and capable.

- Provide a nature connection, which has been shown to be important for many aspects of human health and well-being, as well as being essential for building people's affinity for nature and natural elements. The so-called "extinction of experience", that is the loss of people's interaction with nature, results in a cycle of disaffection toward nature, making it increasingly difficult to gain community support for greening actions on public and private land.

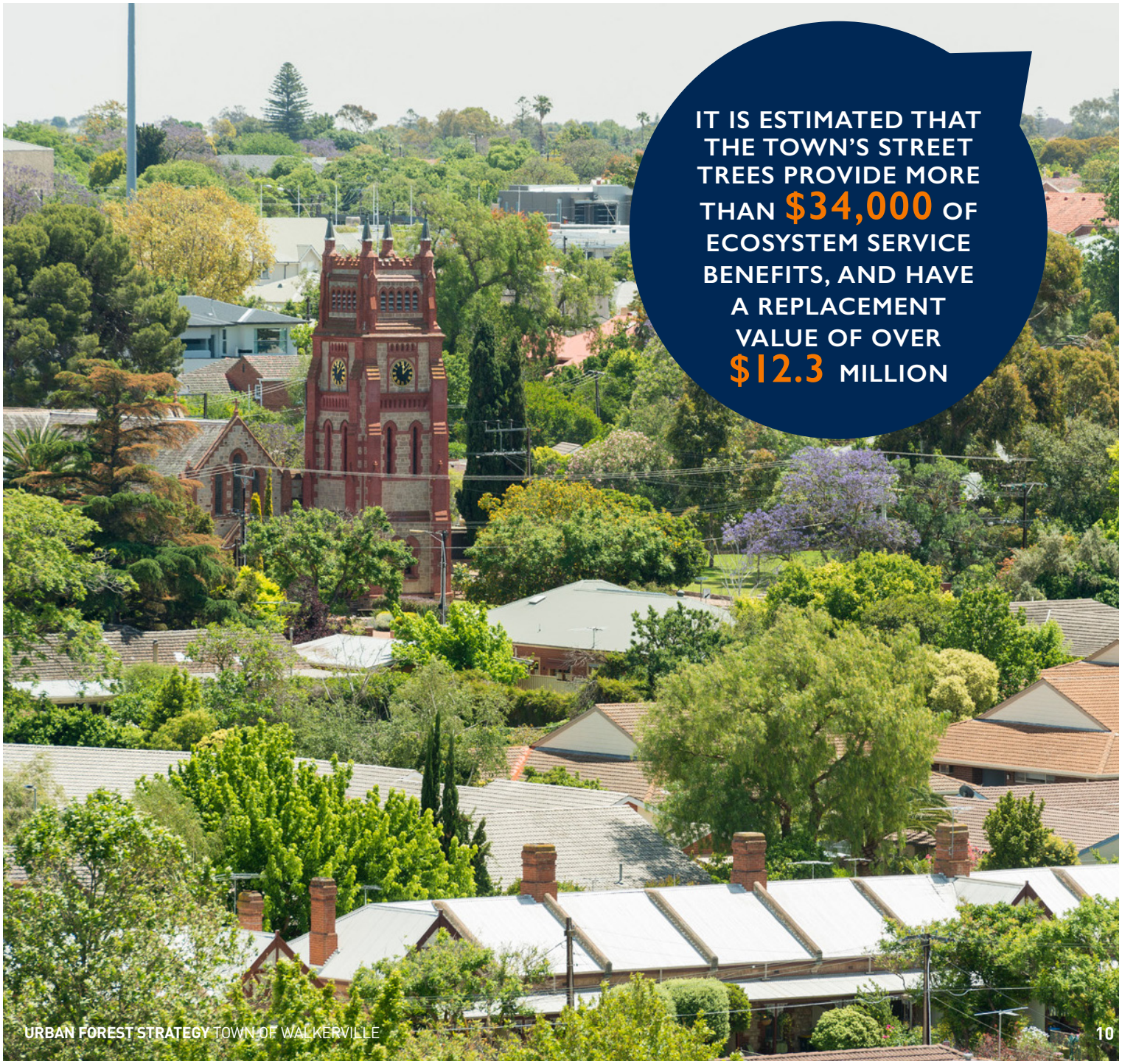
The benefits to people are such that some countries have requirements built in to their national health policies for people to spend time in nature. In Japan, for example, the practice of spending time relaxing amongst trees and nature is referred to as shin-rin-yoku, which translates to "forest bathing".

3.3 Economic benefits

Economic benefits provided by trees can be more difficult to quantify, and can vary substantially from area to area.

Key reported benefits include:

- Reduced energy costs to buildings shaded by trees.
- Increased property values for residential houses on leafy treed streets.
- Avoided costs of infrastructure maintenance and renewal through extended lifetimes of road and footpath surfaces shaded by trees.
- Decreased health system costs through improved community health and wellbeing.
- Enhanced tourism and marketing by creating more attractive places to visit.
- Improved local economic prosperity through more time spent in leafy treed retail precincts.



TREE BENEFITS

Some of the environmental, social, and economic benefits provided by trees.

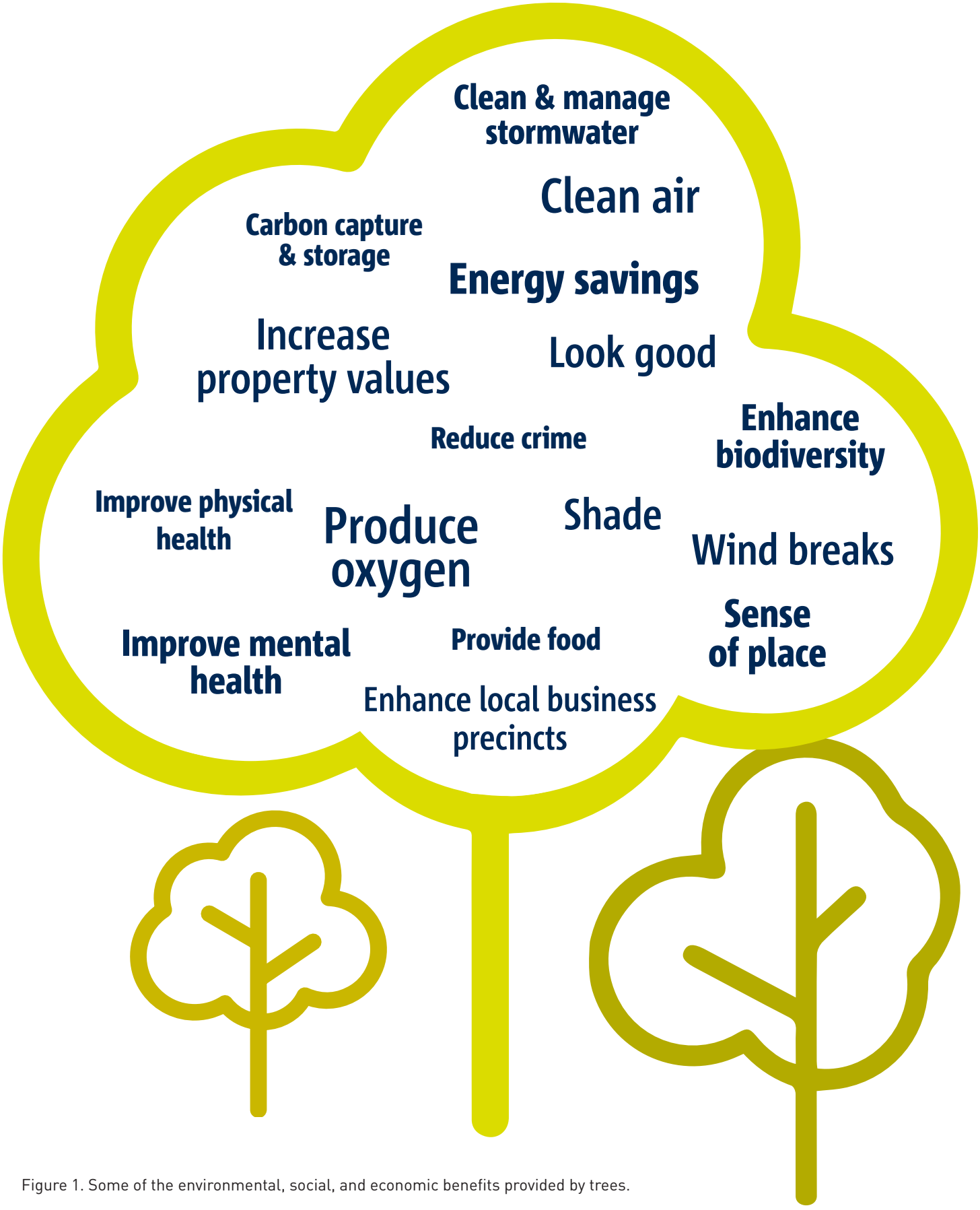


Figure 1. Some of the environmental, social, and economic benefits provided by trees.

4 THE TOWN OF WALKERVILLE'S URBAN FOREST

A combination of globally leading tree monitoring, management, and valuation tools were combined with GIS analysis for this assessment.

The i-Tree Canopy tool was used to assess land cover, including canopy and plantable space. This tool classifies land cover under randomly allocated points within a user-defined area overlaid on Google Earth imagery.

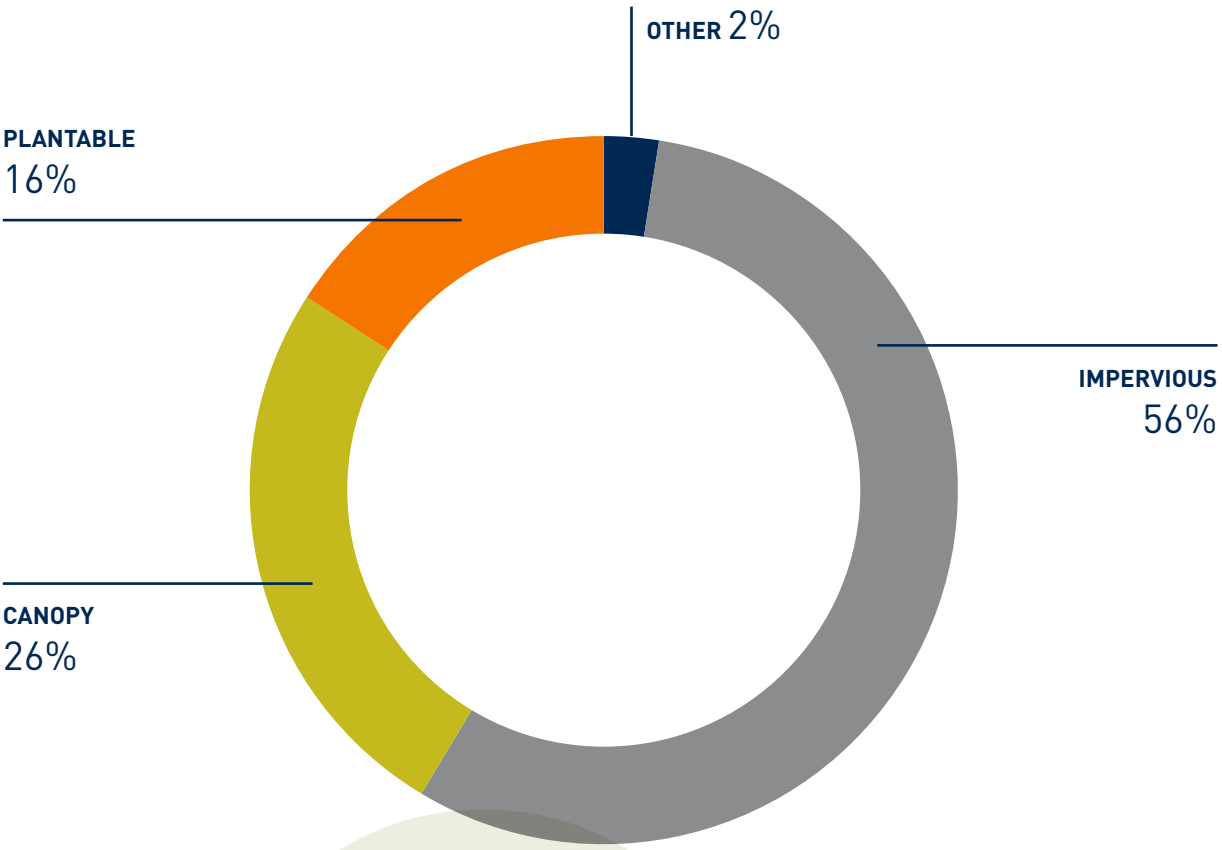
As each point is classified, i-Tree Canopy provides an automated running statistical estimate for each land-cover category of the area (km^2) and percent (%) cover within the study area, as well as an uncertainty estimate (i.e. standard error, SE). The classified points were then further analysed in a GIS to generate spatial outputs for each suburb and tenure.

i-Tree Eco was applied to a subset of street trees measured as part of the street tree audit. This tool provides an estimate of the ecosystem services produced by each tree, based on a set of measurements taken on each tree.

Ecosystem services assessed include: carbon sequestered annually and stored, rainfall intercepted, and air pollution removed.

The replacement value of the tree is also able to be estimated, this is an estimated like-for-like replacement cost based on species, age, size, and industry supply costs.

4.1 City-wide trends



MORE CANOPY AND OTHER COVER ON PUBLIC LAND

MORE IMPERVIOUS AND PLANTABLE COVER ON PRIVATE LAND

STREET TREES ARE VALUED AT OVER $12.3 MILLION

4.1.1 Land cover

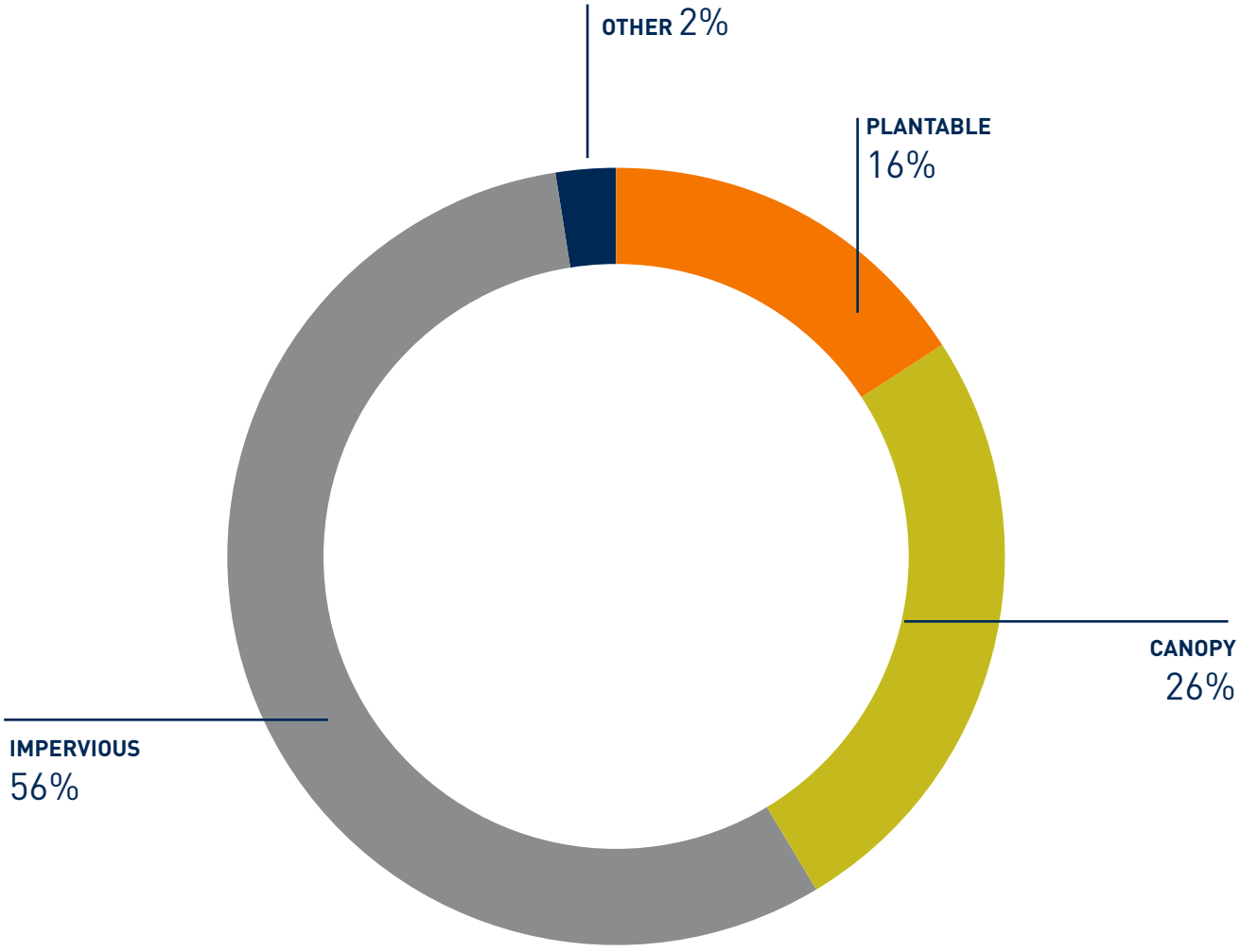
The Town of Walkerville's urban forest covers approximately 25% of the Council area, including public and private land, with the remaining land area being predominantly impervious surfaces (e.g. buildings and roads), followed by potential plantable space, and small proportion of unplantable space such as water and sporting fields (Figure 2).

Based on this assessment, to align with the *30 Year Plan for Greater Adelaide (2017),* the Council will be encouraged to increase its total canopy cover by at least 20% by the year 2045. That equates to an increase of 182,712.6 m^2 of canopy cover, or approximately 9.5 Adelaide Oval's worth. A primary consideration in future planning is where and how this target increase in canopy cover can be achieved.

4.1.2 Land tenure

The ability to protect and grow the urban forest will depend not only on the health and age of existing trees, but also on the proportion of trees currently located on private and public land; with trees on private land often at higher risk of being lost due to urban in-fill development and human/infrastructure conflict.

More than 80% of the Council area is privately owned and managed. The majority of impervious, canopy, and plantable space cover falls within private land (Figure 3).



IMPERVIOUS
- **Building 27.80%**
- **Road 18.62%**
- **Other 9.70%**

CANOPY
- **Pervious 13.67%**
- **Impervious 11.91%**

PLANTABLE
- **Bare ground 2.67%**
- **Grass 13.22%**

OTHER (UNPLANTABLE)
- **Grass sporting 1.43%**
- **Bare ground 0.20%**
- **Low growing native vegetation**
- **Water 0.33%**

Figure 2. Estimated land cover, including canopy (tree) cover within the Town of Walkerville.

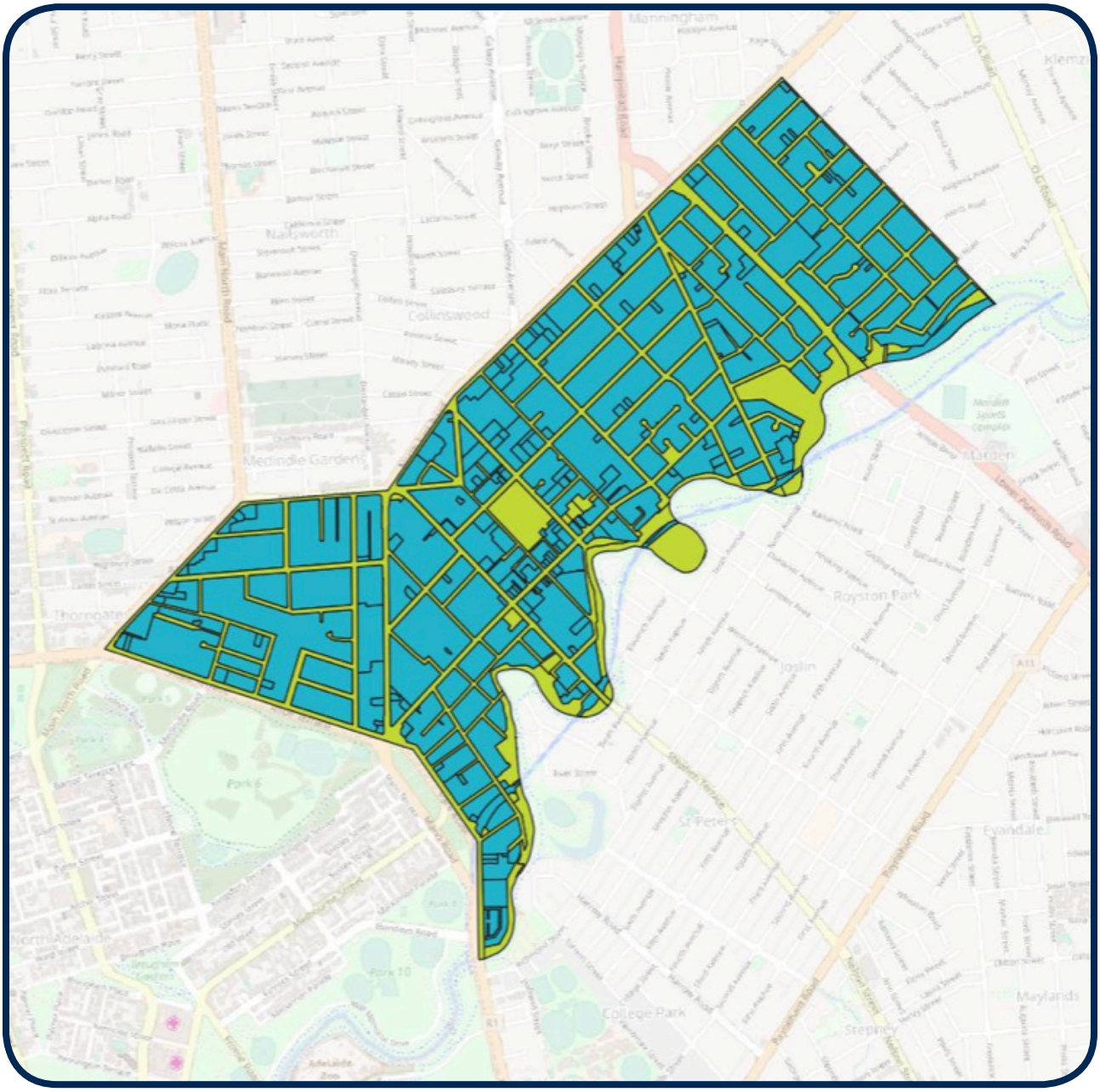


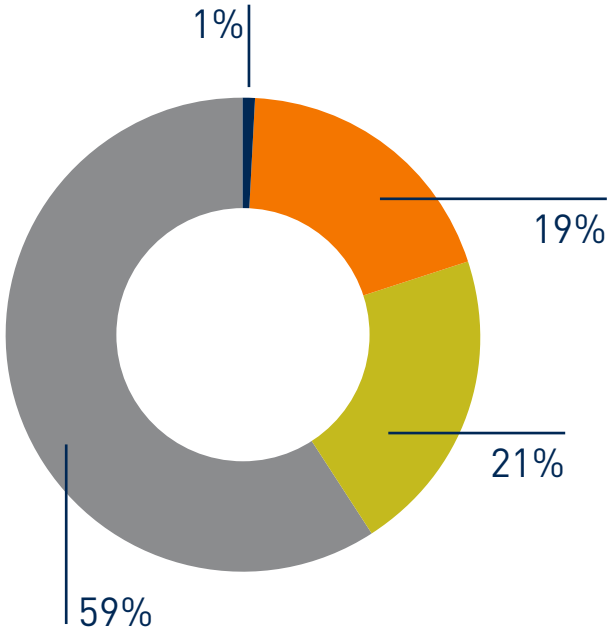
Figure 3. Land tenure within the Town of Walkerville. Public land (green) covers 17% (0.6 km2) of the land area, and private land (blue) covers 83% (2.95 km2) of the land area.

Underlying drivers of these broad land cover types vary somewhat. Impervious cover on public land, for example, is dominated by roads, whereas, buildings and other impervious cover types (e.g. driveways, pools) dominate on private land (Figure 4). On private land, canopy cover occurs mostly over pervious surfaces, but mostly over impervious surfaces on public land. More grass than bare ground areas are potentially able to be planted with a tree (i.e. plantable areas), with this trend being consistent on public and private land (Figure 4). Comparatively, more of the Town's other unplantable land cover occurred on public than private land, with this being driven primarily by the number of grassy sporting fields and water bodies on public land (Figure 4).

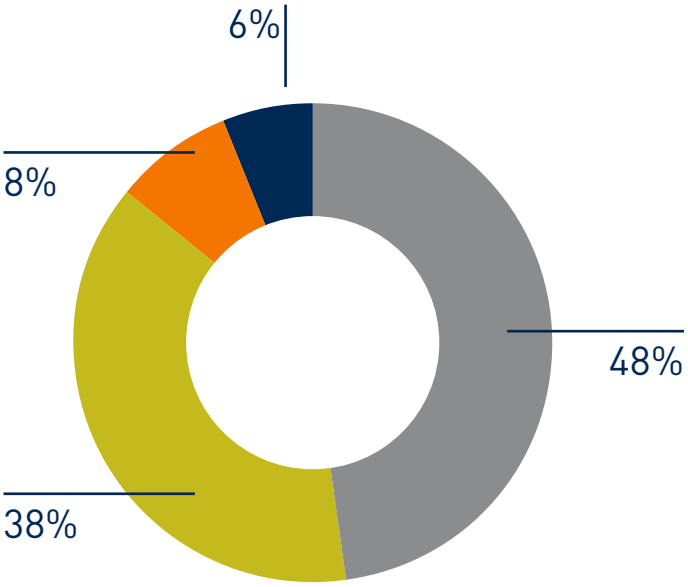
The approximately 17% of public land within the Council area is equivalent to about 0.6 km^2. Of this public land, only 8% is considered plantable space (Figure 4). This is equivalent to approximately 49,909 m^2 or 2.6 Adelaide Ovals' worth. In comparison, of the 2.95 km^2 of private land (Figure 3), approximately 19%, or 29 Adelaide Ovals' worth, of area is considered to have plantable potential (Figure 4).

These findings are particularly important when considering the recommended 20% increase in total canopy cover by the year 2045. To achieve this target requires an increase of 182,712.6 m^2 of canopy cover from the current cover amount, or approximately 9.5 Adelaide Ovals. However, with only 2.6 Adelaide Ovals worth of potential plantable space on public land, approximately 3 times as much private land would need to be planted to achieve.

Private



Public



IMPERVIOUS | CANOPY | PLANTABLE | OTHER (UNPLANTABLE)

Figure 4. Comparison of public and private tenures showing the relative proportions of broad land uses.

4.1.3 Ecosystem services

Trees comprising the urban forest represent a diversity of native and introduced tree species of varying ages and condition. Council's 2017 audit of its 4,130 street trees, for example, reported more than 28 species (see Attachment A) with more than 22 Genus ranging in age from young to senescent and with a useful life expectancy ranging to more than 20 years. Although 62% of the street trees were considered mature, the overall health of the trees was very good, with 63% having a useful life expectancy of more than 20 years and a further 26% with a useful life expectancy of 10-20 years.

The useful life expectancy of a tree is an estimation of the number of years a tree can realistically be expected to remain in the landscape provided growing conditions do not decline and any recommended works for protecting the tree are completed.

Mature, healthy trees tend to provide the most benefits for community, economy and the environment. The Town's street trees for example are estimated to provide more than $12,131 worth of annual ecosystem services, $22,258 worth of total carbon storage value, and have a like-for-like replacement value of more than $12.3M. In addition to the benefits provided, it is clear that people also intrinsically value mature trees. A community survey conducted to inform development of this *Strategy* indicated that residents value the Town's large, mature trees (native or non-native), particularly those that are either visually attractive (e.g. Jacarandas, bottlebrushes), provide resources for wildlife (e.g. river red gums, bottlebrushes), or provide a sense of place (e.g. Moreton Bay figs, Plane trees).

4.2 Suburb trends

All suburbs (Figure 5) are comprised of between 50% - 60% impervious cover, between 20% - 30% canopy cover, and between 10% - 20% plantable space. Understanding suburb-level nuances in canopy cover and plantable space, as well as change over time in land cover will facilitate prioritisation of actions aimed at growing the urban forest, including planting actions as well as community engagement and incentive actions.

Figure 5. Town of Walkerville showing suburb boundaries in black and private (blue) and public (green) land tenures.

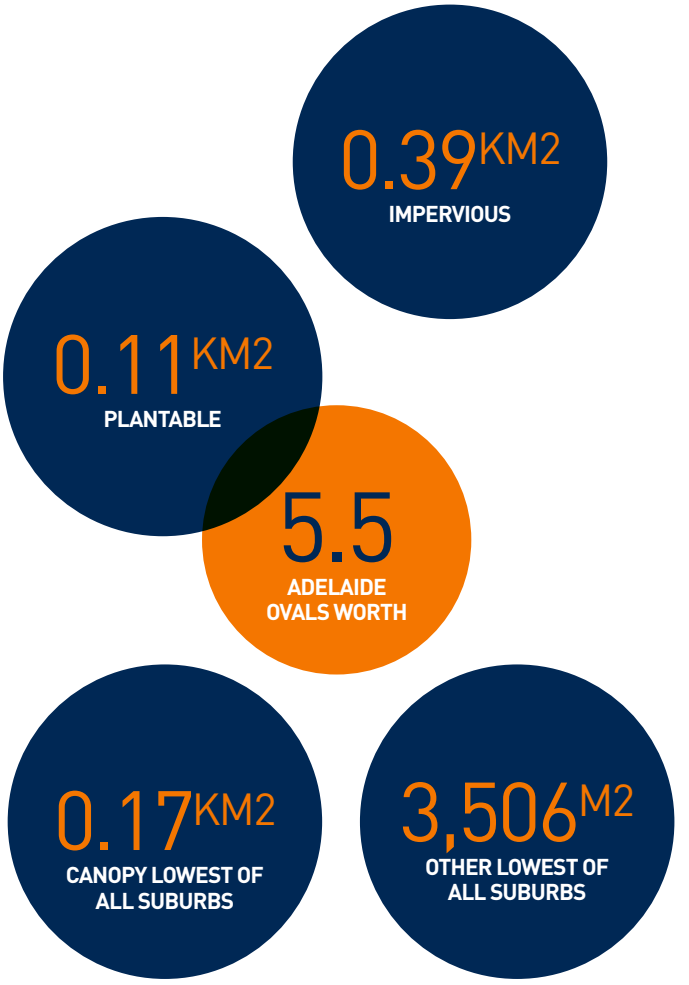
4.2.1 Medindie

19%
OF COUNCIL AREA

INCLUDES
22%
PUBLIC LAND

MOST IMPERVIOUS, CANOPY, PLANTABLE AND OTHER COVER OCCURS ON PRIVATE LAND

Area of cover



Proportion of suburb

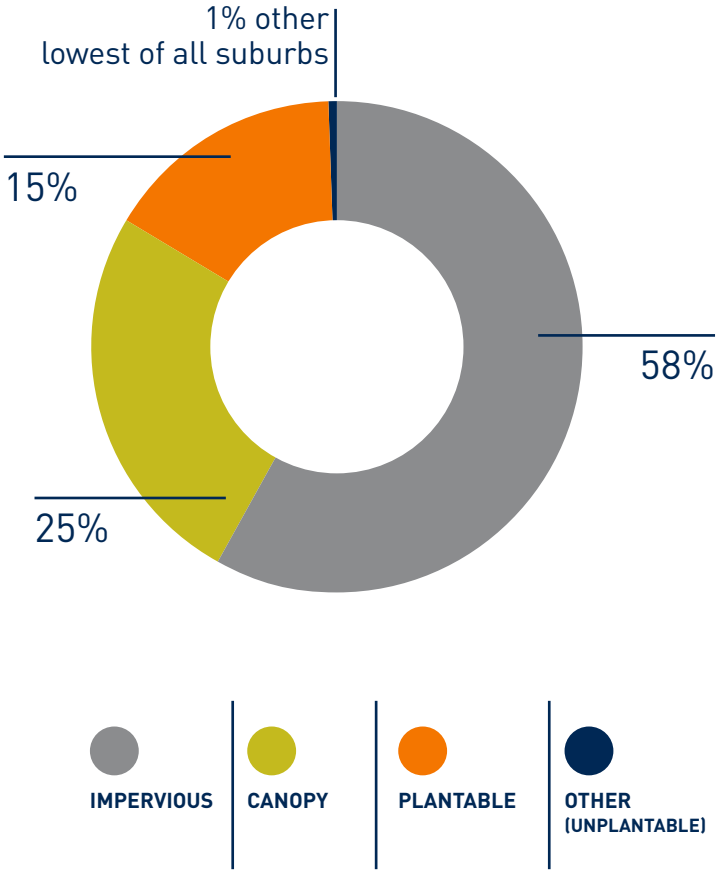


Figure 6. Medindie suburb showing tenure and pie chart of total land cover for suburb

Medindie comprises approximately 19% of the Council area, with 22.7% of the suburb being public land comprised primarily of road reserves. The suburb has the highest relative proportion of impervious cover of all suburbs (Figure 6), with most of this impervious cover falling on private land (45.83%). Over 25% of the suburb is covered by tree canopy, but at an equivalent area of 0.17 km^2, represents the least overall area of canopy cover of all suburbs. Most of this canopy also falls on private land (15.63%), likely explained by the high dominance of road reserves comprising the private land and limiting the space available for trees. Approximately 5 Adelaide Ovals worth of potential plantable space occurs in this suburb, with nearly all of it occurring on private land (15.10% of a total 15.63%).

4.2.2 Gilberton

18%
OF COUNCIL AREA

INCLUDES
33%
PUBLIC LAND

MOST IMPERVIOUS, CANOPY, AND PLANTABLE COVER OCCURS ON PRIVATE LAND

MOST OTHER COVER OCCURS ON PUBLIC LAND

Area of cover

0.34 KM2
IMPERVIOUS LOWEST OF ALL SUBURBS

0.09 KM2
PLANTABLE

4.6
ADELAIDE OVALS WORTH – LOWEST OF ALL SUBURBS

0.18 KM2
CANOPY

0.02 KM2
OTHER

Proportion of suburb

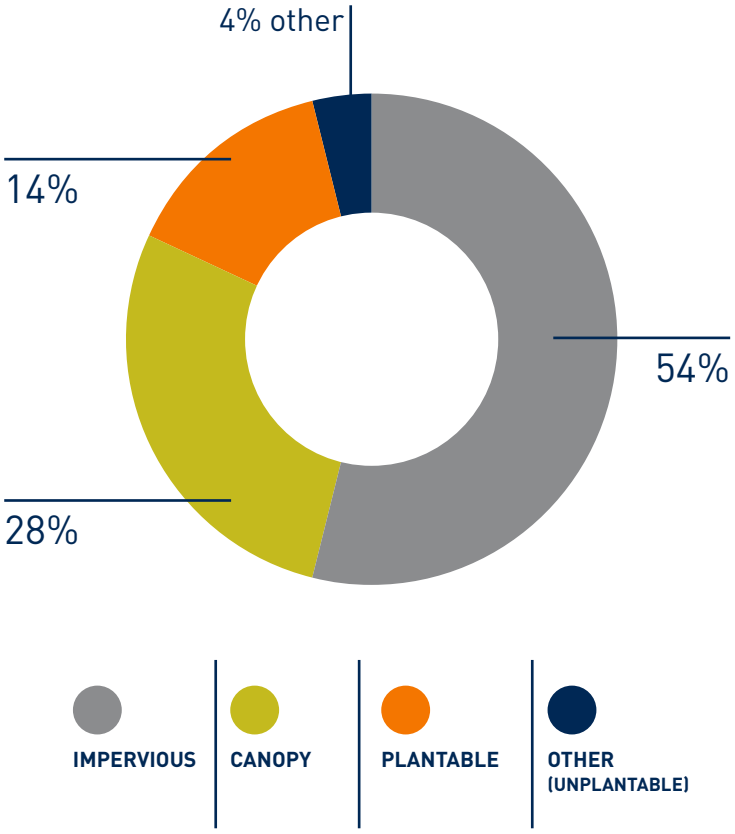


Figure 7. Gilberton suburb showing tenure and pie chart of total land cover for suburb

Gilberton covers about 18% of the Council area, with 33% of the suburb being public land comprising a proportion of the River Torrens linear corridor. Of all the suburbs, Gilberton has the lowest relative proportion of impervious cover and the highest relative proportion of canopy cover. This is consistent with common global urban trends for the proportion of canopy cover to be inversely related to the proportion of impervious cover, indicative of urban in-fill processes. However, despite having the greatest total area of impervious cover, the area of canopy cover is not the greatest across suburbs. The majority of impervious and canopy cover is on private land. Approximately 4.6 Adelaide Ovals worth of plantable space cover occurs in this suburb, with most of this being on private land (11.72% of a total 14.32%).

4.2.3 Walkerville

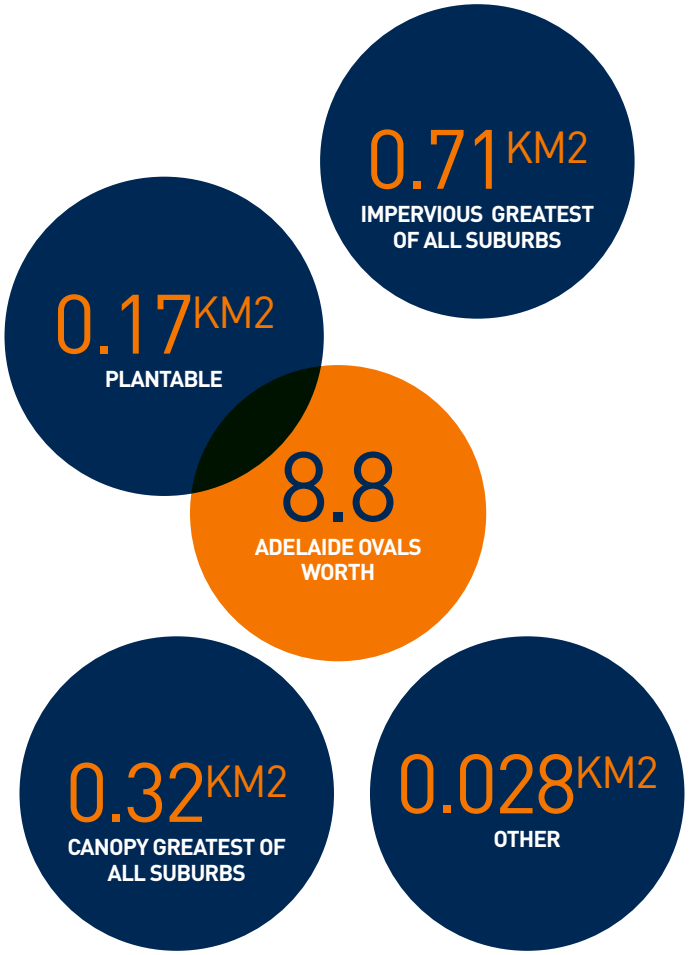
35% OF COUNCIL AREA

INCLUDES 32% PUBLIC LAND

MOST IMPERVIOUS, CANOPY, AND PLANTABLE COVER OCCURS ON PRIVATE LAND

MOST OTHER COVER OCCURS ON PUBLIC LAND

Area of cover



Proportion of suburb

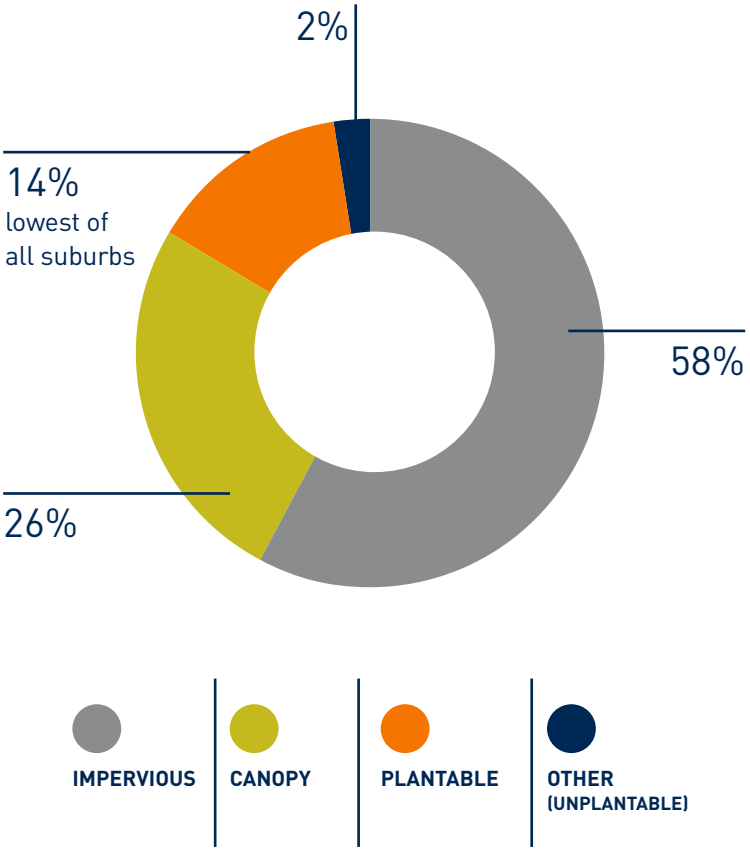


Figure 8. Walkerville suburb showing tenure and pie chart of total land cover for suburb

Walkerville is the largest suburb, covering more than a third of the Council area. Nearly a third of this suburb is public land, including portions of the River Torrens linear corridor, and the Walkerville Sportsclub and Oval. Of all the suburbs, Walkerville has the second highest relative proportion of impervious and canopy cover (Figure 8). Although not the highest relative proportion of cover, being the largest suburb, the total areas of impervious and canopy cover are the highest of all the suburbs. The majority of the impervious and canopy cover falls within private land. Nearly 9 Adelaide Ovals worth of potential plantable space occurs in this suburb, with nearly all of it occurring on private land (12.24% of a total 13.80%).

4.2.4 Vale Park

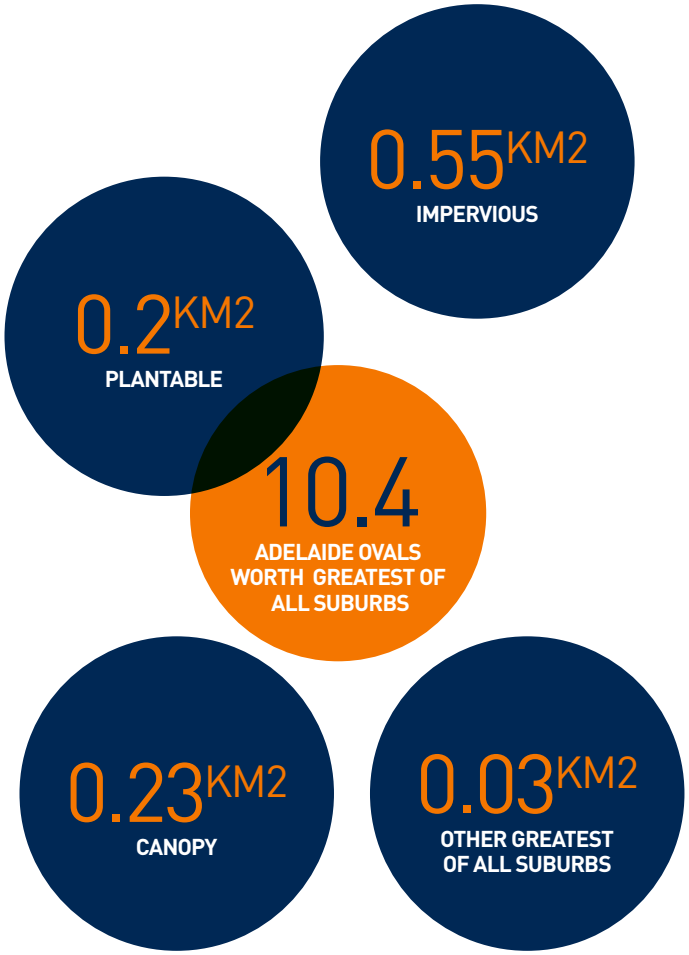
29%
OF COUNCIL AREA

21%
PUBLIC LAND

MOST IMPERVIOUS, CANOPY, AND PLANTABLE COVER OCCURS ON PRIVATE LAND

MOST OTHER COVER OCCURS ON PUBLIC LAND

Area of cover



Proportion of suburb

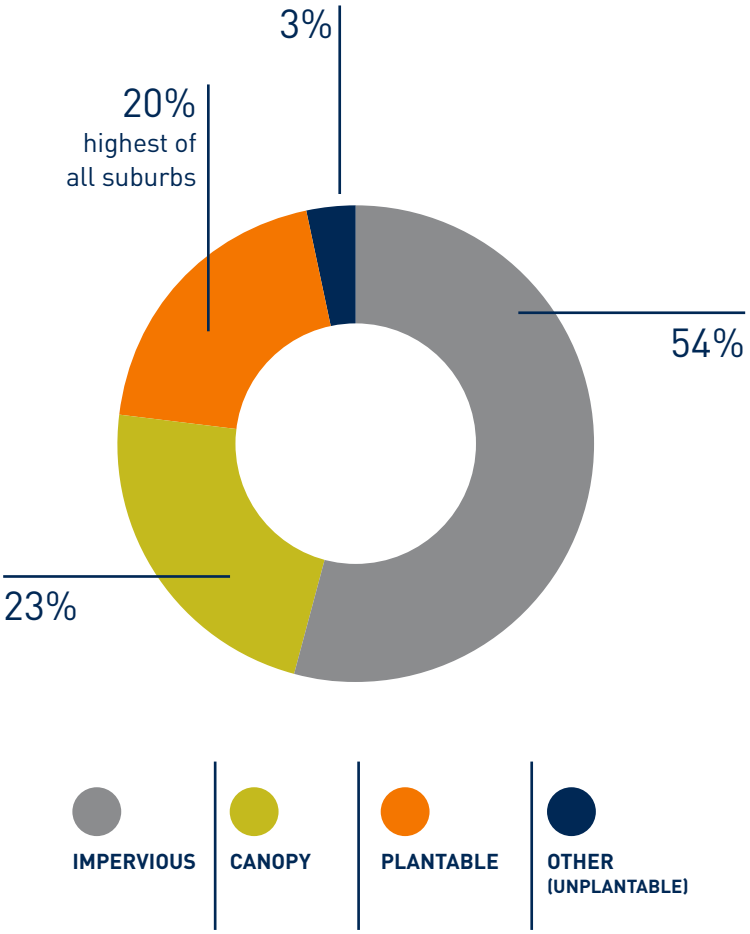


Figure 9. Vale Park suburb showing tenure and pie chart of total land cover for suburb

Vale Park is the second largest suburb, covering nearly 30% of the Council area. Just over 20% of this suburb is public land, including portions of the River Torrens linear corridor and Levi Park Caravan Park. Of all the suburbs, Vale Park has lowest relative proportion of canopy cover, but the highest relative proportion of potential plantable space (Figure 9). The area of plantable space is also the greatest across the suburbs, equivalent to more than 10 Adelaide Ovals worth. Whilst most of this area occurs on private land (15.36% of a total 19.79%), the greatest opportunity for plantings on public land also occur in this suburb.

What is plantable space?

Plantable space is an area of land which is assessed from aerial imagery as being potentially suitable for planting a tree. Identifying these areas is important to help determine where trees could be planted and canopy cover increased. Assessing plantable space generally excludes open space areas like sporting fields and golf fairways where living turf is irrigated to maintain green playing surfaces. Further on-ground examination of potential plantable space areas would need to occur to determine suitability for tree plantings (e.g. consideration of over-and under-ground utilities).

By suburb the highest proportions of impervious cover on private and public land occurs in Medindie 70% and 19%, respectively), with the lowest proportions occurring in Gilberton (45% on private, 14% on public). Comparatively, the highest proportions of canopy cover on private land occurs in Walkerville (26%), and on public land in Vale Park (16%).

Gilberton has the lowest proportions of canopy cover on private and public lands. Vale Park offers the highest proportion of plantable opportunities on both private and public lands (24% and 7%), whereas the lowest proportions of plantable space on private land occurs in Gilberton (13%), and on public lands in Medindie (0.8%).

5 ISSUES & CHALLENGES

Despite the many benefits provided by trees they are vulnerable to a range of threats, some of which are local and others that are regional and global. Managed poorly, trees can also present challenges to residents and Council alike.

The following section outlines some of the key threats and management challenges that need to be addressed as part of maintaining and growing the Township's urban forest.

Urban development and infill

The State's commitment to managing growth within the existing urban footprint has seen a significant increase in the ratio of infill development compared to fringe development in Greater Adelaide. Currently, approximately 76% of Greater Adelaide's new housing growth is in established suburbs. The *30 Year Plan for Greater Adelaide* suggests that 85% of all new housing in metropolitan Adelaide will be built in established urban areas by 2045.

Infill development can lead to the loss of established trees, especially on private land, during the building and construction phase. Furthermore, an increase in the area of buildings and hard surfaces can reduce the amount of land available to support trees.

The Town of Walkerville is experiencing infill development across the Council area, however, it is currently strongest in Vale Park due to the type of existing housing and block sizes in this area. This is resulting in older houses on larger blocks being replaced by more than one dwelling and reduced green space.

The effects of infill on tree canopy cover can be addressed in part by property owners working closely with Council early during a development so that trees can be protected. Council encourages the protection and promotion of trees in accordance with the Australian Standard for the protection of trees on development sites (AS4970-2009), which describes how existing trees can be managed to reduce preventable damage.

Climate change

Climate change is caused by the release of greenhouse gases into the Earth's atmosphere, which trap additional heat (energy) from the Sun. In turn this is causing a change in the global climate. For example, evidence from the CSIRO and BoM* indicate that temperatures in Adelaide have already increased by approximately 1°C from 1910 to 2013.

At a local scale, climate change is creating warmer and drier conditions. Temperature is projected to increase by up to 1.6°C on average in Eastern Adelaide by 2050 coupled with a reduction in Spring rainfall of at least 20%[1]. In addition, the number of periods with two or more days exceeding 35°C is projected to more than double. This places additional stress on trees but also raises the importance of the cooling and other benefits they provide.

Given the lifespan of trees, the maintenance and regeneration of the urban forest needs to consider the longer term changes in the local climate.

People and trees

Many of the benefits provided by trees are related to their growth and canopy cover and so benefits provided increase as trees mature and remain healthy. However, in urban environments, there can be competition for space between trees and built infrastructure and facilities, often creating conflicts which need to be resolved to ensure human safety and uninterrupted utility services.

For example, inappropriate tree selection and/or soil and site preparation, can lead to:

- a tree too large for a given site
- a tree not capable of reaching full maturity if located beneath powerlines or too close to a building
- tree root systems chasing soil moisture which can uplift footpaths and cause damage to building footings
- impact on private property such as fences.

Leaf fall for deciduous trees can also create concerns for some residents during Autumn when large amounts of leaves can accumulate on footpaths.

Another challenge for Council and the community is the design and maintenance of avenue or boulevard plantings. For many people, such plantings are highly valued and represent highly attractive streetscapes that typify the character of Walkerville. However, avenue plantings often consist of single tree species which is not ideal from a tree diversity and hence long-term resilience perspective. More work is required with the community to identify where avenue plantings are desired and how best to get an appropriate species diversity while still achieving the desired local amenity outcomes.

With appropriate tree selection, soil and site selection and preparation, and ongoing management, many of the management problems and concerns of residents and the Council can be addressed. For example, the Town of Walkerville has an Autumn leaf program, which conducts leaf fall street sweeping on a needs basis in troublesome areas informed by leaf accumulation audits.

** Bureau of Meterology*

[1]Further information on project changes in the climate for Eastern Adelaide are provided in the Resilient East Regional Climate Change Adaptation Plan https://www.environment.sa.gov.au/topics/climate-change/programs-and-initiatives/adapting-to-climate-change/regional-adaptation-plans

Urban heat island

Heat accumulates differently in the urban landscape depending on the land surface type. This accumulation of heat can create "urban heat islands" in cities where the average surface temperature is at least 2˚C warmer than that of the suburb, region or city as a whole.

Heat islands can impact individual and community wellbeing due to heat stress, cause reduced economic productivity especially for people working outdoors, and impact on plants and animals. This is especially important given that residents in Adelaide are considered to be the most susceptible to heat impacts of all Australian capital cities[2].

Heat can accumulate for a variety of reasons including:

- Impervious hard surfaces: Buildings and pavements are typically impervious and have high heat absorption capabilities. Evidence from heat mapping undertaken in Adelaide shows that major and minor roads accumulate far more heat than areas of green open space. Also, artificial surfaces such as rubber softfall used in playgrounds and artificial turf, can experience significantly higher surface temperatures than other types of hard surfaces.
- Human activity: Motorised transport is a major contributor to increased greenhouse gas emissions. In hot weather, the use of air conditioners increases, generating more waste heat.
- Low vegetation coverage: With less vegetation, cities receive less natural cooling from shade and evapotranspiration. Research undertaken in Adelaide shows that there can be at least a 7°C different in the average surface temperature of major roads compared to irrigated open space.

The urban forest is a proven performer when it comes to cooling cities through a combination of shade and transpiration from leaves. Continuing to support the maintenance and growth of Walkerville's urban forest will help manage heat island impacts into the future.

Heat islands occur across councils and hence need collaboration to address. For example, one of the most significant heat islands in close proximity to Walkerville is in the northern parklands in an area managed by the City of Adelaide[3]. This area is not irrigated during summer and as a result the dry ground and grass are warmer than the average regional surface temperature. Addressing heat islands now and in the future will require colaboration across councils, as has occurred with the Eastern and Northern Adelaide Collaborative Heat Island Mapping project, in which the Town of Walkerville has partnered with other councils in eastern Adelaide and with the City of Salisbury.

Water availability

The health of trees is influenced by factors such as climate, soil conditions, pests and diseases and the availability of soil moisture. The ability for trees to access sufficient water as they grow impacts whether they reach full maturity and also influences whether they impact infrastructure. For example, tree roots that uplift footpaths may in some instances be searching for water.

The impact of water stress on trees became evident when a decade ago during the Millennium Drought many large, mature trees died as a result of water stress. Periods of water stress as a result of drought and drier seasons in general are expected to increase with climate change.

The Town of Walkerville has already been very proactive in responding to water stress for trees by ensuring that irrigation requirements are suitable and by investing in water sensitive urban design features that help to better manage stormwater and provide water for vegetation. One example of water sensitive urban design that is helping the Township's trees are the TREENET inlets on Rose Street, Elm Court and Briar Ave. These devices are located at the kerb face and allow the first flush of storm water runoff to be captured. This in turn allows water to directly access trees which can reduce the damage by tree roots to road pavements that can be caused by roots searching for soil moisture.

Council photos

Warmer and drier conditions by mid-century will make growing trees more difficult, but also increase their importance for cooling.

[2] *Longden, T. (2018). Measuring temperature-related mortality using endogenously determined thresholds. Climatic Change pp 1-33. https://doi.org/10.1007/s10584-018-2269-0.*

[3] *Seed Consulting Services, EnDev Geographic and Monash University (2018). Collaborative Heat Mapping for Eastern and Northern Adelaide Report. Prepared for the City of Unley on behalf of the Eastern Region Alliance of Councils and the City of Salisbury.*

Ageing tree population

As trees grow and mature they increase the range of benefits that they provide to the community and environment. However, as they age they require maintenance and then eventually removal and replacement. In a natural system this happens gradually and with little impact on people.

In an urban environment, an ageing or hazardous tree cannot usually be left until it completely falls apart, which is often seen through limb fall or dieback of branches and loss of leaves. Managing the aesthetic impact of ageing trees is also a challenge because in many instances entire streets will have been planted within a short period of time meaning that when trees are removed and replaced there can be periods with limited tree canopy.

The Town of Walkerville has a dedicated program for tree replacement which is revised annually and informed by their *Street Tree Management Policy,* which has been updated as part of developing this *Strategy.* This ensures that street tree management and replacement is done according to current practices taking into consideration tree species, infrastructure location, and future development (urban infill).

Maintaining a resilient urban forest

Maintaining a resilient urban forest means having a tree stock that is able to withstand and bounce back from a range of impacts. Aside from water and temperature stresses, the tree stock can also be impacted by pests and diseases.

Maintaining a resilient urban forest requires diversity at the tree species, genus and family levels, which reduces the chance of pest and disease impacts in particular. As a general rule of thumb, the Santamour Diversity Index (SDI) is often used as a basis for achieving adequate urban tree species diversity, particularly in street trees[4]. The SDI states that no tree species should comprise more than 10% of a city's tree population, no tree genus should comprise more than 20%, and no tree family should comprise more than 30%. This rule of thumb is often adapted to suit local Council requirements. For example, diversity targets applied for the City of Sydney and the City of Melbourne range from between no more than 5-10% of the same species, 10-30% of the same genus, and 20-40% of the one family.

Diversity needs to be considered for council wide plantings as well as avenue or boulevard plantings. While traditional avenue plantings commonly consist of one species, introducing a greater diversity of species is important for long term resilience of these areas to pest and diseases. Working with the community to ensure that new avenue plantings or replantings continue to meet amenity objectives while also being more diverse will be important.

In determining the appropriate diversity for the Town of Walkerville, consideration should be given to the size of the Council, the well-established nature of the trees, the limited opportunity to achieve very high diversity targets, and the drier climatic conditions meaning that there is lower species availability than may be the case in some wetter parts of Australia.

Encouraging diversity in tree selection should also include the use of native and non-native trees. While native trees may be well suited to the local environment and provide biodiversity benefits, non-native species provide other benefits such as shedding leaves during winter which provides greater natural light around homes and natural buildings.

- Residents believe most challenges to growing the urban forest can be overcome, but urban infill, the "NIMBY"[5] effect, and lack of political support are considered challenges.
- Mature trees that are visually attractive, provide resources for wildlife, or provide a sense of place are highly valued by the community, such as large mature Eucalypts along the River Torrens, flowering Jacarandas, and well-maintained and flourishing boulevard plantings.

[4] *Santamour FS, Jr. (1990) Trees for urban planting: Diversity, uniformity, and common sense. Proceedings 7th Conference Metropolitan Tree Improvement Alliance (METRIA), 7: 57–65*

[5] *The "Not In My Back Yard" (NIMBY) effect is a natural human psychological phenomenon of ownership and influence whereby community members strongly oppose a project of change affecting their property or local neighbourhood, though are not necessarily opposed to the project occurring elsewhere.*

6 FUTURE DIRECTION

6.1 Vision, goals and objectives

This *Strategy* will guide and shape future tree management within the Town of Walkerville to deliver the following vision:

> A healthy and resilient urban forest that contributes to the health and wellbeing of the Town of Walkerville's community, economy, and environment, creating a desirable place to live, work and visit.

Increasing the level of tree canopy cover will require Council and the community to work together. Based on the Town of Walkerville's current canopy cover of 25%, to meet the target set for Metropolitan Adelaide councils in the *30 Year Plan for Greater Adelaide* will require a 20% increase in canopy cover by 2045. This will require significant plantings on both public and private land.

This *Strategy* is based on five goals for the urban forest. Each goal is accompanied by objectives, which will inform actions identified as part of the annual business plan and budget process . Identification and implementation of actions will also be informed by the Council's *Street tree management policy and procedures manual,* which collectively inform on-ground management of Walkerville's urban forest.

The goals and objectives are as follows:

1. GROW

Grow the urban forest on public and private land through new plantings to maximise the social, economic and environmental benefits of trees and urban greening.

To grow the urban forest, the following objectives will be met:

(a) plan and implement yearly tree planting programs on public land to increase the number of trees currently planted by 20% within the Township

(b) undertake a baseline audit of all trees currently growing on public land, including species, size, canopy spread, and health/condition

(c) increase the existing Council-wide canopy cover by 1% - this will be measured in the four-yearly review

(d) undertake four-yearly tree audits to review and understand the changes in the urban forest across public and private land.

A four-yearly tree audit will provide the data to determine whether tree plantings and increased canopy objectives are being met. While a 1% annual increase in canopy may appear a modest objective, the limited area of plantable space available on public land means that this could prove challenging to achieve. As such, reaching this objective will require work on public and private land, and in some instances, may require more generic green cover activities that allow for contributions from (for example) green walls and green roofs in addition to tree canopy.

2. PROTECT

Protect the urban forest from threats and loss by preserving the Town's existing street trees and maintaining other established trees on public and private land.

The Town of Walkerville strongly values its trees, which are recognised as having both important amenity and significant ecosystem services values as identified in Section 3 of this *Strategy.*

To achieve this goal, the following objectives will be met:

(a) manage the urban forest on public land in a sustainable way to ensure overall good health is maintained and promoted

(b) undertake successional and infill plantings on public land to ensure that at least 90% of the urban forest on public land is maintained at a useful life expectancy of more than 20 years

(c) encourage the protection of the urban forest on public and private land through consideration of current development plan policy in the assessment of development applications which considers the importance of trees against a number of other relevant planning considerations

(d) encourage the protection of trees on public and private land during development through adhering to AS4970-200.

A four-yearly tree audit will provide the data to determine the overall health and useful life expectancy of the trees on public land.

3. ENGAGE

Engage with the community, businesses, schools and the government to care for the urban forest and broaden the understanding of the benefits it provides.

To engage with residents and the broader community, the following objectives will be met:

(a) run tree engagement activities that educate and inspire the community

(b) investigate incentive schemes and guidelines for protecting trees on private land

(c) invite community volunteers to participate in tree audit and planting programs on public land.

4. MANAGE

Manage the urban forest through co-ordinated planning, design and maintenance to ensure its long-term health and sustainability.

To effectively manage the urban forest, the following objectives will be met:

(a) implement and retrofit water sensitive urban design infrastructure into ongoing Council Works programs

(b) develop "right tree, right place" guidelines for tree species selections on private and public land

(c) implement innovative retrofitting solutions for addressing infrastructure and community conflicts with existing mature trees.

5. FUND

Fund on-ground actions that manage and grow the urban forest by continuing to develop funding mechanisms that enable further investment.

To achieve this funding goal, the following objectives will be met:

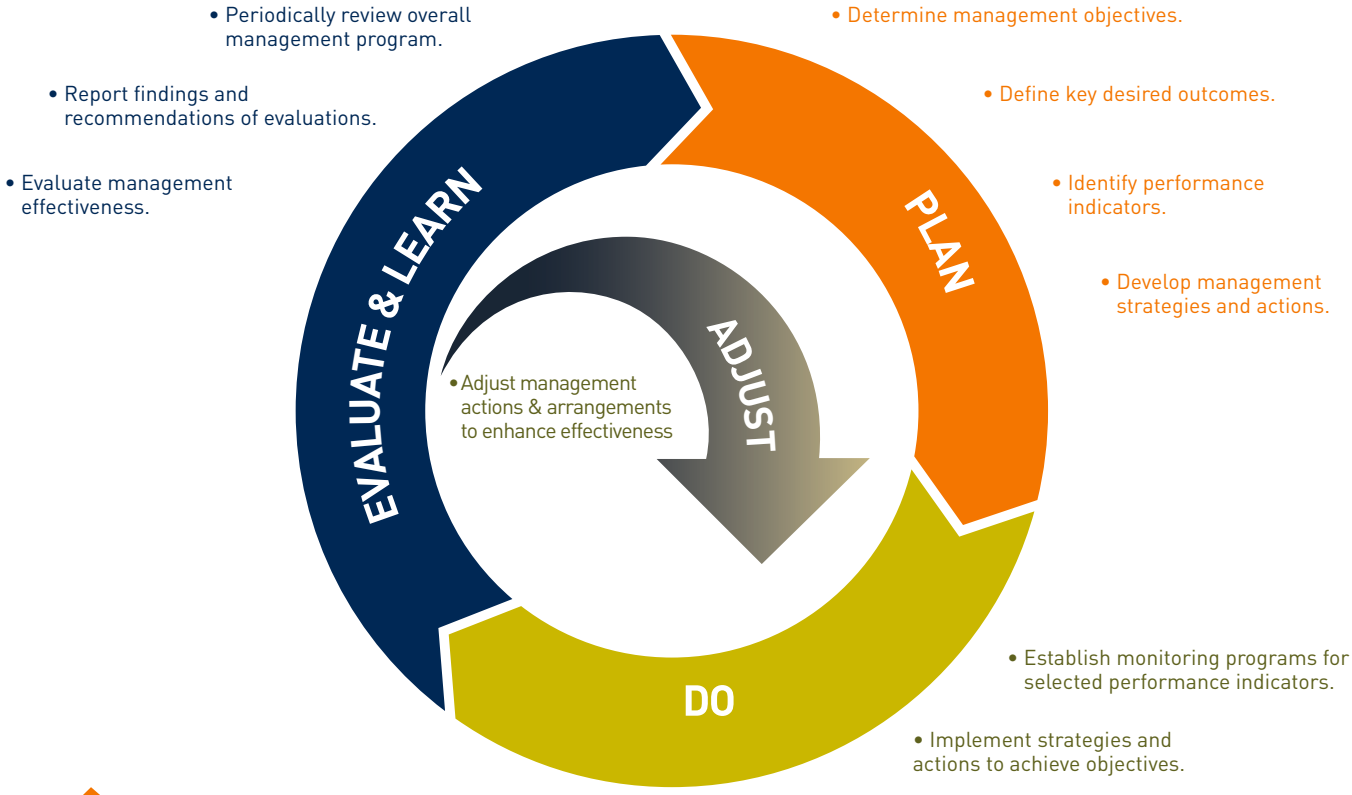
(a) establish a tree valuation method to ensure appropriate value of compensation is received when public trees are wilfully removed

(b) develop a business case for urban trees to advocate for increased government funding for tree planting programs.

6.2 Annual business plan and budget process

This *Strategy* will inform the annual business plan and budget process. Each year it will be used to revise and update an *Urban Forest Action Plan* which will provide details about actions to be taken to achieve goals and objectives, guidelines for implementing the actions, and an adaptive monitoring and evaluation program to assess implementation and relative success of actions in achieving objectives.

Key considerations in developing the *Urban Forest Action Plan* will include quantifiable, time-based and prioritised actions, and a defined procedure for tracking the progress and relative success of actions.



A Monitoring and Evaluation Program (MEP) is a strategic mechanism for assessing whether the *Strategy* is meeting its goals and objectives through the outlined actions in the Urban Forest Action Plan. Specifically, an MEP is "... a detailed program of works which defines what monitoring activities will take place, when and by whom, and how that information will feed back into actions and management decisions". In this way, the MEP assumes the *Strategy* is adaptive in nature to allow, if necessary, changes to objectives and actions to ensure greater on-going success of the *Strategy's* goals.

[6] *Global Environment Division (1998) Guidelines for Monitoring and Evaluation for Biodiversity Projects. s.l: Environment Department, World Bank, 27031.*

[7] *Jones G (2005) Is the management plan achieving its objectives? [book auth.] G Worboys, M Lockwood and T De lacy. Protected Area Management. Principles and Practice. Oxford, Oxford University Press.*

GLOSSARY

ABUNDANCE – the quantity or amount of something. When used in relation to species (i.e. species abundance), it refers to the number of individuals of a particular species.

ACTION – used here to describe a specific set of steps to achieve goals.

ADAPT – a term used to describe animals, plants, or habitats/ecosystems that are able to change or adjust to suit new/altered conditions.

BASELINE – describes the condition of target biodiversity prior to, or in the early stages of, project implementation. It is a benchmark against which management-induced changes can be identified and measured.

BIODIVERSE – used in relation to a habitat or region having a high level of biodiversity.

BIODIVERSITY – an umbrella term encompassing all species of plants, animals, and micro-organisms, and the variation in ecosystems and ecological processes of which they are part. It is a multi-dimensional concept, difficult to define in an operational sense and difficult to measure.

CITIZEN SCIENCE – scientific research conducted in whole or in part by amateur (i.e. non-professional) scientists and/or community volunteers. Typically conducted in collaboration with professional scientists. A bioblitz event is an example of citizen science.

DISTRIBUTION – the spread of something over an area. When used in relation to species (i.e. species distribution) it tends to indicate where areas of suitable environmental and habitat conditions occur for a species. For this BAP, it may be used to indicate if a species is found across the whole Council area, or restricted to certain localities or habitat types/associations.

DIVERSITY – the amount of variation in something. When used in relation to species (i.e. species diversity) it relates to the number of different species (e.g. to measure species diversity is to quantify the number of different species; to increase species diversity is to increase the number of different species).

ECOSYSTEM – refers to the complex network of living organisms and their interactions with each other and their environment.

ENVIRONMENT – the natural surroundings or conditions in which an animal or plant lives or operates. Can be used to describe the whole of the natural world, or a particular area.

GOAL – what is trying to be broadly achieved through implementation of the targets and actions.

IMPERVIOUS SURFACES – ground surfaces that do not allow water to percolate into the soil and so prevents filtering of pollutants and recharging of water tables. These surfaces are often covered by mand-made sealed surfaces (e.g. roads, buildings, footpaths) (compared to pervious surfaces).

INDICATOR – a short-term measurable aspect contributing to the target.

MEASURING [BIODIVERSITY] – data collected about a snap-shot in time of a specific biodiversity value (e.g. number of species). Measurements are useful for comparing relative biodiversity values (e.g. whether one area is more species-rich than another area) (32)

MONITORING [BIODIVERSITY] – comparing multiple measurements taken over time of the same biodiversity value so as trends in changes can be identified and decisions made regarding whether a management action is having the desired result or whether the action needs to be changed.

PERVIOUS SURFACES – ground surfaces that allow water to percolate into the soil to filter out pollutants and recharge water tables. These surfaces are not covered by mand-made sealed surfaces (e.g. roads, buildings, footpaths) (compared to impervious surfaces).

RESILIENT – relates here to animal and plant species and/or habitats, environments or ecosystems being able to withstand, recover quickly from, or adapt to threats and difficult conditions.

STRATEGY – used here to refer to the direction developed to an overall goal.

TARGET – used here to describe a quantifiable element that may be measured to gauge progress towards achieving goals.

THREAT – anything that has a negative impact on animals, plants, habitats, environments and ecosystems. For example, cats and dogs chasing/predating native animals, vegetation clearing/land use change, climate change.

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ATTACHMENT A

List of common street tree located in the Town of Walkerville.

Common name	Scientific name
American Hackberry	*Celtis occidentalis*
Black Locust	*Robinia pseudoacacia*
Box Elder	*Acer negundo*
Brazillian Rosewood	*Jacaranda mimosifolia*
Brush Box	*Lophostemon confertus*
Chinese Pistatio	*Pistacia chinensis*
Coral Gum	*Eucalyptus torquata*
Crepe Myrtle	*Lagerstroemia indica*
Desert Ash	*Fraxinus angustifolia subsp. angustifolia*
European Hackberry	*Celtis australis*
Evergreen Ash	*Fraxinus griffithi*
Golden Ash	*Fraxinus excelsior 'Aurea'*
Golden Rain Tree	*Koelreuteria paniculata*
Hong Kong Orchid Tree	*Bauhinia x blakeana*
Kurrajong	*Brachychiton populneus*
London Plane Tree	*Platanus x acerifolia*
Maidenhair Tree	*Ginkgo biloba*
Manchurian Pear	*Pyrus calleryana*
Oleander	*Nerium oleander*
Oriental Plane Tree	*Platanus orientalis*
Pagoda Tree	*Sophora japonica*
Red Iron Bark	*Eucalyptus sideroxylon*
Red-leaf Photinia	*Photinia robusta*
River Red Gum	*Eucalyptus camaldulensis*
South Australian Blue Gum	*Eucalyptus leucoxylon*
Spotted Gum	*Corymbia maculata*
Weeping Bottlebrush	*Callistemon viminalis*

ADDENDUM

The Town of Walkerville has undertaken a review of the value and costs associated with the removal and re-establishment of trees within the Township. There are two main components that make up the value that we apply to the trees – the value of the tree itself and the costs to re-establish the new tree over the first three years post planting.

The value of the tree that is to be removed is based upon the City of Melbourne's tree valuation method. This method looks at a number of components including a basic value of the tree, the particular species, the current aesthetics, its location and current condition. Each of the components is given a score and is then used in the formula shown below to calculate the final value of the actual tree:

Value (V) = Basic Value ($) x Species (S) x Aesthetics (A) x Locality (L) x Condition (C)

For more information regarding the tree valuation methodology please view the City of Melbourne Tree Valuation Fact Sheet.

The costs associated with the re-establishment of the tree involve a number of components including inspection of the tree, tree and stump removal, new tree costs, service locating, labour associated with the planting and materials such as water wells, stakes, etc. The cost also includes maintenance over the first three years. This involves watering, pruning, fertilising and soil conditioning (a full list can be seen in the table below).

This structure does not include any additional costs that may be incurred due to vandalism, pest and disease control, tree protection from development and additional pruning or watering.

Tree Valuation and Replacement Cost Analysis Methodology Table

Administration Costs

Item
Initial inspection
Tree valuation and data collection
CPI adjustment
Independent Arborist valuation (optional)

Removal Costs

Item
Tree removal
Stump removal
Verge renovations

Amenity Value

Item
Tree value *(Based on City of Melbourne Model – Tree Value = Basic Value x Species x Aesthetics x Locality x Condition)*

Ecological Services Value

Item
Tree Offset Costs (if a replacement cannot be planted in a similar location)

Replacement Costs

Item
Civil works/WSUC/Permeable Paving
New tree
Advanced notice
Service location
Tree planting (labour)
Tree materials: - Water well - Root barrier (optional) - Hardwood stakes - Soil - Synthetic tree ties - Slotted polydrain pipe - Fertiliser/transplant treatment/soil conditioner
Street tree watering – establishment period
Street tree watering – first year
Street tree watering – second year
Street tree watering – third year
Formative pruning – second year
Formative pruning – third year
Fertiliser/soil conditioner – first year
Fertiliser/soil conditioner – second year
Fertiliser/soil conditioner – third year
Miscellaneous: - Vandalism - Pest and disease control - Non-scheduled pruning - Tree protection (Development) - Wetting agents
Final fourth-year inspection: - Tree assessment - Remove establishment materials
Ongoing street tree maintenance

Total Value and Replacement Cost (TVRC)

Formula
TVRC = Administration Cost + Removal Cost + Amenity Value + Ecological Services Value + Replacement Costs

Urban forest strategy

Town of Walkerville

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TOWN OF WALKERVILLE