DRAFT

HOBSONS BAY URBAN FOREST STRATEGY

2020







HOBSONS BAY CITY COUNCIL



April 2020

Acknowledgements

Council acknowledges all language groups of the Kulin Nation as the traditional owners of these municipal lands. We recognise the first people's relationship to this land and offer our respect to their elders past and present.

Council acknowledges the legal responsibility to comply with the *Charter of Human Rights and Responsibilities Act 2006* and the *Equal Opportunity Act 2010*. The *Charter of Human Rights and Responsibilities Act 2006* is designed to protect the fundamental rights and freedoms of citizens. The Charter gives legal protection to 20 fundamental human rights under four key values that include freedom, respect, equality and dignity.

For further information, or to receive a copy of this document in an alternate format, contact Council on (03) 9932 1000.







CONTENTS

Background and context **0**

What is the urban forest? 0

The benefits of Hobsons Bay's urban forest 0

The evolution of urban canopy in Hobsons Bay 0

The existing urban forest in Hobsons Bay **0**

Urban canopy distribution 0

Tree species 0

Tree health and longevity 0

Challenges facing the urban forest in Hobsons Bay **0**

Climate change and urban heat 0

Development and change 0

Hobsons Bay urban forest - principles and strategies **0**

Guiding principles 0

Strategies and targets 0

Priority locations 0

Implementation **0**

Actions 0

Monitoring and review 0

Glossary **0**

Bibliography **0**

BACKGROUND AND CONTEXT

What is the urban forest?

The urban forest refers to all trees on public and private land within urban areas. The urban forest is comprised of tree groves, avenues or individual specimens, located in a range of environments from public parks, squares, street verges, main streets to rail corridors, creek embankments, schools, campuses, business parks and private gardens. The urban forest can also include all types of trees including exotics, natives, deciduous and evergreens of varying sizes.



Tree canopy in dense urban setting

Benefits of the urban forest

Trees in urban areas have traditionally been valued for their role in creating attractive streets, parks and gardens. However, in the last two decades, research has indicated that urban trees also provide substantial environmental, economic and social benefits. Increasingly, urban trees have been viewed as critical infrastructure, protecting and enhancing community health and wellbeing.

Urban trees shade streets and buildings and reduce the amount of heat absorbed by dark surfaces such as streets. Trees can alleviate the urban heat island, a phenomenon that occurs when a city experiences much warmer temperatures than nearby rural areas.

Trees in cities have been found to reduce temperatures by up to 10 degrees C and can reduce the need for air conditioning. Trees can also provide a range of environmental benefits, as carbon sinks absorbing carbon from the atmosphere, improving air quality, reducing stormwater flows and absorbing nutrients that can pollute waterways. They can also enhance biodiversity and support a wide range of species, including endangered animals.

Trees provide substantial economic benefits. They can reduce household electricity costs by shading buildings, improve property values for homes and businesses and increase retail sales and tourism activities. Tree shade can also improve the lifespan of certain assets, such as asphalt, reducing maintenance and replacement costs. Trees have also been found to provide multiple physical and mental health benefits from reducing obesity levels to reducing stress and alleviating depression Trees can improve social connection and cohesion by providing attractive places to meet and socialise.

The evolution of urban canopy in hobsons bay

Located on a basalt plain, the natural landscape of Hobsons Bay would have been comprised of grasslands, mud flats, wetlands, saltmarshes, mangroves and she-oak forests. This landscape provided an abundance of hunting and gathering opportunities for the local Aboriginal people who lived in this area. The rivers feeding into the bay and the coastal lands fostered confluence and exchange between the neighbouring communities of the Woi wurrung and Bunurong language groups, all part of the alliance now described as the Kulin Nation.

Hobsons Bay's natural landscape has been significantly altered through quarrying, land reclamation, and heavy industry. While much of the ecological landscape has been lost, several unique landscapes remain including saltmarshes, mangroves and wetlands at Altona Coastal Park, Jawbone Flora and Fauna Reserve, Cheetham wetlands, and Truganina Explosives Reserve.

While much of the natural landscape has disappeared, cultural tree plantings in the city's streets, parklands, foreshore areas and cemeteries remain. At Logan Reserve in Altona, the Moreton Bay Fig (Ficus macrophylla), likely planted in 1917 is a spectacular specimen and local landmark. Likewise, plantings at Williamstown Botanic Gardens and avenues of Norfolk Island Pines, located on at Altona Foreshore are unique features.

Trees were seen as fundamental elements in the early design of the city. Extensive planting of street trees probably began in the 1880's in Williamstown and were integrated into the streetscape design. They were often given elaborate guards of timber or iron. According to newspapers from 1884, trees were "one of the most noticeable features in the place".



Logan Reserve in Altona, the Moreton Bay Fig (Ficus macrophylla), likely planted in 1917 is a landmark specimen, 2019.

THE EXISTING URBAN FOREST IN HOBSONS BAY

Canopy cover in Hobsons Bay

There is approximately 7.5 per cent canopy cover across Hobsons Bay. Almost two thirds of these trees (4.7 per cent) are in streets, parks and reserves. While over half of the LGA is comprised of private land (54 per cent including land zoned residential, industrial, commercial, comprehensive development and mixed use), these lands contain only one third of trees in the LGA. Over half of the city's total urban tree forest is in residential lands, whereas only one tenth of the total urban tree canopy is in industrial lands.

Street trees are a major contributor to urban canopy. Trees on residential streets form over one third (38 per cent) of Hobsons Bay's urban forest. Even in locations where there are few streets, street verges provide the primary space for trees. In industrial lands, streets comprise only a small portion of area (6 per cent) they contain the same number of trees as all private industrial land combined.

Almost one quarter (22 per cent) of the LGA is public parklands and conservation reserves. Many of these parks have very low canopy cover (5 per cent or less). Over half (12 per cent) of this land is in conservation zones, reserves and golf courses with many of these conservation zones being wetland and saltmarsh environments. Additional tree planting needs to be carefully considered in these zones to ensure there would be minimal impact on the ecological integrity and health of these vegetation communities.

Areas of public land with the most opportunity for additional tree planting are streets and public parks. Other public lands such as conservation lands, private golf courses, public facilities and Port of Melbourne Planning Scheme areas may have limited capacity for additional tree planting. There are also opportunities available to substantially increase tree canopy in industrial lands and on residential lands.

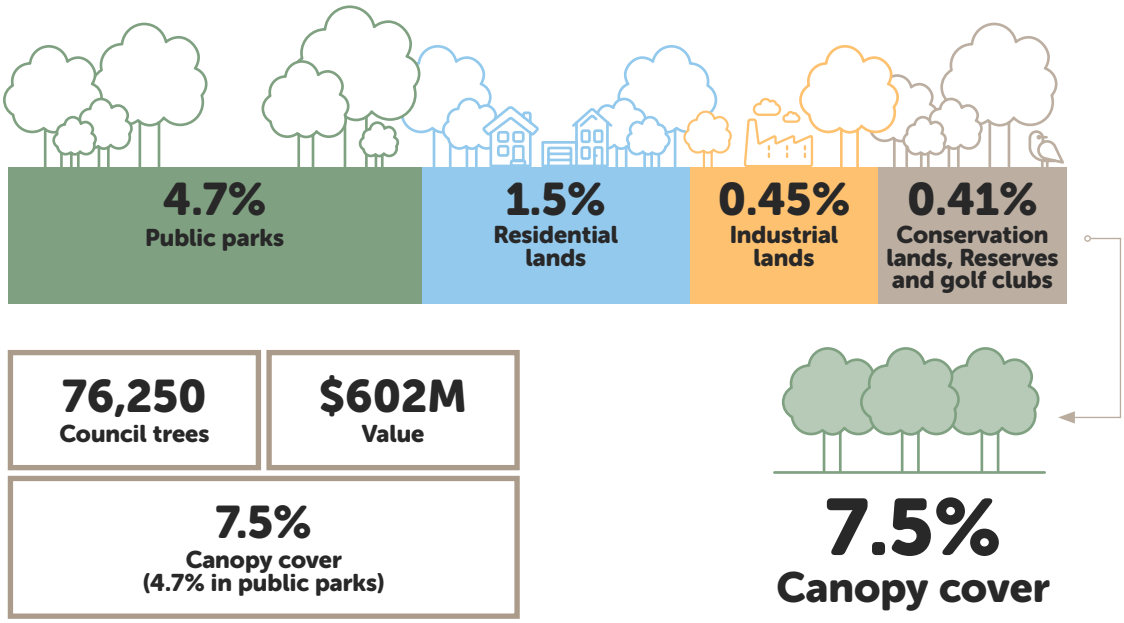


Figure 2.1: Hobsons Bay's existing urban forest location and value.

Trees in parks and streets

There are over 76 000 trees in parks and streets in the city, worth over $600 million dollars. Many of the city's trees are young and only a very small proportion (less than 1 per cent) are in decline. Some existing trees including Lagunaria patersonia (Norfolk Island Hibiscus), mature Melaleucas and mature Melia azedarach (White Cedar) have been a concern to some residents. The Norfolk Island Hibiscus is known to cause health issues and this species of tree is likely to be unsuitable for future use.

In urban environments, trees can be impacted by harsher conditions, such as low water availability, reduced soil volumes and regular disruptions to roots and canopies. This can make trees susceptible to death and decline.

A diverse range of tree species can help to minimise tree loss. While there are more than 550 different tree species in the city, 50 per cent of Hobsons Bay's trees are in the Myrtaceae family. This dominance of a single family or genus can leave the overall tree population at risk of mass decline if a pest or disease is introduced. Future tree plantings should also incorporate a wider range of taller species with generous canopies to help combat urban heat.



Cool Streets© event Hobsons Bay in 2019

CHALLENGES FACING THE URBAN FOREST IN HOBSONS BAY

Climate change and urban heat

Victoria is predicted to be warmer and drier with fewer frosts, more frequent and intense downpours and less rainfall in winter and spring. Melbourne's urban areas are, on average, predicted to be over 8˚C hotter than non-urban areas. Heatwaves are likely to be more frequent and last longer. Heat waves can cause critical urban infrastructure to malfunction or fail, and interrupt health services such as medical supplies, hospitals and emergency services. Heat waves have been linked to higher hospital admissions and illnesses. The elderly, the very young, infirm and the economically disadvantaged suffer the most in these conditions. The Heat Vulnerability Index (HVI) developed by Planning Victoria has found some suburbs in Hobsons Bay including Altona North, Altona Meadows, Seabrook, Laverton and Brooklyn have high heat vulnerability.

Tree canopy has been found to be effective in reducing urban heat and mitigating the urban heat island effect. However, trees will also be affected by changes to climate, through irregular rainfall patterns, heatwaves and extreme weather events such as storms which can damage trees. Urban trees can also be vulnerable to more pests and diseases.

Tree canopy in Hobsons Bay is already challenged due to the LGA's soils, wind exposure, and contaminated lands. Climate change will place further pressure on tree health. Strategies need to be employed to improve tree health and resilience. 'Tree friendly' civil and engineering design standards can be developed to ensure trees can thrive. Design standards that are 'tree friendly' requires adequate provision of soil, free of services and incorporating permeable materials, passive watering and adequate space above and below ground for healthy tree growth.

Development and change

Urban development can impact on urban tree canopy. The resident population in Hobsons Bay is forecast to increase from an estimated 88,990 people to 107,240 people by 2036. Urban renewal, infill and green field development can mean existing trees and garden areas are removed and replaced with buildings and paved surfaces. With many neighbourhoods transitioning from single dwellings to higher density apartments, designing to allow appropriate space for urban trees is critical.

Urban tree canopy crosses multiple jurisdictions and disciplinary boundaries and can be impacted by decisions from multiple parties. Adopting clear goals, targets and standards and mechanisms to deliver these targets, can provide clarity and facilitate a coordinated process for prioritising and planning for urban tree canopy. Compliance and tree protection may also require strengthening to protect existing trees on private land.

The design of urban infrastructure – roads, utilities, etc. are critical to providing capacity for urban tree canopy. Historically urban infrastructure has not provided the best conditions for trees. Space above and below ground for trees can be constrained, with little to no space for trees. In Hobsons Bay, existing infrastructure (such as the LGA's extensive gas pipelines and overhead power lines) and new infrastructure (such as the Westgate tunnel) impacts on tree canopy. Holistic streetscape design, that integrates trees as priority is necessary. Early integration for trees at the project outset can overcome obstacles. Collaboration with other infrastructure stakeholders, such as VicRoads and Melbourne Water, can improve tree canopy provision.

HOBSONS BAY URBAN FOREST - PRINCIPLES AND STRATEGIES

The guiding principles underpinning the Hobsons Bay Urban Forest Strategy are to:

Develop a healthy and resilient urban forest in Hobsons Bay that:
Cools neighbourhoods including residential and industrial areas
Is healthy, resilient and will thrive in our changing climatic conditions
Reflects the unique character and identity of Hobsons Bay
Creates attractive and comfortable streets, parks, waterfronts and public spaces
Improves neighbourhood amenity
Assists in climate mitigation and adaptation
Improves community health and wellbeing
Supports healthy ecosystems and improves biodiversity

Increase the understanding of the attributes, role and benefits of Hobsons Bay's urban canopy to:
encourage greater care, protection and custodianship of urban trees
promote greater participation in decision making on urban trees
encourage all members of the community (including residents and businesses) to contribute by planting new trees on private land

To achieve the vision for a healthy and resilient urban forest in Hobsons Bay, four key objectives have been developed. These objectives are supported by a series of priority actions to assist in delivery and implementation.

OBJECTIVE 1

Increase Tree Canopy in Hobsons Bay to 30% by 2040

A generous urban tree canopy that cools the city is crucial to improving community health and wellbeing. This can vary depending on a city's structure, climate and land use patterns. Targets are best developed based on constraints to creating canopy such as densities and land use.

The objective of 30 per cent canopy target provides an aspirational yet achievable target for Hobsons Bay. This considers the unique attributes of the LGA including the large proportion of industrial areas, parklands and conservation lands including grasslands and wetlands. This overall canopy target of 30 per cent is informed by detailed canopy projections for each land use. Projections for trees in each land use have been drawn from existing canopy cover averages for various land uses in western Melbourne (Hurley et al 2018), as well examples for tree canopy in other Australian cities.

Actions

- develop an LGA wide Urban Canopy Delivery Plan that identifies locations for new trees in high priority locations (areas with high urban heat vulnerability, low cover, main streets, parks, locations connecting to public transport, activity centres and active transport links)
- adopt best practice planting details for all new trees (such as soil and water availability)
- incorporate urban tree canopy targets into existing council policies, strategic planning and reporting frameworks
- apply mechanisms and controls to improve tree canopy provision on private land (such as minimum provision of unimpeded soil zones and tree replenishment)
- strengthen protection of tree canopy on private land and improve reporting on tree removal
- integrate canopy targets, where appropriate, into Plans of Management for public reserves, parks and open space
- promote tree planting on private land through education programs
- prioritise infill street trees in locations identified as available for immediate planting

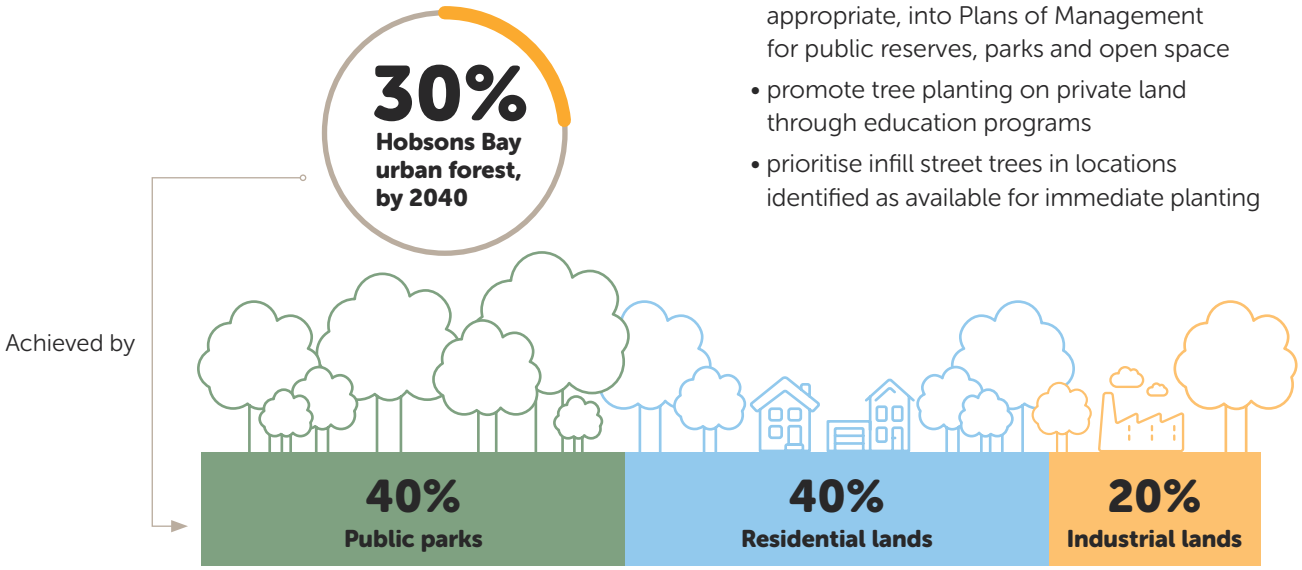


Figure 1.2: Hobsons Bay Urban Canopy Targets

OBJECTIVE 2

Develop a diverse and healthy urban forest

A diverse range of urban trees ensures the long-term health and viability of Hobsons Bay's urban forest. With a changing urban climate including hotter and drier conditions it is important to provide a wider range of species that can tolerate new climatic conditions. A diverse range of tree species will also lower the risk of loss from pests and diseases.

In Hobsons Bay, over 50 per cent of the LGA's street and park trees are in the Myrtaceae family. This dominance of a single family or genus within a family can leave the overall tree population at risk of mass decline if a pest or disease is introduced. The discovery of Myrtle Rust (Puccinia psidii) in the Greater Melbourne area presents a significant potential threat to the LGA's trees. It is important to develop a long-term plan that can withstand these threats. It also provides an opportunity to explore a more eclectic and unique tree palette that can enhance local character and create memorable parks and streets.

Actions

- adopt a target of no more than 5 per cent of one tree species, no more than 10 per cent of one genus and no more than 20 per cent of one family
- update Council's asset management system to provide improved ULE classification, risk assessment and to enable monitoring of tree health
- increase resourcing and staff to allow for increased tree inspections and monitoring
- undertake annual tree health assessments
- develop standard engineering details that prioritise tree health through integrating passive watering, maximising soil volume and minimising impermeable paving
- explore opportunities to trial new urban tree species that can thrive in changed climatic conditions
- monitor and review urban canopy pests and pathogens and develop management plans to address these issues

OBJECTIVE 3

Adopt a 'trees led' approach to city planning, design and delivery

Delivering a successful urban canopy requires an effective and integrated approach across all levels of administration, planning and delivery. Knowledge sharing, planning and collaboration are required to deliver an expanded, healthy and resilient urban forest for Hobsons Bay. Many of the challenges of integrating trees into the landscape can be overcome by developing an integrated approach that is supported in strategic planning, design and delivery. This objective reflects Hobson Bay City Council's wider commitment to be a council of excellence and innovation, in order to deliver well designed, maintained and environmentally sustainable places to the community.

The city's street verges are important areas for the delivery of urban trees. Many of the obstacles to tree planting can be overcome by early planning. An integrated approach to designing streets for trees can provide the dual benefit of reducing local temperatures on hot streets and mitigating stormwater runoff in the form of roadside tree pits, bioswales and rain gardens. This approach not only improves tree health but can reduce stormwater pollution.

Actions

- incorporate minimum urban tree canopy and deep soil targets into all capital works projects
- increase resourcing and staff for Council's Urban Forest team
- promote early engagement with Council's Urban Forest team to ensure appropriate design that will achieve canopy targets
- incorporate an integrated approach to streetscape design that prioritises tree provision, passive watering, soil volume and permeable paving
- develop park masterplans that increase tree canopy and incorporate alternative water sources for irrigation

OBJECTIVE 4

Educate and foster care for urban trees

Delivering a healthy urban forest relies on not only community acceptance but encouraging care for the urban forest. Information sharing can increase acceptance and encourage wider participation from residents. Allowing people to participate in growing and sustaining the urban forest is critical.

A coordinated approach to working with the local community can provide a robust mechanism for information sharing and partnering that supports more tree planting. This may involve partnering with existing advocacy groups and/or developing new ways to engage with a wider cross section of residents. This aligns with Council's 2030 Community Vision which identified a strong desire from the Hobsons Bay community for expanded natural areas and more sustainable practices.

Actions

- develop a coordinated urban forest communication strategy that educates the community on the benefits of trees and encourages increased tree planting

  This can incorporate:

  - advocacy and information sharing through multiple platforms including social media
  - a calendar of events including Cool Streets© engagement activities, workshops, community planting days and school planting days
  - arts and culture activities focused on and about trees
  - plant giveaways and information seminars
- develop key regional partnerships with organisations such as Greening the West, and service and utility providers such as VicRoads
- encourage landowner participation in greening particularly for businesses on industrial lands
- strengthen partnerships with other greening agencies such as Landcare, Greening Australia, and local greening community groups

Priority locations

Priority locations have been identified across the LGA. These priority locations have been selected based on a range of factors and include areas that have been identified as priorities by staff during workshop sessions (Gallagher Studio 2019).

These factors include:

- places where there is capacity for additional trees on public lands, such as in street verges, in reserves and parklands
- suburbs and locations which have been identified as having high urban heat vulnerability
- locations where there will be high volumes of pedestrian movement such as retail streets, activity centres, school zones and public transport interchanges
- active transport corridors such as cycleways, waterfront and coastal trails
- locations zoned for increased residential density.

There are locations in Hobsons Bay that have been identified as having urban heat vulnerability index of 4 or higher in Planning Victoria data. These areas include the suburbs in the south and west including Altona North, Altona Meadows, Seabrook, Laverton and Brooklyn. The HVI rating is based on three indicators - heat exposure, sensitivity to heat and adaptive capability; and indicates how vulnerable specific populations are to extreme heat events on a scale from 1 to 5, with 5 indicating the highest vulnerability.

The following locations have been identified as priority locations for new tree plantings on public land:

- local streets and parks in Altona North, Altona Meadows, Seabrook, Laverton and Brooklyn
- main streets including Kororoit Creek Road, Grieve Parade, Millers Road, Civic parade, Central Avenue, Point Cook Road, Blackshaws Road and Melbourne Road
- parks including Glouster Reserve, Hatt Reserve, Sadler Reserve, Cherry Lake (perimeters) and JK Grant Reserve (boundaries and edges)
- waterfronts and coastal paths including Esplanade
- public park and reserves
- local streets within industrial precincts at Altona North, Brooklyn and Spotswood
- existing and future neighbourhood activity centres including new centres at Altona Meadows, Newport and Altona Gate
- cycleway links, shared paths, coastal trails and waterfront paths
- Council carparks in shopping precincts and at sports fields
- streets, car parks and public spaces near bus stops and train stations (Laverton, Westona, Altona Stations)
- streets in new residential precincts and urban renewal sites
- Westgate Tunnel interfaces

There is a requirement for much of the tree canopy to be delivered on private land. There are opportunities to develop planning mechanisms to increase tree planting in new developments. There may also be opportunities to explore opportunities for voluntary agreements for private industrial landowners to provide increased tree canopy on their lands.

IMPLEMENTATION







Objective 1: Increase Tree Canopy in Hobsons Bay to 30% by 2040

	Action	Time frame
1.1	Develop an LGA wide Urban Canopy Delivery Plan that identifies locations for new trees in high priority locations and implementation targets.	1 to 2 years
1.2	Employ a Project Manager to oversee annual tree planting program and to assist with identifying priorities and delivery of new tree plantings.	Ongoing
1.3	Deliver an annual tree planting program that is in line with proposed target model recommended in Strategy (Delivery of 8,000 to 8,500 trees per year for 5 years, 4,000 to 4,500 trees thereafter).	1 to 5 years
1.4	Review planning polices, reporting frameworks, and statutory planning instruments to integrate targets. Review tree protection policies.	1 to 2 years
1.5	Improve tree protection and planting requirements in planning scheme to increase tree canopy delivery requirements on private land.	1 to 2 years
1.6	Investigate opportunities for matching grants and community planting programs to expand upon Council's tree planting programs.	Ongoing

Objective 2: Develop a diverse and healthy urban forest

	Action	Time frame
2.1	Employ a Inspecting Arborist to review and ensure compliance with Tree Protection requirements for council and private trees. Ensure trees are managed in accordance with industry and legislative requirements.	Ongoing
2.2	Improve inspection frequency of trees and tree maintenance works. Improving ULE classification and review.	Ongoing
2.3	Provide specialised tree health measures to existing tree canopy.	Ongoing
2.4	Undertake regular audits of maintenance performance and to ensure all works are performed in accordance with Australian Standards	Ongoing
2.5	Replacing the Laguanaria patersonia species with appropriate new large trees.	1 to 5 years

Objective 3: Adopt a 'trees led' approach to city planning, design and delivery

	Action	Time frame
3.1	Integrate minimum urban tree canopy and deep soil targets into all capital works projects.	1 to 2 years
3.2	Develop and deliver an LGA wide Urban Canopy Delivery Plan that identifies locations for new trees in high priority locations and implementation targets.	1 to 2 years
3.3	Review and early engagement with council's Urban Forest team to ensure appropriate design to achieve canopy targets.	Ongoing
3.4	Develop/review standard engineering details that prioritise tree health, incl. passive watering, soil volume and permeable paving. Review WSUD standards and integrate with tree canopy requirements.	1 to 2 years

Objective 4: Educate and foster care for urban trees

	Action	Time frame
4.1	Develop key regional partnerships with organisations such as Greening the West, and with service and utility providers such as VicRoads.	Ongoing
4.2	Strengthen partnerships with other greening agencies such as Landcare, Greening Australia, and local greening community groups.	Ongoing
4.3	Develop a coordinated urban forest communication strategy. This would include coordination of approach including fact sheets, templates, process and response to all council related tree enquiries, for ongoing use by the Urban Forest team.	1 to 2 years
4.4	Develop partnerships with businesses and offer grants for tree planting on existing industrial sites. Commitment would have to be made with organization to match $2 for every dollar council gives in grants.	Ongoing
4.5	Provide residents with a free tree at engagement events.	Ongoing
4.6	Continued delivery of 'Cool Streets' program	Ongoing

GLOSSARY

Biodiversity refers to the wide variety of ecosystems and living organisms from all sources including terrestrial, marine and other aquatic ecosystems, their habitats and their genes, and the ecological complexes of which they are part. Biodiversity also refers to the degree of variation of life forms within a given species or ecosystem, and is a measure of the health of ecosystems.

Botanical family (pl. families). A taxonomic group composed of one or more genera. The names of most botanical families end in '-aceae' (e.g., Myrtaceae, Ulmaceae, Plantanaceae etc.), however, there are some exceptions. Groups of similar families are placed in orders.

Botanical genus (pl. genera). A taxonomic group consisting of related species that resemble each other more closely than they resemble other groups. Genus is subordinate to family and ranked above species. The genus name forms the first part of a scientific name (e.g., Eucalyptus leucoxylon) and is written in Latin with the first letter capitalized. Collections of similar genera are grouped into families.

Canopy (in addition to the definition in Section 2.1). The uppermost branches of the trees in a forest, forming a more or less continuous layer of foliage.

A carbon sink is a natural or artificial reservoir process that accumulates and stores any carbon-containing chemical compound for an indefinite period, thus lowering the amount of carbon dioxide in the atmosphere.

Photosynthesis by terrestrial plants is a major natural carbon sink.

Climate change adaptation refers to the ability of natural or human systems (i.e. ecosystems or communities) to adjust in response to actual or expected climate change, including climate variability and extremes. It involves a process (or outcome of processes) of anticipating or monitoring change and undertaking actions to address the consequences of that change – such as moderating potential damage, reducing harm or risk of harm, coping with the consequences, and taking advantage of beneficial opportunities (evident or unforeseen) of climate events, variability and climate change.

Greenfield sites are areas of land, often in rural or countryside areas in proximity to towns and cities that have not been built on before but are being considered for urban development. While these areas usually support agricultural or environmental amenity, as development potential they offer better access, have less congestion, a more pleasant environment, and have more space to expand.

Resilience is the capacity to deal with change and continue to develop. Ecological resilience refers to the capacity of an ecosystem or natural population to resist or recover from major changes in structure and function following natural or human-caused disturbances, without undergoing a shift to a vastly different regime but remain within its natural variability and viability. Social resilience is the ability of human communities to withstand and recover from stresses, such as environmental change

or social, economic or political upheaval. Resilience in societies and their life-supporting ecosystems is the key to sustainable development and is crucial in maintaining options for future human development.

Urban forest (in addition to definition in Section 1.1). 'The art, science and technology of managing trees and forest resources in and around urban community ecosystems for the physiological, sociological, economic and aesthetic benefits trees provide society'. (Helms, 1998) 'The art, science and technology of managing trees, forests and natural systems in and around cities, suburbs and towns for the health and wellbeing of all people'. (USDA Forest Service).

Urban forestry is a planned and programmatic approach to the development and maintenance of an urban forest, including all elements of green infrastructure within the community, especially when resulting from a community visioning and goal-setting process. (Schwab, 2009). In its broadest sense, it is a multidisciplinary process that takes account of water municipal water catchments, wildlife habitats, outdoor recreation opportunities, design, and care of trees and cultivated landscapes.

Urban Heat Island Effect (UHI) or urban heat refers to the significantly warmer temperatures found in urban areas in comparison to surrounding areas due to there being less green cover and more hard surfaces which absorb, store and radiate heat.

Useful Life Expectancy (ULE) (in addition to the definition in Section 2.3) is the safe 'with an acceptable level of risk' life expectancy of a tree modified by economic considerations (Jeremy Barrell 1996). The objective of an ULE assessment is to determine the relative value of individual trees for the purpose of informing future management options.

Vulnerability refers to the propensity and degree of sensitivity of social and ecological systems to suffer from exposure to external stresses and shocks. It is generally regarded as the antithesis of resilience.

Water Sensitive Urban Design (WSUD) is an approach to urban planning and design that is 'sensitive' to the issues of water sustainability, resilience and environmental protection. The strategy is often to reuse stormwater, stopping it from reaching natural waterways by mimicking the natural water cycle as closely as possible.

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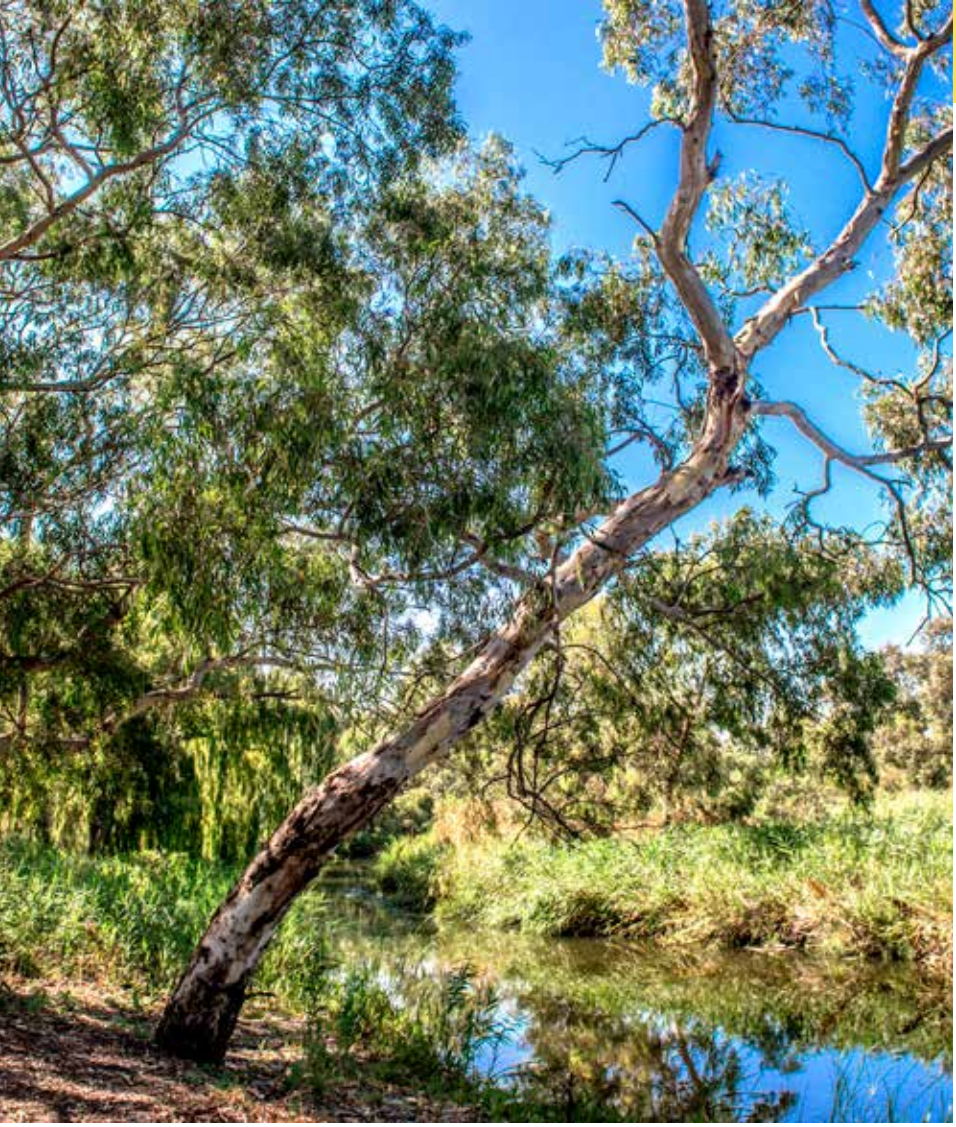
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