Bayside Council

Urban Forest Strategy 2024–2040

A plan to increase trees canopy across Bayside

Acknowledgment of Country

Bayside Council acknowledges the Traditional Custodians, the Gadigal/Bidjigal people of the Eora Nation.

The people of the Eora Nation, their spirit and ancestors will always remain with our waterways and the land, our Mother Earth.

Executive summary

This is Bayside's first Urban Forest Strategy. It uses an evidence-based approach to effectively protect and grow the urban forest.

Bayside Council recognises that the urban forest is a critical asset and prioritises its protection and growth. The urban forest plays a crucial role in shaping Bayside's health and character. While the value of the urban forest is being increasingly recognised, minimising tree loss through advocacy, planning, planting, and community engagement programs needs to be implemented.

Bayside has set a tree canopy cover target of 35% on public land[1] within its control by the year 2040, and this target contributes to the NSW government tree canopy target of 40% for Greater Sydney within the target timeframe. To meet the target, the Strategy proposes a long-term tree planting program from 2024 to 2040 that prioritises locations based on current canopy cover, plantable opportunities, urban heat, and socially vulnerable communities.

Bayside has focused on the public land within its control. Calculations for private land removals/ plantings have not been included as Council has minimal control over plantings on private land.

Actions will increase the current canopy cover to contribute to providing a liveable and cool environment. The actions have been proposed based on internal and external input, technical analyses, global best practice, and an understanding of the challenges in growing the urban forest.

1. Public land is defined as land owned and/or managed by Council, including Crown Land and Sydney Water Land, (such as bushland, reserves, parks, local roads and footpaths).

To successfully implement the Strategy, the high priority actions include:

- Obtaining the updated Tree canopy dataset from the Department of Planning, Housing and Infrastructure to make available to the public;
- Updating Bayside Street Tree Master Plan;
- Updating Significant Tree Register;
- Preparing a Tree Management Policy and Tree Offset Policy required within Bayside's DCP;
- Partnering with community to grow the urban forest e.g. 'Adopt-a-Tree', 'Trees for Mum', 'Trees for Dad'; and
- Expanding community education, support and engagement.

As Bayside changes and develops, the urban forest must also evolve to meet future needs and challenges. Opportunities to improve the quality and quantity of the urban forest must be found and pursued, as trees in streets, public open spaces, backyards and businesses all provide opportunities to integrate natural habitats that enhance biodiversity.

The evolving development practices such as the Transport Oriented Development (TOD) program and the changes to the Development Control Plan (DCP) allowing more new homes and secondary dwellings on suburban allotments, will significantly impact the potential for tree planting and potential tree loss both in private property and in the public domain.

To address this, the DCP must adapt swiftly to keep pace with these changes. Specifically, they should mandate the replacement of any lost trees with equivalent or greater replacement in terms of tree and/or tree canopy.

Additionally, internal council practices must be scrutinised, and all tree removals need to be undertaken with the need for appropriate replacement recognising both quantity and size, age, and condition of the existing canopy.

By working together to plant more diverse and resilient trees and providing habitat for native fauna, we can help tackle the challenging impacts of climate change and contribute to the Net Zero targets set by the NSW State Government.

Environment & Resilience, April 2024

Bayside Council gratefully acknowledges the contribution by NSW Department of Planning, Housing and Infrastructure of a Greener Neighbourhoods grant for the creation of this Strategy.

Contents

Abbreviations

The following terms and definitions are used throughout this document:

AQF5	Australian Qualifications Framework Level 5
COP15	The United Nations Biodiversity Conference 2022
Council	Bayside Council
CSP	Community Strategic Plan 2032
DCP	Development Control Plan
DPHI	NSW Department of Planning, Housing and Infrastructure
GIS	Geographic Information System
IPA	Integrated Prioritising Assessment
LEP	Local Environmental Plan
LGA	Local Government Area
LSPS	Local Strategic Planning Statement
NSW	New South Wales
POs	Plantable Opportunities
SEPP	State Environmental Planning Policy
STP	Street Tree Prioritiser
STR	Significant Tree Register
TPP	Tree Planting Predictor
ULE	Useful Life Expectancy
UV	Ultraviolet
WSUD	Water Sensitive Urban Design

Vision statement

Bayside's vision is to protect and grow a diverse and resilient urban forest that creates a cool and liveable community into the future.

It recognises the urban forest as a highly valued asset that is key to Bayside's long-term resilience planning by generating and sustaining our community's health, wellbeing, amenity and natural environment.

1 Introduction and context

1.1 Defining the Urban Forest Strategy

Over recent decades, urban forests have become a key part of sustainability, resilience planning, strategies, and actions in cities worldwide due to their associated community and biodiversity benefits. The New South Wales Government Architect defines an urban forest as "The layer of trees and tree populations that exist in urban settings" (NSW DPIE, 2020). However, an urban forest is much more than just a sum of all individual trees. The United Nations Food and Agriculture Organisation guidelines on urban forestry state that urban forests should be viewed as crucial infrastructure that provide tangible benefits and values that enhance quality of life, safety, and public health (Salbitano, 2016).

For the purposes of this Urban Forest Strategy, the definition adopted aligns with the NSW Government Architect's definition, as the strategy will focus on Bayside's tree population. This definition also aligns with other Council documents such as the Bayside Council Development Control Plan 2022. Whilst the focus here is on trees, Bayside Council recognises and acknowledges the importance and benefits provided by all vegetation.

The definition for this Strategy is as follows:

Bayside's urban forest comprises all trees within the boundary, irrespective of land ownership or context within which the tree grows.

(Source: NSW DPIE, 2021)

1.2 What is the Bayside urban forest?

Figure 1: Examples of vegetation comprising the urban forest: (a) natural bushland; (b) street trees; (c) private garden trees; and (d) parkland/open space trees.

Bayside's urban forest is a critical part of the environment as it foundational to our character, identity, and resilience to climate change. Our urban forest is immensely diverse and dynamic, ranging from natural bushland to public parkland, street verges and backyard plantings (Figure 1).

1.3 Understanding the urban forest

A baseline understanding of the status of Bayside's tree assets and monitoring system is required to plan the future of our urban forest. At present, Bayside does not have a public tree inventory, though one action from this strategy is to prepare a tree inventory to guide future urban forest management. The selected approach should aim to capture a rigorous evidence-base using leading tools. The choice of the approach will depend on the existing information, desired outputs and use, and budget.

The creation of a Significant Tree Register (STR) is a strong starting point to understanding the entire forest. The STR focuses on locating, recording, protecting, and monitoring trees of importance on public land. Furthermore, this strategy outlines tree data analyses as a part of the recommended actions moving forward.

These analyses can be used to understand our urban forest by:

- Establishing realistic canopy cover targets;
- Identifying key drivers of canopy loss and target actions to minimise impacts;
- Quantifying the number of trees needed to achieve canopy cover targets;
- Identifying tree planting priorities;
- Monitoring and managing tree risks;
- Improving resilience to climate change impacts through increased species diversity; and
- Planning for replacement plantings to counteract loss of species through natural senescence.

1.4 Why is the urban forest important?

The diverse urban forest provides a multitude of benefits to Bayside community, wildlife, environment, economy, and infrastructure. To help maximise the benefits of greening actions, the primary focus of this Strategy is urban trees.

Urban trees are one of the very few public assets that appreciate in value over time, with larger and well-growing trees providing greater benefits than small trees and those in poor health or condition.

Bayside Council area covers 50 square kilometres and contains 29 suburbs. Its population is around 162,900 and is expected to reach 228,200 by 2036. The residents are culturally diverse, with 46% of residents born overseas. Notably, Bayside is becoming an increasingly older community (Bayside Council, 2020).

The urban forest will not only provide cooler areas, reducing the risk of heat-related stress during the hot weather, but also foster community interaction and provide a venue for outdoor activities to the older community.

1.5 Perceived benefits of street trees

The perceived advantages offered by trees tend to lean towards visual and environmental benefits, which are more immediately noticeable or felt, while the economic and social benefits they provide are often underappreciated or undervalued. This pattern was consistently observed in the survey.

Among the benefits attributed to trees, they were most commonly seen as valuable for enhancing air quality, improving the visual appeal of streets, and offering shade and comfort for pedestrians (FAO, 2020). On the other hand, their potential impacts on real estate values and privacy were rated as less significant (Figure 2).

These trends were consistent across various demographics, housing types, and suburban areas. However, it is worth noting that notably more individuals under the age of 50 placed a higher importance on the effects of trees on property values and privacy compared to their older counterparts. Additionally, the importance of privacy provided by trees was significantly greater for residents currently residing in high-density housing compared to those in detached houses.

Figure 2: Benefits of the urban forest (FAO, 2020).

1.6 Perceived concerns with street trees

In addition to the widespread recognition of the importance of urban forests, residents have voiced some concerns regarding street trees. This underscores a tendency to focus on challenges rather than the benefits of trees.

These concerns include:

- Trees offer minimal shade, prompting a call for more suitable tree varieties throughout the street;
- Overgrown branches encroaching on power lines;
- Leaf shedding necessitating frequent cleaning, and causing house gutter and swimming pool pump blockages, resulting in extra maintenance expenses; and
- Neglected and overgrown trees contributed to an overall sense of disorderliness, with bird droppings being a common nuisance.

These concerns highlight the imperative for thorough consideration and maintenance of street trees to effectively address specific challenges raised by residents.

1.7 Environmental benefits

1.7.1 Habitat for wildlife

Birds, mammals, insects, and soil biota rely on trees for shelter, food, and safe passages to move through the landscape (Figure 3). Increasing the number and diversity of tree species will help to improve and protect Bayside's biodiversity. Research has found that increasing the diversity of native plants in a single urban greenspace can result in a sevenfold increase in the number of insect species present after three years. This, in time, can have flow on effects and support the persistence of other species, such as birds and mammals (Lu, 2023).

Biodiversity-sensitive urban design encourages biodiversity goals to be set early in the planning process, alongside social and economic targets, before stepping users through a transparent process for achieving those goals (Ketchell, 2018).

1.7.2 Cleaner air

Trees help to improve air quality by absorbing harmful gases in the air and filtering these chemicals to release oxygen back into the environment. Through this process, trees also help to address climate change by absorbing carbon dioxide and storing the carbon.

1.7.3 Natural air conditioning

Large trees around homes help to provide natural cooling by creating shade and through the process of evapotranspiration. Through this process, water is absorbed through the roots and released into the air via tiny pores in the tree's leaves. Evapotranspiration and the shade provided by trees can reduce air temperatures by up to 1 to 5 degrees (NCCARF, 2017). Trees also provide a buffer to strong winds.

Figure 3: Rainbow lorikeet using a tree hollow.

1.7.4 Reduction in urban heat island effect

The urban heat island effect is a localised phenomenon where an area is warmer than its surroundings due to hard impervious surfaces such as roads, pavements and roofs that absorb and radiate heat. As a result, less rainwater enters soils and more rainwater is directed into drains, limiting the ability of 'available water' to cool the environment. This problem worsens as cities expand and replace greenery (Taylor, 2023).

The urban heat island effect is being magnified as urban temperatures continue to rise causing more frequent and intense heat waves that have negative health impacts. Very young individuals and those that work outside are at significant risk of heat-related health impacts (Osmond, 2017). Due to these risks, heat monitoring and planning should be a policy focus.

Research suggests that parks heat up slower than urban regions during the day, and that green public spaces containing water had a better cooling effect both inside the park and for the surrounding areas. More specifically, trees over 15m in height with dense canopies, provide the most cooling benefits for communities and are key to reducing adverse health impacts (Sherriff, 2023).

1.7.5 Water retention

Trees help to retain water in the landscape and contribute to healthy soils. They reduce the flow rate and volume of surface water runoff, helping to delay peak flows into stormwater systems. Further, tree roots, trunks, leaves, and soil absorb and filter pollutants and nutrients from water before flowing into waterways, helping to keep them clean.

> *"Trees over 15m in height with dense canopies, provide the most cooling benefits for communities and are key to reducing adverse health impacts (Sherriff, 2023)."*

1.8 Community benefits

1.8.1 Improved streetscapes

Trees help to create a 'sense of place' and contribute to the identity and character of Bayside. Trees in our streets can define precincts and soften the built environment by adding colour and screening less-desirable objects. A healthy tree population can help to create a sense of pride in the community.

1.8.2 Improved community cohesion

Open green space provides areas for events, festivals, and celebrations for the community. This can bring diverse groups of people together within the public realm, which is available for everyone to enjoy.

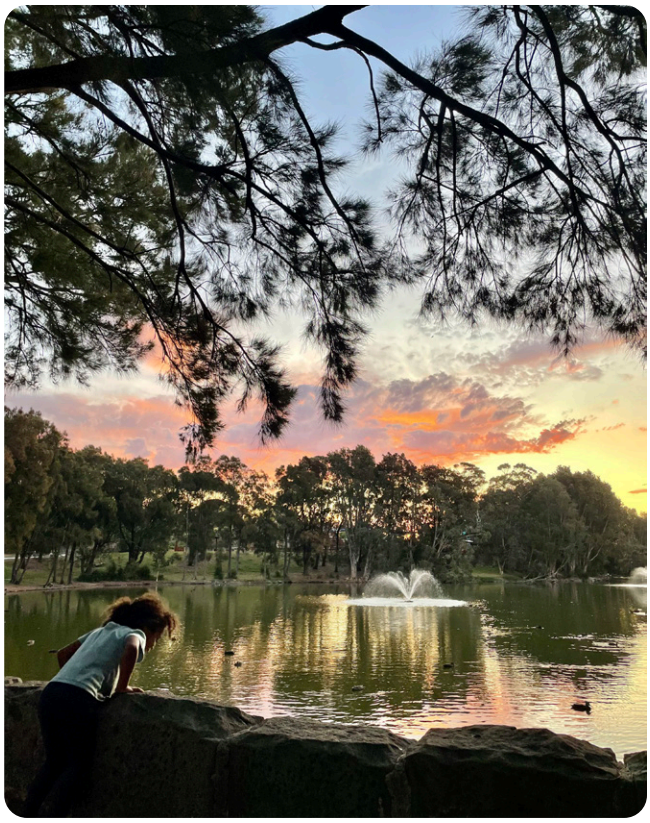
1.8.3 Improved community health

Trees are an essential aspect of community health and wellbeing. They encourage our community to go outdoors and reconnect with nature, which helps to increase physical recreation and improve mental wellbeing (Astell-Burt, 2019). For example, in the Netherlands, disease rates, including mental disease, were shown to be less prevalent in areas with a higher percentage of green space within a 1km radius than those with lower percentages (de Vries, 2016).

Research suggests that to gain such benefits urban planners should follow the 3-30-300 rule. The rule requires that every citizen should be able to see greenery of at least three trees of a decent size from their home, have a 30% tree canopy in their municipality and live at most 300m away from a good quality greenspace (Nieuwenhuijsen, 2022).

1.8.4 Reconnecting children with nature

Research suggests that green spaces provide therapy to children by allowing creativity, encouraging exploration, promoting physical activity, increasing resilience, and enhancing learning through experience (Vanaken, 2018).



1.8.5 Reducing sun exposure and heat related illnesses

The prevalence of skin cancer and other heat-related illnesses highlight that shade within our community is vital. Trees provide the best form of natural shade and have been found to reduce the overall exposure to UV radiation by up to 75% (Grant, 2002). Shade from trees also helps to reduce localised temperatures by up to 2 degrees Celsius (Armson, 2012).

This is essential considering days over 30 degrees Celsius are increasing due to climatic change and heat contributes to the deaths of over 1,000 people aged over 65 across Australia annually (Arsad, 2022). One study estimated that by doubling leaf canopy there would be up to 28% fewer heat-related deaths (Chen, 2014).

1.9 Economic benefits

1.9.1 Property and economy

Research has found positive correlations between increased housing prices and the presence of leafy suburbs and streets. Aesthetics associated with tree-lined streets can also help the local economy by encouraging people to visit and appreciate the local amenity (Plant, 2017). Planting the right tree in the right location beautifies properties, provides cooling, increases privacy, and creates a sense of place. These benefits are well studied, globally acknowledged, and increasingly quantified for their financial value. For example, the City of Melbourne reports that the benefits associated with their urban trees which represent 22% of their canopy cover provide annual services valued at $650 million (City of Melbourne, 2014).

1.9.2 Reduced energy costs

Restoring natural systems are often more cost-effective than technological substitutes and infrastructure construction. By providing shade to buildings, trees reduce the need for air conditioners and ultimately cut energy costs. Research suggests that increasing tree cover by 10% or planting a minimum of three shade trees per building lot can save annual heating and cooling costs by $50-90 per dwelling (McPherson E.G., 1995)

1.9.3 Avoiding costs of infrastructure damage and removal

Trees that provide significant canopy cover in urban settings can extend the lifespan of certain infrastructure. For example, research suggests that shading asphalt from UV rays can potentially increase longevity by 30% (Gong, 2023). Further, tree canopies and root systems can reduce damage to the built environment by mitigating flooding during extreme events and lowering stormwater flows into drainage infrastructure.

1.9.4 Reduced health costs

Research suggests that the burden on health systems can be alleviated by increasing greenspace in urban environments. It is difficult to calculate a direct link between the urban forest and quantifiable dollar savings, however it is likely costs associated with sedentary behaviour, obesity and mental illnesses are reduced. For example, research suggests that a view of greenspace, such as trees, can expedite hospital patient recoveries (Ulrich, 1984).

1.10 What the Bayside residents say

In September 2023, Council conducted a random telephone community satisfaction survey with 601 residents living in the Bayside LGA. Nearly 90% of residents think that management of waterways and foreshore, open green space and natural environment management should be prioritised in the future (Figure 4). Bayside residents also value the protected natural environment which influence on the overall quality of life in Bayside.

A concurrent community survey on public trees and canopy conducted from March to October 2023 reveals valuable insights into public perceptions regarding the growth and management of the urban forest. The survey received responses from 109 individual residents, representing 19 of the 29 suburbs. The participant demographics were evenly distributed in terms of gender and age, with roughly equal numbers of both younger individuals (under 40 years) and older age groups (over 50 years). The key survey findings are as follows:

- Expectations of urban forest growth. Most respondents place a high level of importance on the urban forest. Over 96% of respondents expressed a strong desire for Bayside to enhance its tree canopy, with a similar number expressing a preference for an increased presence of native trees.
- Willingness to assist in improving tree canopy. Residents demonstrated a keen interest in and willingness to support tree planting initiatives in the following ways:
  - 25% expressed their readiness to request a street tree to be planted on the verge in front of their homes;
  - 22% were inclined to commit to the ongoing care, including watering, of newly planted street trees;
  - 35% indicated their eagerness to participate by accepting a free tree from the council and planting it on their own property; and
  - 18% considered purchasing a tree for their property as a means of contributing to the improvement of the tree canopy.

These findings underscore a robust community enthusiasm and active engagement in bolstering the urban forest and represent a statistically relevant view.

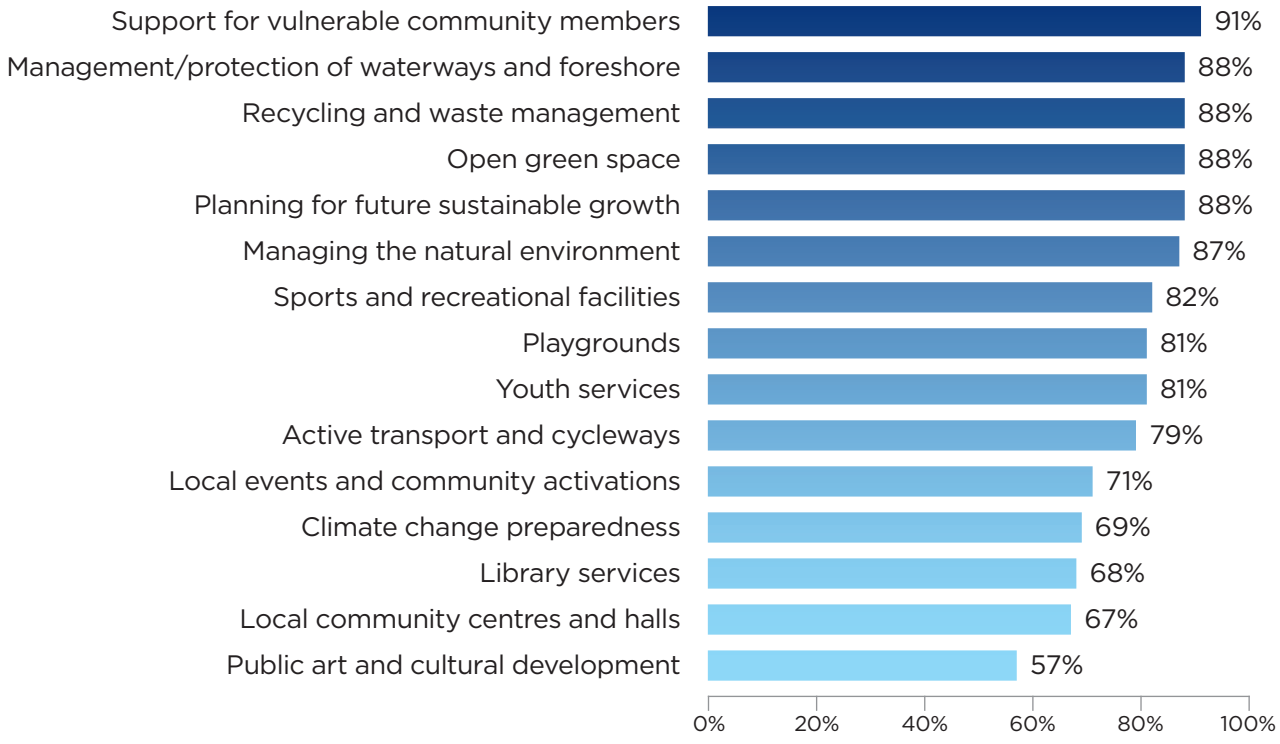


Figure 4: Future priorities selected by Bayside residents.

2 Tree canopy status, targets and priorities

2.1 Tree canopy status and trends

Tree canopy cover was assessed across the Bayside local government area and within twenty (20) land use zones. The spatial boundaries of each land zone were based on 2021 Local Environment Plan (LEP) Council spatial layers.

Based on the tree canopy data released by the Department of Planning, Housing and Infrastructure in late 2023 (NSW DPHI, 2023), tree canopy cover in Bayside is 12.4% (including airport, ports and waterways).

With the exclusion of airport, ports and waterway, tree canopy cover in Bayside is 15.4% with 39.2% of this cover occurring on public land (Figure 5 and Figure 6).

Based on the tree canopy data from the NSW DPHI in 2019 and 2022, the average tree canopy in Bayside decreased overall by 0.46% per year. Private lands have experienced a more significant loss of 0.75% per year. On a positive note, public area has seen an approximate annual increase of 0.24% per year since 2019.

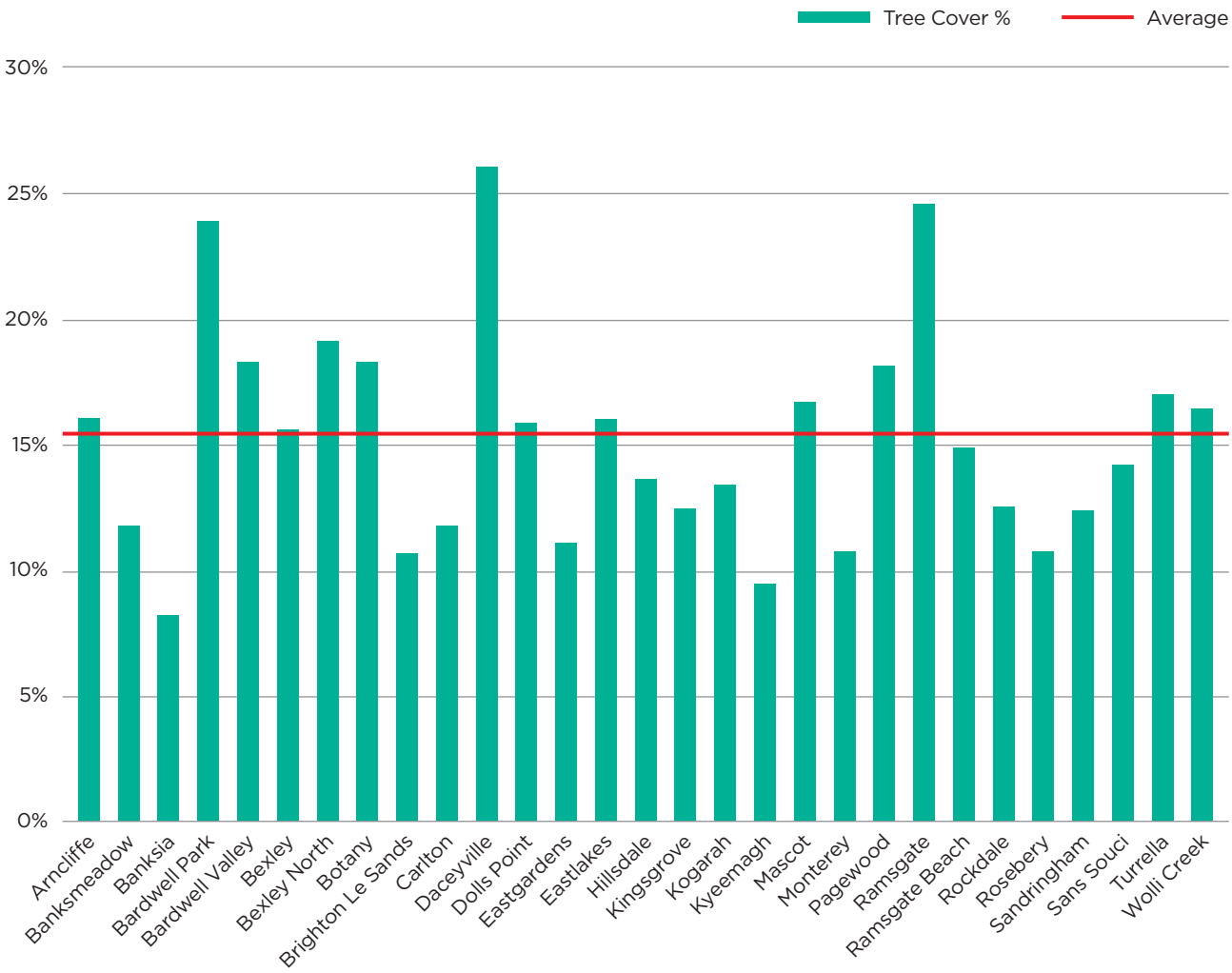


Figure 5: Tree canopy in Bayside Council by suburbs in 2022, excluding airport, ports and waterways. (Source: NSW DPHI, 2023).

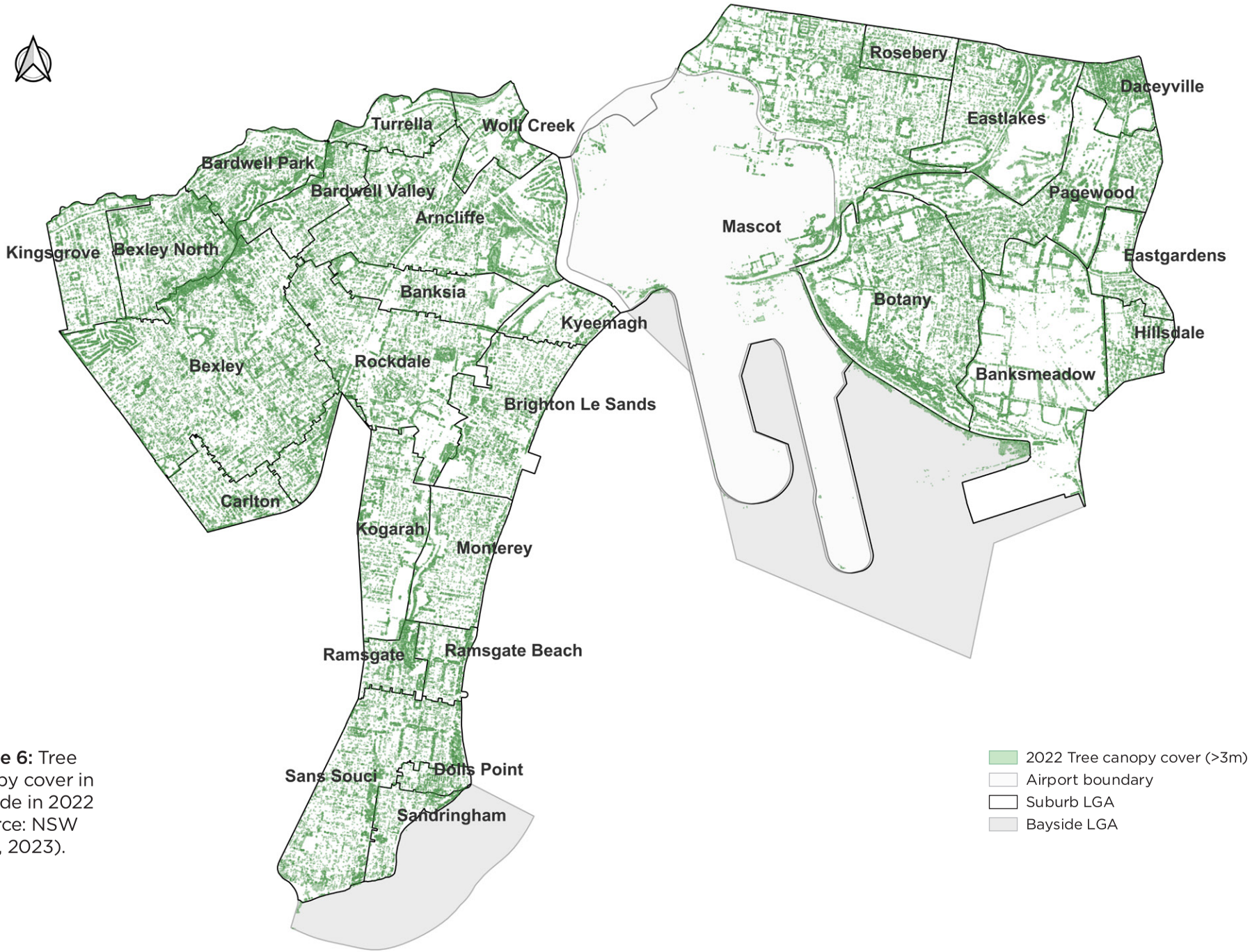


Figure 6: Tree canopy cover in Bayside in 2022 (Source: NSW DPHI, 2023).

2.2 Tree canopy cover targets

As the benefits of urban forests are becoming more understood and widely acknowledged, there is a global focus on growing urban forests to increase their derived benefits. This can be achieved via two approaches (1) protecting and retaining existing trees to ensure they reach maximum growth and (2) planting new trees to grow the existing population and replace mature trees that are lost. Though, effective management and planning needs to occur for these approaches to be enacted by establishing baseline targets and reporting on progress.

Tree benefits are mostly associated with leaves and above-ground woody material; therefore, canopy cover is widely used as a proxy for quantifying urban forest cover. In response to this local councils are establishing ambitious canopy cover targets.

Bayside has set a tree canopy cover target of 35% on public land within its control by the year 2040, and this target contributes to the NSW government tree canopy target of 40% for Greater Sydney within the target timeframe. The term 'public land' within this strategy encompasses all land owned and/or managed by Council, including Crown Land and Sydney Water Land, (such as bushland, reserves, parks, local roads and footpaths). The Urban Forest Strategy target will address goals 3, 11, 13, and 15 of the United Nations 'The Global Goals for Sustainable Development' (Figure 7).

Figure 7: United Nations 'The Global Goals for Sustainable Development'.

2.3 Planting scenarios

Multiple planting scenarios were modelled using the TPP® tool (Annexure D) by the consultant, Edge Environment. The first scenario being Council's current planting mix (Business as usual planting effort of 1,043 trees per year), illustrating what canopy cover is projected to do if no changes are made while the remaining scenarios aimed to investigate the feasibility of four different Council actions:

1. Business as usual planting effort of 1,043 trees per year;
2. Increasing the number of plantings whilst maintaining a constant planting rate;
3. More large trees in the plantings and maintaining a constant rate and effort;
4. BAU mix of plantings with a front-loaded effort, then variable; and
5. More large trees in the planting mix and a front-loaded effort (Table 1).

SCENARIO	TOTAL PLANTINGS BY 2040	LONG-TERM FINANCIAL COMMITMENT	TARGET ACHIEVED?	PLANTABLE SPACE AVAILABILITY
35% by 2040 on public land (More large trees mix + variable rate + front-loaded effort)	22,022	$13 Million	Yes	Public land: 100%

Table 1: Summary of the preferred planting scenario only (Number 5) to achieve a 35% canopy cover target by 2040 on public land.

2.4 What are the cost implications?

The cost estimates for planting trees are based on an average cost of $600 per tree, which includes purchase cost (30%), planting labour (23%), and management (47% of the total cost) over a 12-month establishment period.

2.5 Prioritising street tree plantings

Council engaged the Edge Environment to develop planting scenarios with Tree Planting Predictor™ (TPP) and Street Tree Prioritiser™ (STP) using the Integrated Prioritisation Assessment (IPA) framework.

For practicality of planting implementation and on-going management, public areas were first divided into realistic management unit areas, such as whole road segments or parks. For each of these areas, current canopy cover, urban heat, social vulnerability, and the number of potential plantable opportunities (i.e. metrics) were quantified using the IPA framework. The IPA allows for areas to be prioritised according to a combination of all four metrics. This means that the highest prioritised areas will occur in locations with the combined lowest canopy cover, highest heat, greatest social vulnerability, and with existing potential plantable opportunities.

Within the study region's 14,490,255.57m^2 of potential plantable space, a total of identified 123,408 potential plantable opportunities (POs) have been identified, of which 27,867 are located on public land. Council also conducted actual site inspection on various places to ensure the potential POs are achievable factoring in a number of site factors (such as overhead and underground services, traffic safety and others). This results in total of achievable POs of 22,022.

Relative to public POs, the suburbs of Arncliffe, Bexley, Rockdale, and Sans Souci offer the greatest number of POs (4,448, 3,642, 2,848, and 2,544, respectively). These are also amongst the largest suburbs within the Council area with some of the greatest current canopy areas, though this canopy represents only moderate proportions of the overall suburb areas (between 12.28% and 16.85%).

Comparatively, Dolls Point, Ramsgate, and Daceyville have the fewest public POs (180, 201, and 210, respectively), though these are also some of the smallest suburbs. Ramsgate and Daceyville are also already relatively well-treed, having the two highest proportions of current canopy cover within the Council area (24.5% and 26%). Dolls Point, however, whilst being the smallest suburb, has a relatively moderate current canopy cover of just 15.8%.

Cook Park along the Foreshore has been identified as one of high priority planting areas. This aims to fill in "blank spots" within the existing urban canopy as well as planning for significant tree replacement along the Grand Parade. In addition, Council is undertaking a development of Master Plans for Riverine and Pemulway Parks. The Master Plans create opportunities to identify and incorporate additional areas for tree planting in the development.

Planting trees along the railway corridors will provide greater and immediate benefits to the community such as reducing noise from passing trains, improving air quality, providing greenery aesthetic appeal of the area, while providing more shading and reducing urban heat island effects. The places that will get these improvements are Railway Street and Railway Parade in Banksia, Rockdale, Kogarah, and Carlton (Figure 8).

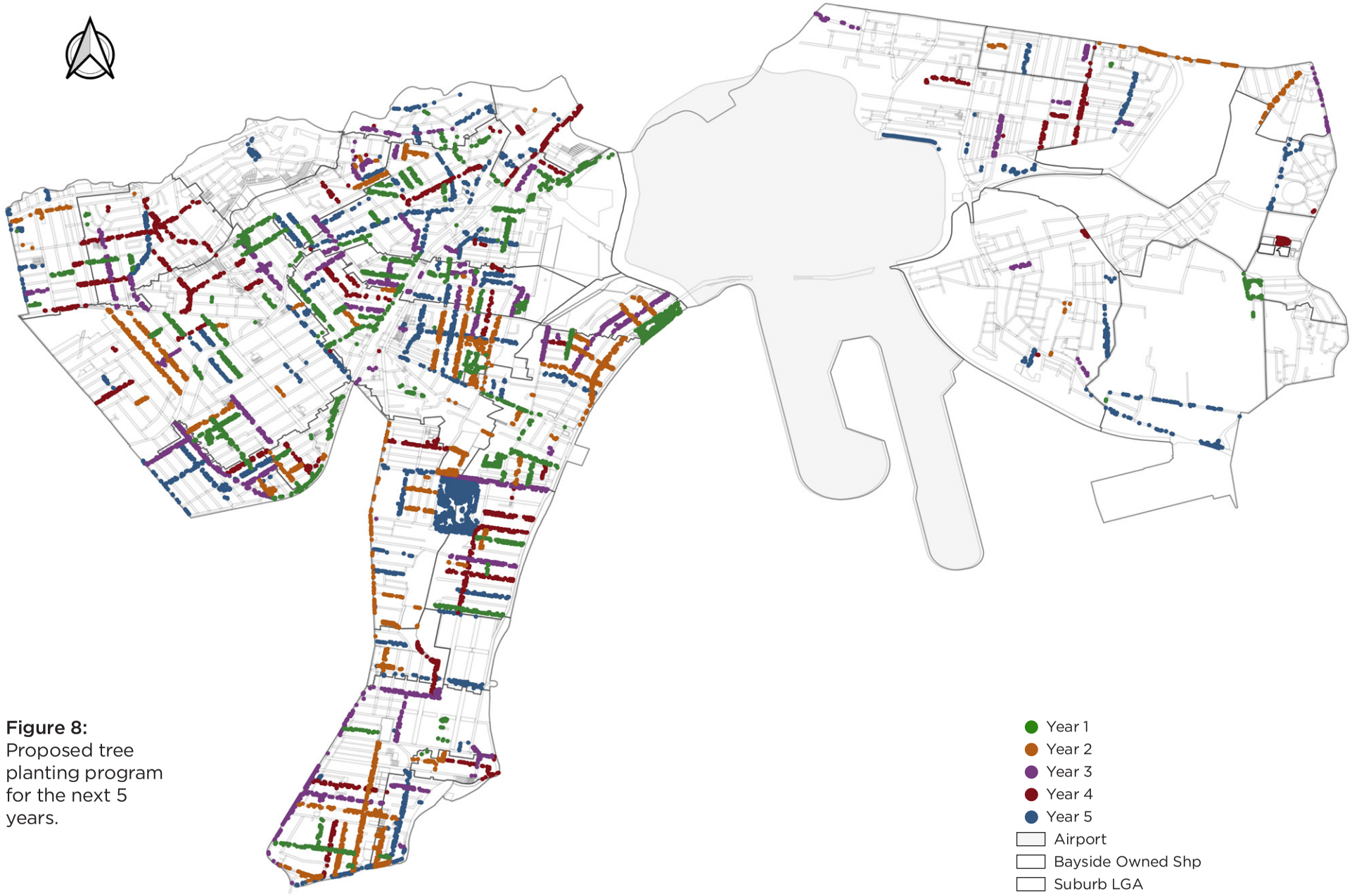


Figure 8:
Proposed tree planting program for the next 5 years.

3 Challenges of meeting canopy cover targets

Although Bayside's urban forest is highly valued, it is under threat from a series of challenges that endanger its protection and growth.

3.1 Aviation Safety Constraints

Bayside, encompassing Sydney Airport, faces unique challenges in urban forestry due to aviation safety regulations. The primary concern is the potential for trees to obstruct flight paths or attract wildlife, such as birds, which can pose significant risks to aircraft during take-off and landing phases. Trees planted near flight paths are required to maintain a height of at least 1 metre below the Australian Height Datum (AHD) of the flight path (Figure 9).

Additionally, the selection of tree species is critical in minimizing the attraction of birds. Certain native Australian trees, such as Blueberry Ash (Elaeocarpus reticulatus) and Tallow wood (Eucalyptus microcorys), are less appealing to birds and therefore may be suitable for planting near airports.

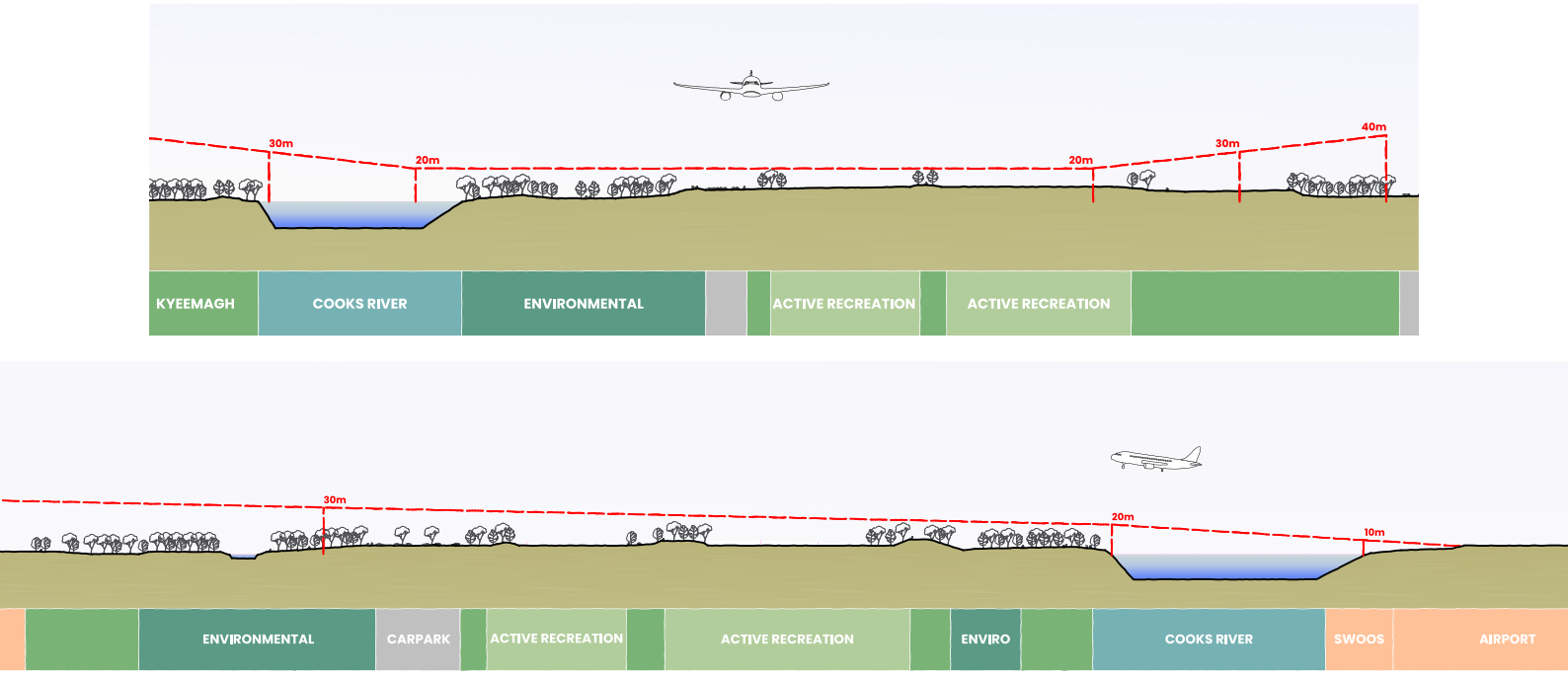


Figure 9: Aviation Safety impacts on tree heights around Riverine Park (Bayside Council, 2024).

Regular maintenance, including trimming and pruning, is also essential to prevent trees from becoming overly dense, which could obscure pilots' visibility during critical flight phases. Such maintenance practices are crucial for ensuring that the trees do not exceed regulated height limits over time.

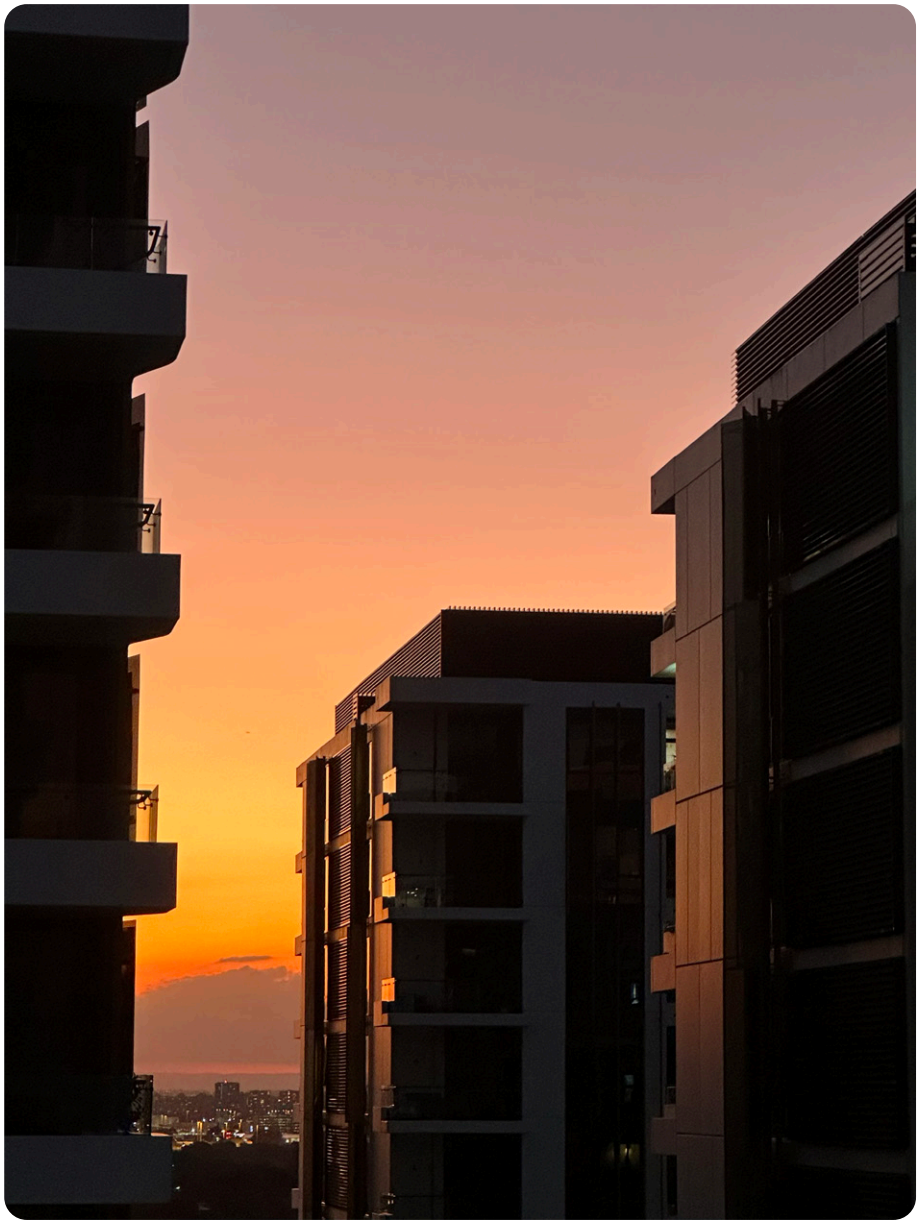
While large trees may not be suitable for areas in close proximity to runways or the Sydney Airport, careful planning and management of urban forestry can contribute to the increase of tree canopy cover within the Bayside LGA, without compromising aviation safety.

3.2 Urban densification

Maintaining existing and increasing urban forest is increasingly challenging in an area that is growing in density and population. Bayside's estimated resident population is projected to increase from 186,985 in 2023 to 209,896 in 2036, an increase of over 12% (ABS, 2020).

To account for this increase, the number of dwellings in Bayside is forecast to grow from 74,697 in 2021 to 86,475 in 2036. The development required to balance this growth and the current policy focus on increasing affordable housing may impact on the existing urban forest, the available plantable space and permeable ground surfaces that allow for infiltration of rainwater into soil. Simultaneously, it increases the need for green spaces, as they are vital to the health and wellbeing of people living in high-density areas.

Further, age structure forecasts between 2021 and 2026 suggest an almost 20% increase in population under the working age (ABS, 2020). This demographic change introduces new challenges in the way open space is not only increased but used to meet the needs of the community. Spaces that include urban forest need to be able to support the activities of young people, including parkland to play in and shady canopies for walks. Therefore, future development needs to be balanced with the protection of open space, including our urban forest to ensure Bayside retains its character and liveability throughout this growth.



3.3 Climate change impacts

Climate change refers to a significant alteration in long-term weather patterns, encompassing interconnected shifts in oceans, land surfaces, and ice sheets. It results from an increase in greenhouse gases in the atmosphere, including carbon dioxide. As these gases accumulate, increasing amounts of energy from the sun are trapped in the atmosphere and the oceans. This impacts weather through changes in temperature, rainfall, and sea level rise.

Future projections of climate change are developed using a range of global climate models. Of most relevance to Bayside Council are the following climate projections for the near future to 2039 and far future (2060-2079) (NSW OEH, 2019).

3.3.1 Temperature

- Maximum temperatures are projected to increase in the near future by 0.3–1.0°C and in the far future by 1.6–2.5°C.
- Minimum temperatures are projected to increase in the near future by 0.4–0.8°C and in the far future by 1.4–2.5°C.
- In the near future, the number of days over 35°C per year is expected to increase by 1 to 5 days, whereas in the far future there will be a further 5 – 10 days over 35°C each year.

3.3.2 Rainfall

Rainfall is projected to decrease in spring and winter but increase in summer and autumn (NSW OEH, 2019). This will impact on the planting seasons as well as trees need to adapt to different rainfall patterns.

3.3.3 Sea level rise

Projections suggest at least a 10cm rise is sea level by 2030 and up to 50cm by 2079. These projections highlight the importance of expanding Bayside's urban forest.

These changes will also alter the health and longevity of urban trees through a variety of mechanisms. Decreased average rainfall will increase tree stress, and mortality. The extreme weather associated with climate change will also impact our urban forest. Heatwaves can cause crown desiccation, exacerbate fire risk, and increase run-off and water insecurity. Intense rainfall events can destabilise root systems, increase soil salinity and impact flower and fruit production, harming both tree reproduction and the fauna species reliant on these resources for survival. Pest life cycles are also altered by temperature changes by increasing development rate, reproductive potential, and geographical range. Trees not previously at risk could become vulnerable due to these changes. The cooling benefits and carbon storage associated with trees will therefore become increasingly important to mitigate these impacts of climate change.

3.4 Water availability and soil moisture

Water is the primary element needed for vegetation growth. Extended periods of drought and dry spells threaten the health of our urban forest, and the ecosystem benefits it enacts. Several active and passive approaches are currently undertaken to replenish soil moisture and ensure it is maintained at levels that enable healthy growth, such as mulching. Due to predictions of a low water future, urban greening programs need to find ways to provide trees with enough water when rainfall is unreliable. The capture and reuse of stormwater is a potential option, particularly given the expected increase of stormwater flows due to climatic change. This can be supported through the conservation of wetlands, creation of underground tanks and utilisation of water sensitive urban design (WSUD).

However, this presents further challenges, including storing stormwater in dense urban areas. New techniques such as passive irrigation storage pits, that capture and store stormwater in underground trenches, should be investigated. This both decreases runoff during storms and provides water for trees. The use of raingardens should also be investigated as they naturally reduce stormwater runoff and use plants to filter pollutants from rainfall (NSW DPIE, 2021). Tree health monitoring and measurement of soil moisture should also be used to provide strategic guidance and ensure the health of the future forest.

3.5 Long-term staging of planting and replanting

To effectively grow and safeguard our urban forest, an understanding of the number of trees and desirable species is required to inform long-term planting programs. The use of forward planning ensures suppliers have the growing lead times necessary to produce adequate stock levels annually. A variety of tree ages and species are required within a community to enhance local biodiversity and strengthen ecosystem resilience.

3.6 Age diversity

Larger, more mature trees tend to provide greater benefits, such as carbon storage, pollution removal, and biodiversity resources. However, the mismanagement of aging trees to mitigate risk and offset future losses of intergenerational planting senescence can endanger our urban forest and the wider community.

To increase canopy cover and maintain our urban forest, replacement plantings of dead trees should be complemented by additional tree plantings. Replacement plantings are best planned as inter-generational plantings, whereby a replacement is planted when a tree reaches maturity rather than senescence. This maintains canopy cover through the creation of a mature, healthy, and functioning urban forest. At present, Bayside Council does not know the age diversity or useful life expectancy (ULE) of our urban forest, which impedes our ability to address this challenge.

3.7 Species selection and diversity

In planting programs, species selection is generally based on set criteria, such as location suitability, aesthetics, function, and availability. A high level of genetic diversity is required within our urban forest to ensure resilience and minimise risk of catastrophic decline via disease and pests. Santamour's diversity, also referred to as the 10-20-30 rule of thumb has been proposed as the minimum diversity for urban forests. The rule states that at a minimum, urban forests should compromise no more than 10% of one species, 20% of one genus, or 30% of one family (Santamour, 1990).

It is also becoming increasingly important to consider climate resilience in species. Species that can withstand future climate extremes whilst also enhancing tree diversity should be favoured. For example, Plane trees (Platanus spp) while a robust street tree in many cityscapes, have been identified as vulnerable to drought. Consequently, when Plane trees need to be removed, they may be replaced with native species that are better suited to the warming and drying climate (Bowring, 2023).

3.8 Community perception

To meet the target of this strategy, the community needs to actively work with council to achieve canopy cover targets. Our community generally appreciate trees, however, there remains a 'Not in My Backyard' obstacle to be overcome. Requests for tree removal and illegal tree removal on or near properties are contributing to city-wide declines in canopy cover. There are a range of reasons why trees may be polarising for some individuals, including cultural backgrounds, spiritual beliefs, aesthetic preferences, health conflicts (e.g. asthma), fear (e.g. falling limbs, fire), infrastructure challenges (e.g. trees blocking sun from solar panels, Mannheim 2023), and perceived nuisance (e.g. fruit and leaf drop).

Addressing and alleviating community conflicts and negative perceptions around trees is essential. The solution is a combination between practical planning, early community engagement, education and demonstration on the benefits of trees. By inviting the public to participate in species selection, tree plantings and data collection, a community-level stewardship over trees will be fostered and canopy cover targets will more attainable.

Council has initiated an educational program for the community to overcome these obstacles, featuring initiatives like 'Adopt a Tree', yearly tree planting ceremonies, and a memorial tree scheme. These initiatives inspire a sense of ownership and motivate community members to nurture the trees (Figure 10).

Similarly, the 'Wild Thing' initiative, an eco-friendly community program, is set to be reintroduced to assist locals in creating native ecosystems in their gardens. Additionally, fostering volunteerism and group activities, such as conservation volunteer groups, could further endorse the acceptance of urban forestry.

Council could also investigate further penalties for illegal tree removals, including the prosecution registers and promoting tree planting as part of developments and on private property (Sambul, 2023). At present, councils can issue a maximum on-the-spot fine of $3,000 for illegal tree removals by individuals or $6,000 for businesses. This fine can reach up to $110,000 for certain endangered and heritage-listed trees. Despite this, illegal tree removal still persists.

Figure 10: Proud resident with their 'Adopt a Tree' (Credit: Thu Nguyen).

3.9 Conflicting land uses

A major limiting factor to our urban forest and its associated benefits is the array of conflicting land uses, which limits the size and number of trees that can be planted. Especially with the predicted population increases over the coming years, there is a need to balance tree plantings, open space, and the infrastructure required to support a growing population. In many cases, trees are often considered a lower priority and lose out to competing land uses. For example, pruning activities may be required if certain species are planted in locations that compromise road sightlines or overhead powerlines.

There is a need to investigate and implement solutions that allow trees to be integrated and complement land uses, as canopy cover targets cannot be met by only planting on public land. This may include a combination of strategic and infrastructure solutions, such as:

- Updating appropriate species planting lists for specific locations (e.g. under powerlines) under the Bayside Landscape Technical Specifications;
- Altering infrastructure (e.g. create narrower roads, use underground electricity cables, or retrofit overhead cables with aerial bundled cables to enable additional/larger trees to be planted on verges); and
- Investigate the potential of increasing canopy cover on golf courses and other large open spaces (Bucci, 2023).

3.10 Tree protection and removals

Due to conflicting land uses, tree removals are a major limiting factor to enhancing the urban forest. Considering over 72% of Bayside is private land, improving the current Development Control Plan (DCP) and Local Environmental Plan (LEP) controls for trees on private land and public domain has been identified as a key potential for improvement.

Programs could be established to incentivise tree retention on private land, and there is a potential to set mandated canopy target goals and tighten controls on tree removal on private land.

Engagement and education programs could be implemented that focus on addressing barriers to behavioural change rather than just building awareness on tree values. They could also focus on assisting the community to consider appropriate ways to address tree-related issues. Appropriate maintenance and the repair or redesign of infrastructure could also be undertaken with little impact to a tree to alleviate concerns. These initiatives could also highlight how the repercussions of individual actions threaten the long-term viability and sustainability of the urban forest. This information should be readily available and may entail translation into different languages and accessibility options at a variety of community venues.

3.11 Biodiversity

A healthy urban forest is vital for protecting and enhancing local biodiversity within our modified built urban landscape. Some of the area's most severely impacted by urbanisation are bushland habitats that have previously acted as an important resource for native species.

Increasing access to green and blue spaces (spaces with visible surface water) and ensuring biodiversity-inclusive urban planning was agreed as one of the targets of the UN Biodiversity Conference (COP15) summit. Tree planting programs can help to reach the COP15 targets by acting as important movement corridors between bushland patches, foraging resources, and providing safe havens to escape predators. To optimise these benefits, understanding tree species-specific requirements, complementary planting and placement must be considered and prioritised in the planning and management of the urban forest.

Animal species can have different requirements. For example, rainbow lorikeets (Trichoglossus moluccanus) will forage on flowers, fruits, and seeds of a wide range of trees and shrubs but require hollow-bearing eucalypts for nesting (Figure 11). Alternatively, magpie (Gymnorhina tibicen) readily forages on a wide range of resources and nest in nearly any tree over 15m. Considering other climate and community-related challenges, the consideration of specific biodiversity requirements when managing urban forestry is often overlooked.

Further, improvement of native biodiversity and regeneration of natural ecosystem processes will require the protection of existing trees and habitat across development and infrastructure zones. Strategic planning and the use of key planning mechanisms (LEP and DCP) will play an important role in implementing vegetation controls to protect existing native habitat and enhance connectivity. The Bayside Biodiversity Strategy (in preparation) is strongly aligned to this strategy. It will complement the objectives of this strategy by providing actions to promote the protection and expansion of the urban forest for native wildlife.

Figure 11: Group of rainbow lorikeets *Trichoglossus moluccanus* perched in a tree.

4 Tree selection

Choosing the right tree in the right location is an essential aspect to consider when increasing our tree canopy coverage. Currently, tree selection in Bayside is based on the Rockdale City Council 2009 Street Tree Master Plan and City of Botany 2014 Street Tree Master Plan.

The 2009 and 2014 Street Tree Master Plans are planned to be reviewed to include best practice approaches regarding urban tree selection, preparation of planting sites and the management of trees (Table 2).

Use of a single family can leave the population vulnerable to pests or disease. Diversification of the urban forest is necessary to ensure the best conditions for success.

Online tools created in partnership with Government and academic institutions will continue to provide data to assist in the selection of the right tree for future climatic conditions (i.e. Which Plant Where™ - www.whichplantwhere.com.au)

CONSIDERATION		DESCRIPTION
Environment	Climate	We need to consider the prevailing climate and micro-climate, including wind and heat radiation from infrastructure.
	Soils	Urban soils may be disturbed and/or in poor condition. Compacted soils and paved areas reduce the amount of oxygen that can accessed by tree roots.
	Contribution towards micro-climate	Species that improve micro-climate by providing shade and reducing glare in the summer and allow sun through in winter will be favoured.
	Minimal water requirements	Species selected must be able to survive without further watering beyond one year establishment.
	Tolerance of pests and diseases	Use of a small diversity of families can leave the population vulnerable to pests or disease. Diversification of the urban forest is necessary to ensure the best conditions for success.
	Wildlife habitat	Locally native and indigenous tree species that create habitat for wildlife are preferred.
	Low risk of becoming an environmental weed	Species that pose a risk of becoming an environmental weed are not to be selected.
Management	High-performing species	Species that have consistently performed well in local conditions will be chosen over those that are known to be problematic.
	Litter	Species with low levels of leaf and fruit drop are preferred.
	Minimal infrastructure disturbance	To prevent damage of surrounding structures from tree growth, appropriately sized trees will be selected to ensure there is sufficient growth space above and below ground.
	Low maintenance	Preferred species will be those that once established, do not require high maintenance beyond routine watering, pruning and/or fertilising.
	Cost	The planting of large trees at appropriate locations (e.g. parks) will be prioritised, followed by the installation of medium, then small trees.
Aesthetic	Unity	Planting will be done with consideration for the visual character of an area.
	Scale	Council will ensure that tree height and width are appropriate for the localised setting to create the desired scale for a location.

Table 2: Tree species selection criteria for urban areas (NSW DPIE, 2020).

5 Best practice planting and management guidelines

Successful tree planting and establishment requires implementation of four key factors, including: planning and species selection; quality stock; correct planting and establishment maintenance.

The process should be underpinned by effective communication and monitoring throughout all stages to ensure all partners understand the process and that each stage is monitored for quality and correct practices.

Figure 12: Bayside volunteers planting trees at Landing Light wetland (Photo: M. Hourihan, 2023).

5.1 Planting

5.1.1 Planning and species selection

By underpinning tree planting programs with evidence-based strategies (as outlined in below), we can ensure the tree is planted in the 'right place' the 'right way'.

Species selection: Species selection should consider climate resilience (current and future), soil quality, contribution to the micro-climate, maintenance requirements, disease tolerance, plant location suitability, mature tree size, risk mitigation, aesthetics, and community support.

Species availability: Tree stock is often sourced from commercial nurseries. Unusual tree species or large quantities will likely need to be pre-ordered several years in advance. Bayside Nursery will be consulted to determine their ability to meet this demand.

Prioritised planting locations: Tree planting should begin strategically by identifying where tree planting will make the most impact.

Identify suitable planting sites: Before identifying a planting location, proximity to above and below ground services, built infrastructure and sightlines should be considered.

Soil type, volume, and quality: The size of a mature tree is influenced by the quality and quantity of soil available for root growth. Soil should be assessed and considered to inform the selection of suitable species and allow for any necessary adjustments to ensure successful tree establishment.

Available space: Available above and below ground space should be considered, and the largest possible tree species should be chosen for each location to ensure the biggest impact.

Water Sensitive Urban Design (WSUD): Most urban trees need about 120L to 150L of water every few days. Due to water constraints, it is important that trees are planted with WSUD in mind to ensure water requirements are met sustainably.

Other factors: Microclimate and drainage considerations should also be considered as they can influence the success of tree establishment in urban spaces.

5.1.2 Quality stock

The tree itself is generally the smallest cost of the project in comparison to labour costs and maintenance. Therefore, the quality of the tree is essential to the success of a planting program. For example, if industry best practice is not supplied, future structural defects may produce safety hazards, including falling limbs or uprooting.

Stock standards: Tree stock quality can be variable. Trees must comply to Australian Standard AS 2303:2018 Tree stock for landscape use.

Contract growing: A 3-to-5-year lead time is required for the supply of certain species, so a long-term planting program is required to plan how many trees of each species are needed, and at what time.

Tree size: When selecting the size of the tree, cost, establishment success and the ability to meet project needs should be considered. To ensure trees are a suitable size for street conditions, pot sizes should range from 45L to 200L.

5.1.3 Correct planting

Correct planting protocols are essential to urban tree establishment and planting program success.

Size of hole: The hole should be three times the diameter of the container the tree is grown in to provide enough 'good' soil around the root ball and allow for unimpeded root development during the tree's early life.

Drainage and soil improvement: The planting hole should be free draining as root systems will suffocate if excessive water is retained due to oxygen exclusion and the creation of toxic anaerobic conditions.

Height of root ball: The root ball should be placed onto a consolidated base at the bottom of the planting hole to ensure the weight of the tree will not cause subsidence and result in collar rot.

Root pruning: Prior to planting, the root ball should be inspected for pot-bound roots.

Pruning: Prior to planting, trees should be pruned to ensure all sucker growth is removed and there is only one central leader.

Staking: 'Protective' staking should be used to prevent any damage, particularly in highly urbanised and high traffic areas.

Watering: Tree must be watered at 50% of the root ball volume in the pot prior to planting to ensure the root ball is soaked and watered again once planted in ground.

Mulching: Mulch assists in moisture retention and provides organic matter to replenish the soil as it breaks down. Mulch application should occur immediately after planting and should be replenished every 4-6 months or as needed.

5.1.4 Establishment maintenance

During the establishment period, it is essential that new tree plantings are carefully managed. This period varies between species and microclimate conditions and should be understood to assist in tree planting program success.

Adequate resourcing: A tree establishment period is often between 12-24 months but can be up to three years in more arid environments. It is essential to ensure appropriate management occurs so that the required resources are available to ensure tree survival during this period.

Watering: The most important element when establishing a newly planted tree is watering. Passive irrigation should not be relied upon for watering new tree plantings, particularly with large tree stocks and under drying climate conditions. In the first few weeks, trees needed to be watered regularly.

Other maintenance: Other maintenance that should be considered during a tree's establishment period, includes weeding, fertilising, pest and disease control, maintenance of protective staking and pruning.

5.2 Alignment with best practice

The following summarises Council's current alignment with best practice planting and management guidelines. Opportunities for improvement and key recommendations are also outlined.

Bayside Council is taking proactive steps towards improving our understanding and management of the urban forest. In the pursuit of improvement, such steps should not be undervalued.

The following are the positive actions currently being undertaken to manage the urban forest:

- Good variation of tree sizes across the LGA;
- Capable and experienced in-house tree maintenance team;
- Successful grant funding for tree planting programs;
- Highly knowledgeable and engaged Council staff;
- Robust internal processes in place;
- Clear information provided to residents via website, community events, brochures, letters, and customer services enquiries; and
- Adopted Street Tree Master Plans.

5.3 Focus areas: opportunities for improvement

5.3.1 Focus Area 1: Tree asset management

Bayside does not currently possess a public tree register for public trees and the absence of this information has implications for risk management and best practice urban forest planning. Inventories help to prioritise operational maintenance requirements by providing information on tree health and condition, species diversity, age diversity and risk profile. By having 'up to date' information, evidence-based decision-making regarding public tree management can be made.

Recommendation: Using aerial imagery (e.g. Nearmap or vegetation map images from the DPHI) prepare a simplified user-friendly public tree mapping which includes 'significant trees'.

5.3.2 Focus Area 2: Tree maintenance

At present, Bayside predominantly performs reactive tree maintenance in response to customer requests. A lack of resources and budget has been identified as a barrier to increasing the levels of tree maintenance to a proactive or cyclic program. This has serious implications for tree risk management, as solutions are only implemented after trees become a hazard.

To address this barrier, a tree 'risk-benefit' management approach should be adopted. This approach acknowledges that all trees pose varying levels of risk, and therefore a tolerable level should be permitted due to the benefits that the urban forest provides.

Recommendation: To contribute to achievement of 35% canopy cover target on public land, an increased budget for maintenance of the increased number of trees will be required beyond the first 12 months (included in planting cost).

5.3.3 Focus Area 3: Tree planting program

Council needs a well-resourced tree planting program to support an increase in canopy cover. Current 'grant funded' tree planting programs are managed by the Environment & Resilience team, with about 400 trees planted annually by experienced contractors.

Current public tree planting programs are not sufficient to facilitate an increase in canopy required to meet a canopy target on public land of 35% by 2040 (see Section 3). Whilst the analysis undertaken as part of the development of this Strategy has provided an evidence-base for achieving targets and planting priorities to 2040, additional budget and staff resources will be required for implementation of the planting program.

Recommendation: A source of sufficient annual budgets and resourcing to implement tree planting and achieve a 35% canopy cover target on public land.

5.3.4 Focus Area 4: Internal culture and integration

Bayside's internal culture and attitudes towards trees play a key part in the delivery of best practice urban forest management. Delivering on canopy targets will be significantly impeded without a united Council vision and approach. Further, the protection and planting of trees must be integrated into the delivery of Council's capital programs.

For example, all new capital and/or infrastructure renewal works should incorporate and budget for sufficient new tree planting and greening where practical. Designs should also seek to maximise canopy to assist with achieving targets outlined in Bayside's Local Strategic Planning Statement (LSPS) 2020.

Recommendation: Use this Strategy as a vehicle for change and to educate and engage Bayside staff on the importance of trees, and to ensure consideration of trees in all Council programs.

5.3.5 Focus Area 5: DCP controls

Council only has management control of about 43% of public land in Bayside's LGA (medium and high Council influence areas) meaning that canopy change outside of this space has a significant impact on Bayside's ability to meet canopy cover targets.

Improving the current DCP controls for trees on 'non-Council' owned and managed land helps to prevent loss in canopy and/or helps to grow the canopy.

Recommendation: As required, improve DCP controls and/or guidelines/policies in Master Plans/ Conservation Management Plans for tree retention and/or tree planting on public (and private) land.

6 Actions & implementation plan

6.1 Principles and objectives

A framework of principles will be used to implement Bayside's Urban Forest Strategy, each with their own objectives and targeted actions (Figure 13).

6.1.1 Principle 1: Learn

Proposed actions related to Principle 1 include:

1. Using aerial imagery (e.g. Nearmap or vegetation map images from the DPHI) prepare a simplified user-friendly public tree mapping which includes 'significant trees'.
2. Reviewing and updating a Street Tree Master Plan. Address suitability of species to climate change, local character, biodiversity needs, wildlife corridor linkage, and list of non-preferred species with justification.
3. Partnering with community to grow the urban forest via engagement and education e.g. Adopt-a-Tree', 'Trees for Mum', 'Trees for Dad'.
4. Reviewing prioritised tree planting locations every 4 years (subject to available data) to optimise benefits of tree planting, noting that priorities may change due to the dynamic nature of urban heat, canopy cover and other factors.
5. Monitor tree gains and/or losses of approved development.

6.1.2 Principle 2: Engage

Proposed actions related to Principle 2 include:

1. To expand community support, Council to pursue understanding of community's perceptions and barriers relating to protection and growth of urban forest. Surveys regarding tree attitudes to continue to be completed.
2. Promoting urban forest growth achievements.
3. Using this Strategy as a vehicle for change and to educate and engage Bayside staff on the importance of trees, and to ensure consideration of trees in all Council programs.

Learn	Engage	Invest	Protect	Grow
Council understands the structure, composition, condition of and benefits provided by its urban forest. Council understands how to maximise co-benefits by prioritising planning.	Council staff and community value urban trees and work together to grow the urban forest on private and public land.	Bayside's urban forest is valued and funded to ensure effective planning and management is not impeded.	Council advocates for the protection of all urban trees from development and urban intensification.	Bayside's urban forest is planned and managed to support healthy growth and achieve realistic targets. This will be done by applying up-to-date data and best practice approaches.

Figure 13: Five Principles of Urban Forest Strategy.

6.1.3 Principle 3: Invest

Proposed actions related to Principle 3 include:

1. Allocating sufficient annual budgets and resourcing to implement tree planting and achieve a 35% canopy cover target on public land.
2. Increase budget for maintenance of increasing number of trees to contribute to achievement of 35% canopy cover target on public land.
3. Identify opportunities to trial dense vegetation planting (e.g. micro-forests), and explore potential to install additional Woody Meadows projects, with the option to partner with community via a citizen science partnership (Earthwatch n.d., 2023).

6.1.4 Principle 4: Protect

Proposed actions related to Principle 4 include:

1. Updating a Significant Tree Register (STR) for trees with outstanding aesthetic, botanic, ecological, historical, cultural, and social value. The STR will include assessment criteria and audit process.
2. As required, reviewing and improving DCP controls and/or guidelines/policies in Master Plans/ Conservation Management Plans for tree retention and/or tree planting on public (and private) land, including: incentives for tree retention/planting and/or increased fines for unlawful removal of trees (e.g. development applications, complying development, driveway application); and review definition of trees in DCP that can be pruned or removed without approval (e.g. consider removing 3m height rule and including a canopy cover provision) .
3. Preparing a Tree Management Policy to provide strategic direction for protection and growth of urban forest to align with Bayside's DCP and Biodiversity and Conservation SEPP.
4. Audit and improve development compliance for tree retention and planting.

6.1.5 Principle 5: Grow

Proposed actions related to Principle 5 include:

1. Investigating opportunities to increase plantable space on public land. e.g. consider reclaiming space on public land (e.g. concrete verges) for tree planting.
2. Identifying Councillor/s and/or community tree champions to promote urban forest growth.
3. Developing a Communications and Engagement Plan to promote growth of the urban forest.
4. Utilising NSW government datasets, review Bayside's performance against the 35% canopy cover target on public land.
5. Working co-operatively with Bayside Garden Centre to supply suitable native plants for tree planting programs.
6. Compiling an inventory of water sensitive urban design devices on public land (e.g. passive irrigation storage pits and raingardens) to complement urban forest growth and urban heat reduction.

7 Glossary of terms

Aerodrome
A defined area on land or water (including any buildings, installation and equipment) intended to use wholly or partly for the arrival, departure and surface movement of aircraft.

Biodiversity
Biodiversity refers to the variety of life on Earth, including the variety of species, ecosystems, and genetic diversity within species. It encompasses the diversity of living organisms, from microbes to mammals, and the diversity of ecosystems, from coral reefs to rainforests.

Climate change
Climate change refers to long-term changes in the Earth's climate, including changes in temperature, precipitation, and weather patterns over many decades or centuries, rather than variability evident from year to year. Climate change is a global threat, with potential impacts on human health, food security, water resources, coastal areas, and biodiversity.

Community Engagement
Community engagement refers to the process of involving community members in the design, implementation, and evaluation of programs and policies that affect their lives. It is a key component of community development and social change, as it helps to ensure that the perspectives and needs of community members are taken into account, and that they have a sense of ownership and commitment to the process.

Obstacle limitation surfaces
A series of planes, associated with each runway at an aerodrome, that defines the desirable limits to which objects or structures may penetrate into the airspace around the aerodrome, so that aircraft operations at the aerodrome may be conducted safely.

Private land
For the purpose of this strategy, private area includes land parcels privately owned.

Public land
For the purpose of this strategy, public land encompasses all areas owned and/or managed by Council, including Crown Land and Sydney Water Land, (such as bushland, reserves, parks, local roads and footpaths).

Resilience
The capacity of individuals, communities, businesses, organisations and systems within a city to survive, adapt and thrive in the face of whatever kind of chronic stresses and acute shocks they experience.

Sustainable development
Sustainable development is a concept that aims to meet the needs of the present without compromising the ability of future generations to meet their own needs. It is a holistic approach that considers the economic, social, and environmental dimensions of development and aims to balance these competing demands.

Useful Life Expectancy (ULE)
Useful Life Expectancy is the average period of time where a tree is expected to maintain condition, after which it is expected to decline. Is a method to compare short-lived and long-lived species.

Water Sensitive / Urban Design (WSUD)
WSUD is a land planning and engineering design approach which integrates the urban water cycle, including stormwater, groundwater and wastewater management and water supply, into urban design to minimise environmental degradation and improve aesthetic and recreational appeal.

8 List of figures and tables

9 Review

This strategy is scheduled to be reviewed every four years or major changes in legislation.

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ANNEXURES

Annexure A
State and local documents of relevance to the Urban Forest Strategy

DOCUMENT	RELEVANCE TO THE URBAN FOREST STRATEGY
State Level	
Premier Priorities: Greening our City	Increase the tree canopy and green cover across Greater Sydney by planting 1 million trees by 2022. This is part of the government's longer-term commitment to plant 5 million trees by 2030 and increase average canopy cover across Greater Sydney to 40%.
Environmental Planning and Assessment Act 1979 (NSW)	Defines the planning framework for NSW, including identifying the important role that council has in the strategic land use planning for its local government area.
Biodiversity Conservation Act 2016 (NSW)	The main piece of legislation that protects ecological communities and threatened species in NSW.
Greater Sydney Region Plan: A Metropolis of Three Cities	Sets a 40-year vision to manage and grow Greater Sydney in the context of social, economic, and environmental matters. The relevant sections to the Strategy are: **Liveability:** *Direction: A city of great places* – Objective 12: Great places that bring people together. – Objective 13: Environmental heritage is identified, conserved and enhanced. **Sustainability:** *Direction: A city in its landscape* – Objective 27: Biodiversity is protected, urban bushland and remnant vegetation is enhanced. – Objective 28: Scenic and cultural landscapes are protected. – Objective 30: Urban tree canopy cover is increased. – Objective 31: Public open space is accessible, protected and enhanced. – Objective 32: The Green Grid links parks, open spaces, bushland and walking and cycling paths. *Direction: A efficient city* – Objective 33: A low-carbon city contributes to net-zero emissions by 2050 and mitigates climate change. – Objective 38: Heatwaves and extreme heat are managed.

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Eastern City District Plan 2018	Establishes a 20-year plan to meet the vision outlined in the Greater Sydney Region Plan: A Metropolis of Three Cities. The relevant sections to the Strategy are: **Sustainability:** *Direction: A city in its landscape* – Planning priority E15: Protecting and enhancing bushland and biodiversity. – Planning priority E16: Protecting and enhancing scenic and cultural landscapes. – Planning priority E17: Increasing urban tree canopy cover and delivering green grid connections. – Planning priority E18: Delivering high quality open space. *Direction: A resilient city* – Planning priority E20: Adapting to the impacts of urban and natural hazards and climate change. **Implementation:** – Planning priority E21: Preparing local strategic planning statements informed by local strategic planning.
Local Level	
Community Strategic Plan 2018-2032	Sets the vision for the Local Government Area (LGA) and is a guide to decision making in relation to the social, environmental, and economic future of the area. The relevant sections to the Strategy are: **Theme 1: Bayside will be a vibrant place** *Community outcome 1.2: Bayside's places are dynamic and connected* – 1.2.1 Create green and welcoming streetscapes. *Community outcome 1.3: Bayside's places are people focused* – 1.3.2 Create and maintain vibrant, visually appealing, and welcoming places with their own village atmosphere and sense of identity. **Theme 3: Bayside will be green, leafy, and sustainable.** *Community outcome 3.3: Bayside's waterways and green corridors are regenerated and preserved* – 3.3.2 Enhance and extend green grid corridors. – 3.3.3 Increase Bayside's tree canopy. – 3.3.4 Involve community in the preservation of natural areas. – 3.3.5 Respect, manage and protect the natural environment and biodiversity.

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Local Strategic Planning Statement 2020-36	Creates Council's 20-year vision and priorities for land use in the Bayside region. It sets the direction for Council's economic, social, and environmental planning priorities to help guide future planning policy. The relevant sections are: **Part 2 Liveability:** *Direction: A city of the people* – Planning Priority B4: provide social infrastructure to meet the needs of the Bayside Community. *Direction: A city of great places* – Planning Priority B9: manage and enhance the distinctive character of the LGA through good quality urban design, respect for existing character and enhancement of the public realm. **Part 4 Sustainability:** *Direction: A city in its landscape* – Planning priority B19: Protect and improve the health of Bayside's waterways and biodiversity. – Planning priority B20: Increase urban tree canopy cover and enhance green grid connections. – Planning priority B21: Deliver high quality open space. – Planning priority B22: Protect and enhance scenic and cultural landscapes. *Direction: A resilient city* – Planning Priority B24: reduce community risk to urban and natural hazards and improve community's resilience to social, environmental, and economic shocks and stressors.
Bayside Local Environment Plan 2021	The key document used when considering land use planning across Bayside Council area. It implements the LSPS by providing the local environmental planning provisions. *Part 2.1 – Land Use Table: Zones SP1, RE1, RE2 and C1*
Bayside Development Control Plan 2022	Outlines a set of guidelines, objectives, and controls for Bayside's future development, including the implementation of the LEP. *Section 3.8: Tree preservation*
Rockdale City Council Street Tree Masterplan 2009 and City of Botany Bay Street Tree Masterplan 2014	Rockdale City Council Street Tree Masterplan 2009 and the City of Botany Bay Street Tree Masterplan 2014 will be amalgamated so that it represents the entire Bayside area. It will include the concepts, priorities and actions outlined in this Strategy.
Bayside priority green grid corridors spatial framework	The Bayside Priority Green Grid Corridors Spatial Framework sets the vision and next steps for delivering integrated open space and ecological assets that promote healthy living, active transport, community engagement, and environmental benefits.

Annexure B
Developing the Urban Forest Strategy

Developing the Urban Forest Strategy commenced in 2022 and included the following key steps:

2022: Bayside Strategic Planning 'Brainstorm' to produce a project outline for Bayside's Urban Forest Strategy.

2022-2024: Received NSW Department of Planning and Environment's Greener Neighbourhoods grant funding to prepare an Urban Forest Strategy.

2023: Met with Woollahra Council to discuss the scope and preparation of the Woollahra Urban Forest Strategy.

2023: Bayside's Urban Forest Officer employed.

2023: Consultant 'Edge' engaged to set a future canopy cover target, calculate plantable space and provide a prioritised tree planting plan to 2040, and included two workshops held with Bayside staff.

2023-2024: Prepare the Draft Urban Forest Strategy.

2023-2024: Meetings and collaborative discussions with Bayside staff to prepare Stategy actions.

Operational capacity workshop outcomes

In 2022 prior to the development of this strategy, the Strategic Planning team held a brainstorm to inform the consultant brief. The objectives of the brainstorm were to gauge what council is 'doing well' and opportunities regarding (1) public tree management and operations; and (2) private tree management and planning. The brainstorm image below summarises the key findings and consequent actions regarding the most important opportunities for improvement and development (Figure 15).

The organisational capacity to deliver the outcomes outlined in this strategy are fundamental to the growth and management of the urban forest. Consequently, an internal workshop was undertaken with relevant council staff on 22 August 2023 to understand the current challenges and barriers that exist in achieving improved urban forest outcomes. The objective of the workshop was to determine Bayside's capacity and current level of progress in urban forest management.

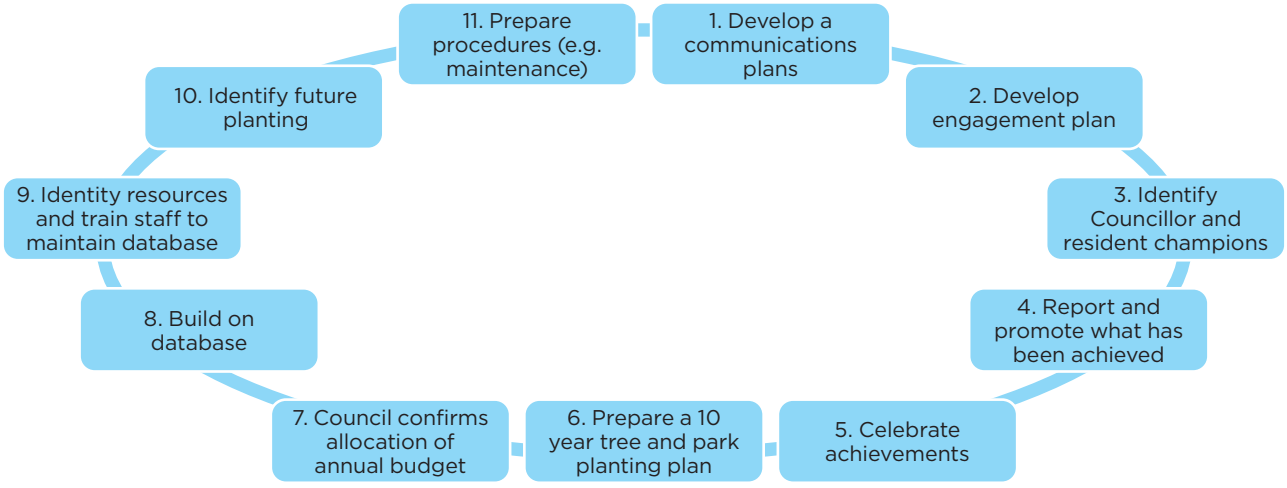

Figure 14: Strategic Planning 'Brainstorm' for this Strategy, project outline and potential actions.

Annexure C
Canopy cover

Canopy cover was assessed using artificial intelligence (AI) and 2022 photogrammetry datasets available from the former NSW Department of Planning, Housing and Infrastructure (Figure 16). The DPHI 2022 dataset defines a tree as any vegetation greater than 3m in height.

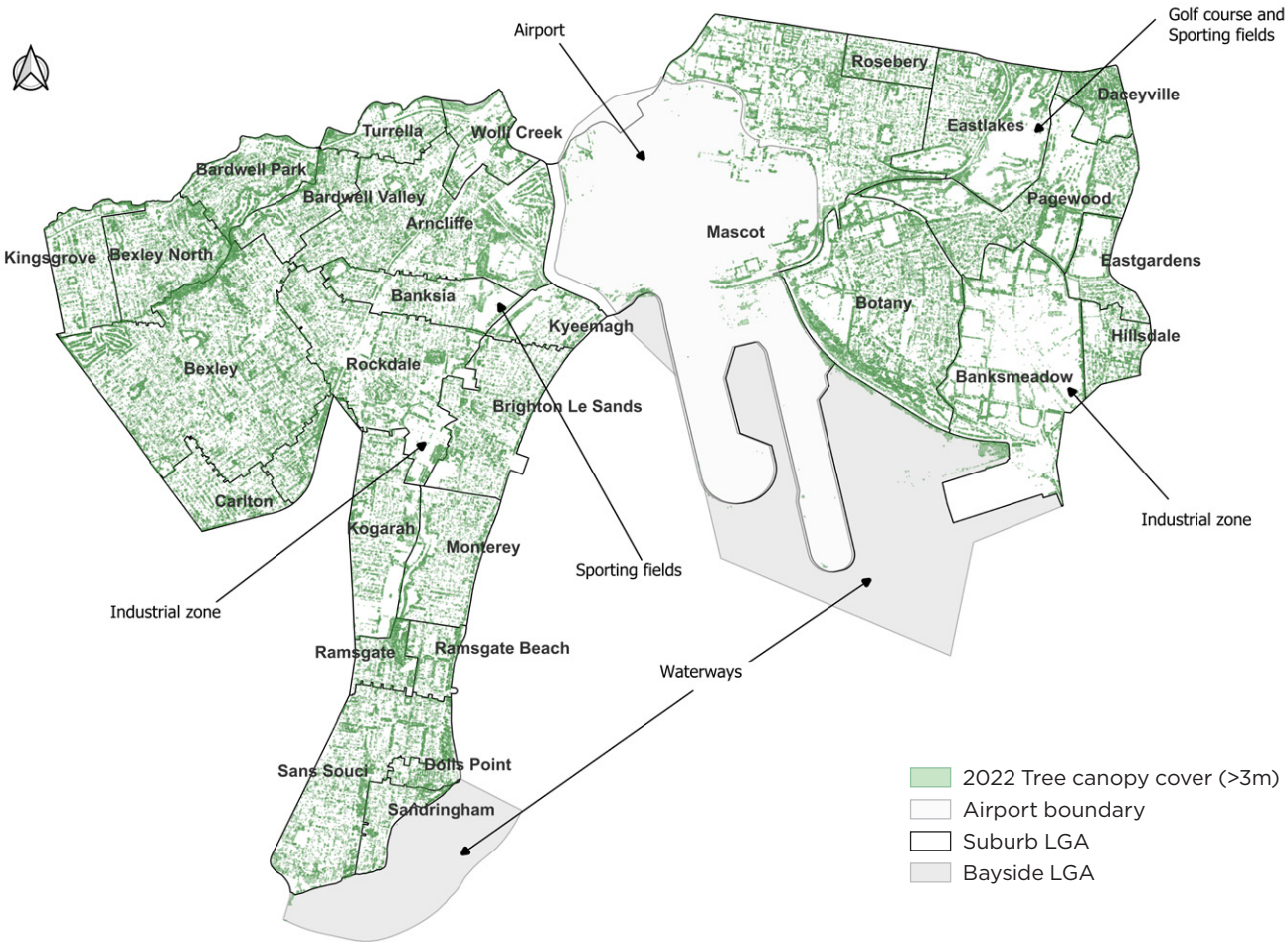

Figure 15: Mapped canopy cover for Bayside Council (NSW DPHI, 2023).

The low density residential (R2) zone comprises the greatest proportion of the Bayside area at 29.97% which is substantially higher than areas reserved for public recreation (6.77%). Further, the commercial centre comprised the least amount of Council area at 0.17% (Table 3).

'Council influence' was allocated to each land zone to indicate the relative level of control (low, medium, high) that Bayside Council has over tree planting in each zone. The canopy cover identified in 2022 using this methodology across Bayside was calculated at 28.9% (6,198,990.54m^2).

Over one-third of tree canopy cover occurs on public recreation land zones (6.77% of total Council area, Table 3), of which council has a high level of control. Almost half of Bayside's canopy cover occurs on the four land zones (Low Density Residential, Mixed Use, Private Recreation, Special Activities) under medium Council influence which in total covers over 36% of Council area (Table 3).

COUNCIL INFLUENCE	LAND ZONE 2021 LEP	LAND ZONE AREA (M²)	% OF COUNCIL AREA	CANOPY COVER (M²)	TREE COVER AREA (%)
High	Public Recreation	3,826,775	6.77	1,284,370	33.56
Medium	Low Density Residential	16,941,806	29.97	2,073,277	12.24
	Mixed Use	1,222,830	2.16	127,892	10.46
	Private Recreation	104,805	0.19	9,665	9.22
	Special Activities	2,286,490	4.04	396,310	17.33
Low	SEPP	7,428,565	13.14	533,028	7.18
	Commercial Centre	97,661	0.17	6,699	6.86
	General Industrial	896,913	1.59	97,720	10.90
	High Density Residential	1,858,330	3.29	293,724	15.81
	Local Centre	652,472	1.15	70,120	10.75
	Medium Density Residential	3,572,035	6.32	429,866	12.03
N/A	Infrastructure	11,362,220	20.10	704,517	6.20
	National Parks and Nature Reserves	17,826	0.03	0.00	0.00
	Natural Waterways	42,554	0.08	17,495	41.11
	Primary Production Small Lots	106,986	0.19	6,931.03	6.48
	Productivity Support	1,120,097	1.98	131,018	11.70
	Recreational Waterways	2,678,463	4.74	7,756	0.29
	Tourist	16,047	0.03	259	1.62
	Unzoned Land	333,659	0.59	8,239	2.47
	Working Waterways	1,963,602.15	3.47	96	0.00
Total		**56,530,146**	**100.00**	**6,198,990**	

Table 3: Land Zones assessed, listed in order of land area within each of the Council Influence areas, Tree canopy cover (incl. vegetation >3m height, 2022 DPHI data).

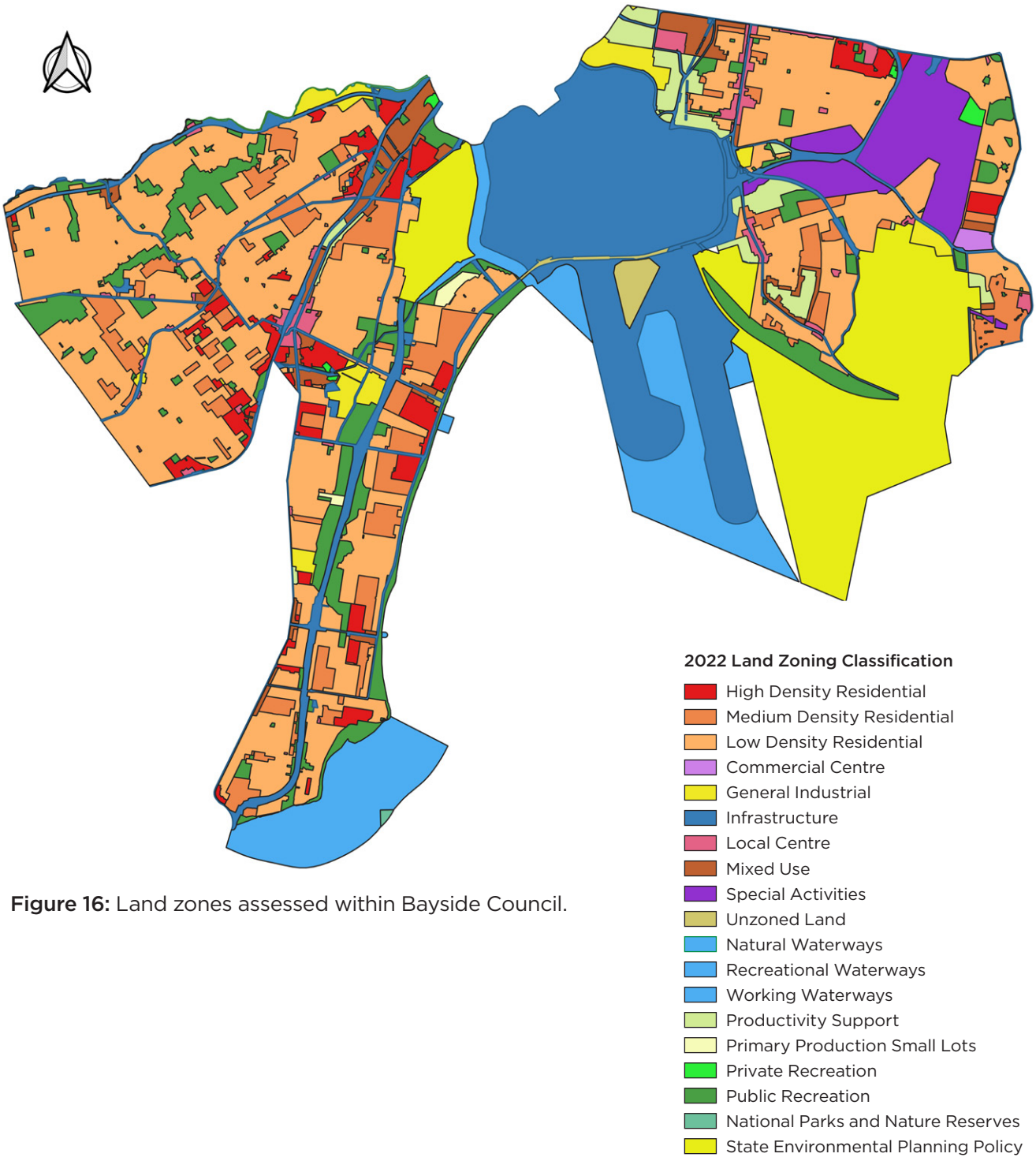

Figure 16: Land zones assessed within Bayside Council.

Annexure D
Tree Planting Predictor (TPP)

The Tree Planting Predictor® (TPP) was developed by Edge Environment to assist urban land managers and decision-makers make evidenced-based decisions about setting future canopy cover targets. It is an Excel-based tool that is delivered in a paired workshop process as this helps to tailor its application to the Bayside area and build confidence in technical staff and decision-makers about its accuracy and applicability.

The tool considers a range of input metrics relating to current canopy, rates of loss, and establishments success, as well as the number of different species planted. At the core of the tool's modelling, are over 500,000 equations that relate to the growth rate and crown spread at maturity of five categories of trees. It is important to note that the growth rate, crown spread, species mix, and the number of species planted each year have been customised to match Bayside's conditions.

Annexure E
Street Tree Prioritiser (STP)

Approach

Edge's Street Tree Prioritiser (STP) tool is used to quantify public potential plantable opportunities (POs) and prioritise these across the study region. Whilst the STP was originally designed for application within road corridors, the approach is also readily applied to areas outside of road corridors (e.g. parks and reserves). The STP builds on the potential plantable space layer derived from the NearMap surfaces AI datapack with 2023 imagery and defined as any area of currently non-tree bare ground or grassed area. The potential plantable space is revised by Council to apply a local knowledge lens about areas that should be removed (e.g. known contentious planting areas or areas earmarked for future development) or included (e.g. areas of currently sealed surfaces that could be removed for tree planting purposes).

The public potential plantable space areas are then assessed within the STP using a bin-packing algorithm to identify individual POs based on the following criteria: a $1m^2$ of potential plantable space that is at least 5m from an existing tree crown or another potential PO (Figure C1).

The potential POs are then prioritised based on an integrated prioritisation analysis (IPA) that considered in this project the following input metrics: current canopy cover, urban heat, and social vulnerability. The IPA ranks binary combinations of each of the input metrics. For example, the combination of social vulnerability and urban heat results in a ranking of UHIs that disproportionally affect the most disadvantaged citizens and a map showing how social vulnerability varies inside and outside of heat islands. The combination of the binary outputs produces the integrated prioritisation of plantable opportunities.

To provide outputs that are practically achievable the POs are aggregated to realistic management parcels (e.g. a whole park or street length) and these are allocated an IPA score based on the average prioritisation of the composite plantable opportunities. As well as a spatial map, STP outputs are also provided as a tabulated ranking of each of the plantable opportunities aggregated to management units. This can provide key insights in to where tree plantings can occur across the Council region to maximise benefits for people through urban cooling. The outputs from the STP analysis are also combined with the desired TPP scenario to develop the annual prioritised planting plan.

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Case Study

By assessing the number, placement, and anticipated tree size at each location, it is possible to generate informed estimates regarding the future canopy contributions resulting from these new tree plantings. For example, applying the STP to Besborough Avenue in Bexley identified a total of 19 plantable opportunities (Figure C1-B). This management unit area has a current canopy of 564m^2 (11.9%). Assuming all POs are filled with large street trees (10m crown diameter at maturity), a total of 1,262.1m^2 of canopy cover would be added, resulting in a total canopy cover within the area of 1,862m^2 (27.2%).

It should be noted, that should smaller sized trees be used to fill these POs, the cost would remain constant, but the impact of resulting canopy cover would be negatively impacted. For example, if all 19 POs were planted with small street trees (4m crown diameter at maturity), a total of 238.75m^2 of canopy cover would be added, resulting in a total canopy cover within the area of 802.75m^2 (Figure C1-C). This highlights the importance of planting larger crowned trees wherever possible and realistic to maximise the canopy cover and associate benefits able to be achieved by tree plantings.

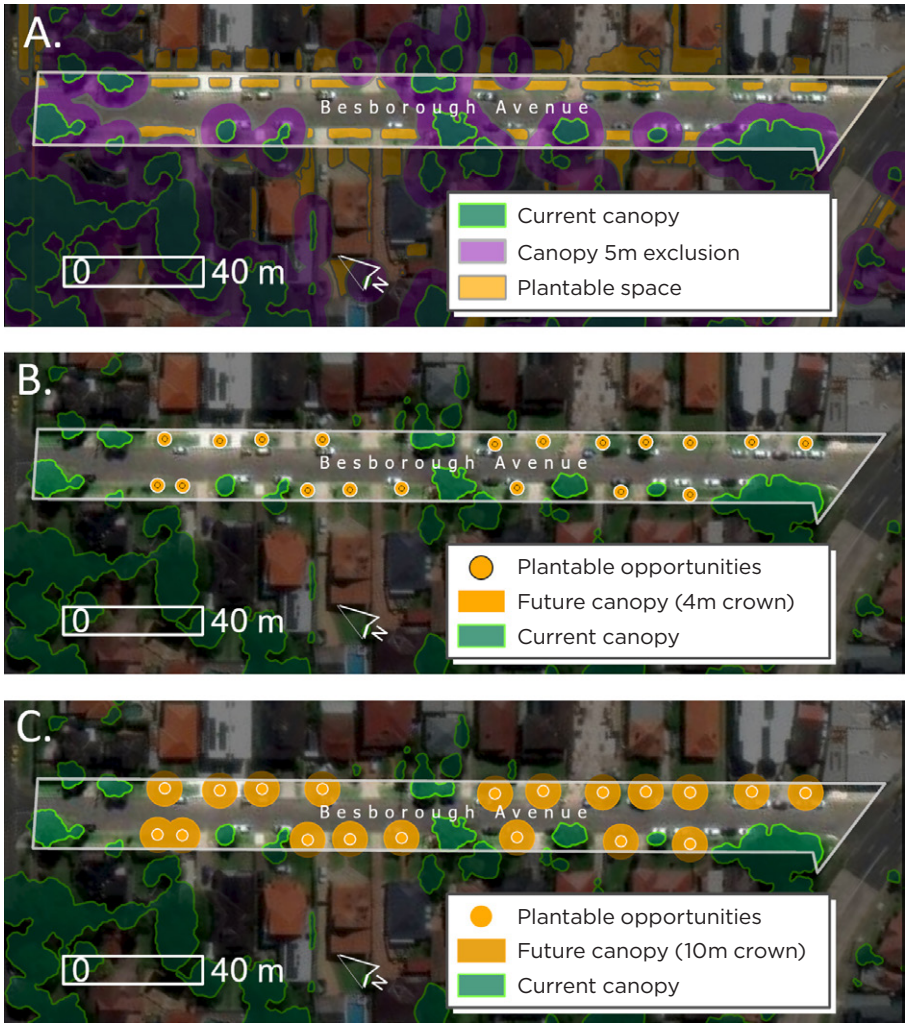

Figure C1: STP applied to the Besborough Avenue management unit in Bexley, illustrating: (A) existing canopy cover, 5m STP buffer, and potential plantable space; (B) STP output of potential plantable opportunities located within the potential plantable space, and potential canopy cover assuming large trees are planted; and (C) STP output of potential plantable opportunities located within the potential plantable space, and potential canopy cover assuming small trees are planted.

Data

Canopy and Plantable Space Cover

NearMap imagery and AI datapacks (May 2023) were used to determine canopy cover (Vegetation datapack) and plantable space cover (surfaces datapack). NearMap is a subscription-based data service providing regular high resolution aerial imagery updates and a suite of AI-based add-on packs. Canopy cover was derived from the Vegetation datapack, specifically canopy cover (vegetation >2 m height). Plantable space was derived from the surfaces datapack, specifically lawn grass, natural soft, and natural pervious surfaces. From this derived plantable space layer, areas of canopy cover (from the vegetation datapack) and non-plantable surfaces derived from Council and use layers (e.g. active sports fields, golf courses, areas within the AEZ) were removed.

For the IPA analyses, canopy cover values were normalised to the 95th percentile to minimise the influence of outliers. Inverse canopy values were used with lower canopy percentages equating to greater higher priority for planting.

Urban heat

Urban heat island data was acquired using NSW DPHI 2022 Thermal dataset that provides satellite-captured surface temperature values for the whole Council area. Surface, or 'skin' temperature, provides a snapshot of the distribution of heat energy retention across the landscape, one of the predominate influences on air temperature. Heat values were trimmed to 5th and 95th percentiles (19.63 °C and 33.30 °C) to minimise the skewing influence of high and low temperature outliers such as water. Values below and above these values were given a 0 (low priority) and 1 (high priority) heat score, respectively.

Social vulnerability

Social vulnerability data was provided by the Australian Bureau of Statistics using the 2021 Socio-Economic Indexes for Areas (SEIFA) Index of Relative Socio-economic Disadvantage (IRSD), assigned using SA1 level data. Several SA1 areas within the study region have zero population (e.g. business/industry/natural areas) and therefore are not given a SEIFA score. Excluding the SEIFA component for these areas would over-weight the remaining variables and bias the results (i.e. excluding SEIFA scores all together would multiply the influence of areas with no canopy or high heat, artificially promoting those areas to highest priority). As such, areas without a formal SEIFA score were assigned the mean SEIFA score of the Council for the purposes of the IPA analysis, so as not to under- or over-prioritise these areas. Inverse values were used for the prioritisation assessment with lower SEIFA scores equating to greater socioeconomic disadvantage and therefore higher priority for planting.

Council data

Some of the Council data provided required analysis to assess and remove overlapping or duplicated areas, with examples like three parcels within Finch Drive and Oscar Place having upwards of 16 duplicate entries. A total of 39 redundant entries were removed for this analysis, but additional overlaps were unable to be identified and removed. As a result, aggregating the individual analysis areas results in a 2.48% overcount restricted to public space of the plantable opportunities. Summary statistics at the suburb and Council levels were not subject to this overcounting and represent an accurate count of plantable opportunities.

All datasets were post-processed within ArcGIS and QGIS and all results were tabulated to the Council, LGA, and road reserve and park reserve areas. All data was projected using Geocentric Datum of Australia 2020 (GDA 2020) Map Grid of Australia Zone 56.

Prioritisation

To pinpoint the areas where tree planting would generate the most immediate cooling benefits, we ranked each aggregated management unit (individual roads and park reserves) according to its existing canopy area, urban heat levels, and social vulnerability. Values for all three variables were calculated for each public analysis area. These values were normalised on a 0-1 scale with low canopy, low SEIFA IRSD, and high heat scores indicating high priority areas for planting (for more details on methods see Appendix A). The average of these three values was used to calculate the Integrated Priority Assessment (IPA) Score allowing for areas to be ranked according to their combined need for planting.

Constraints

Whilst the STP provides a robust, data-informed estimate of plantable opportunities, its accuracy is reliant on the accuracy of the plantable space layer. Any misclassifications or inaccuracies within the plantable space layer will inevitably propagate into the plantable opportunities results. This assessment approach works to remove non-plantable areas from the plantable space layer, however additional restrictions may be present. Local sites should be checked prior to planting to verify local considerations.

The process of calculating plantable opportunities from plantable spaces aggregates many points into a single location, inducing a 4m range of accuracy in the precise optimal plantable opportunity location.

Each of the three IPA metrics (canopy, heat, and social vulnerability) individually provide a robust rationale for prioritising planting. However, combining all three metrics into a single indicator provides a quantitative approach to prioritise tree plantings based on multiple factors. As such, the Integrated Priority Assessment (IPA) compares the metrics listed but other, often more localised priorities such as those of stakeholders, should also be considered.

Differing impacts of planting locations

Plantable opportunities vary in impact, as the planting of trees in certain locations may provide greater benefits compared to other areas. Adding trees to areas with the lowest current canopy aims to fill in “blank spots” within the urban canopy. Previous projects have shown urban landscapes with a greater mixture of natural surfaces (especially trees) are generally cooler than urban landscapes dominated by built surfaces and with greening limited to large parks. Additionally, adding trees in areas of high urban heat exposure provides cooling in areas where it is (and will be) needed most, contributing to an overall increase in evapotranspiration benefit. As such, distributing trees along road reserves (often some of the main drivers of urban heat islands) best spreads the benefits of each additional tree to the largest area.

It has also been shown that to maximise the health benefits provided by trees, trees need to be planted within close proximity to people (ideally within 300m). Adding trees in areas of lower socioeconomic status aims to reduce inequalities of green amenities and provide benefits where people may not be able to plant trees themselves or withstand impacts of heat due to lack of trees and lack of means. This will have additional benefits such as reducing the household cost of cooling in extended hot weather or heatwave periods (via the reduction of appliance use) and a reduced long-term economic burden on vulnerable communities.

Photo Comp Acknowledgment

The following photos have been submitted as part of the 2023 Bayside Photo Competition:

page 3: Mark Collins, Sunrise at Pine Park

page 13: Maria Eileen Novak, Sunset by the Park

page 14: Sara Corlis, Why did the Wren Cross the Road

page 23: Francez Madrid, No Name

page 25: Idrees Daloran, Eventide

page 35: Nick Hyde, Bardwell Creek under the Milky Way

page 41: Michelle Sparkes, Take a Seat

page 55: Justin Pearce, Carlton Station Sunset

Bayside Council
Serving Our Community

Bayside Customer Service Centres
Rockdale Library, 444-446 Princes Highway, Rockdale
Westfield Eastgardens, 152 Bunnerong Road, Eastgardens
Monday to Friday 8:30am – 4:30pm

Phone **1300 581 299** | **9562 1666**
Email **council@bayside.nsw.gov.au**
Web **www.bayside.nsw.gov.au**