Urban Forest Strategy

2024-2050

Woollahra Municipal Council

edge impact

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Acknowledgement of Country

Woollahra Council acknowledges the Gadigal and Birrabirragal people who are the traditional custodians of this land and pay respects to Elders both past and present and leaders emerging.

Cover image: view over Vaucluse Park and surrounds (source: Woollahra Municipal Council)

Revision	Revision Details	Author/s	Approved by	Date
V1	First draft for review	JG, JVB, MS, KD, CC, AB	JG	28/2/23
V1.1	First draft – partial review	JG	JG	10/3/23
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PubCons	Minor edits from Council feedback	JG	JG	13/07/23

Mayor's Message

The beautiful trees which adorn our streets and parks are one of the best things about Woollahra and they are a defining characteristic of our local area. Our trees and landscaped areas – or urban forest – on public and private land are not only beautiful, they also provide many other benefits to our community: they clean our air, keep our streets cool and shade our schools, parks, playgrounds, homes and commercial areas in summer, and provide habitat for local wildlife.

It's heartbreaking to learn that we are steadily losing our canopy of trees across the municipality.

We've lost 16 Sydney Cricket Grounds worth of trees since 2010 alone. We can't let this trend continue.

The biggest impact we can have on the cooling, and ensuring the long-term wellbeing of our local area is to plant more large trees – and do more to protect the trees we currently have.

I'm proud of Woollahra Council's environmental leadership and the commitment made by the community to plant more trees and actively engage with us on community gardening, Bushcare regeneration and many other opportunities to green Woollahra.

In preparing Woollahra Council's Urban Forest Strategy we have set an ambitious and realistic target of planting 13, 410 new trees across our local area over 25 years to create 30% tree canopy cover by 2050. It's a huge undertaking, with a substantial financial investment, and we won't be able to do it on our own. We're also calling on you to plant trees in your backyards, workplaces and schools.

We all have a responsibility to protect and grow our tree canopy so future generations can also enjoy the unique, leafy character or our area and the environmental and health benefits which trees bring.

This Strategy is a legacy for the future of our area and our community. We hope you will support us and join us to act now so the future we imagine will indeed become reality.

Councillor Susan Wynne

Mayor of Woollahra

Executive Summary

This Urban Forest Strategy (UFS) has been prepared to align with Council's vision of a *thriving, inclusive, sustainable and resilient community that will benefit future generations*. Developed off the back of the *Floor Space Ratio/Canopy Control* project in 2020, this UFS sets the context, target, evidence-base, and framework for growing our urban tree canopy cover.

Of all the vegetation in our Council area, our urban trees provide the greatest benefits to our community, environment and economy which is why this UFS focusses on growing our urban tree assets. We acknowledge though that our urban trees are just one component of our Urban Forest and additional greening efforts focusing on non-tree vegetation should be actioned to complement the canopy targets that form the basis of this UFS.

Through a combination of current best practice research and evidence-based modelling of the Woollahra environment, we have established a **canopy cover target of 30% by 2050**. This target is both ambitious and realistic. In setting this target we have considered:

- current canopy cover and rates of canopy cover loss;
- the total area available to plant trees;
- the species mix used in our tree plantings;
- the number of trees that would need to be planted overall and in each year;
- the financial commitment required to plant and establish trees; and
- where to plant trees first in order to maximise the benefits provided to our community.

Achieving this target will require an increased financial commitment of at least $14.8M over the next 25 years to plant and establish trees on Council managed public land. Funding will also be required for staff to manage the project and to support the ongoing maintenance associated with managing a healthy, thriving tree population.

This strategy represents a shift in Woollahra's tree management paradigm, and it compels us to rethink how we plant and manage trees, and how we protect existing trees. We will also need to consider how we engage and collaborate with other government agencies and institutions, and private land owners and managers so that we can achieve a greener, cooler, and healthier urban environment for our community and future generations.

Our five guiding principles for implementing this UFS are:

- **Plan:** this principle builds on key findings presented in this Strategy and will be critical is implementing in the earliest stages of the Strategy lifetime.
- **Grow:** this principle relates to the strategic and on-ground actions required to "put trees in the ground" to achieve our target.
- **Protect:** this principle relates to the effective protection of existing tree assets on public and private land.
- **Fund:** this principle relates to ensuring adequate budgets are available in the long-term financial plan to implement actions and achieve our canopy cover target.
- **Engage:** this principle relates to connecting the community to the urban forest, this strategy, and the ensuing action plans.

Monitoring and review of Strategy progress will be undertaken every five years. The first review will be important for gauging practical implementation of the Strategy, identifying any obstacles, and allowing for practical revision of actions. The penultimate review will be important for auditing the Strategy actions and clarifying ongoing actions and strategies for the urban forest after 2050.

Contents

GLOSSARY

The following terms are defined relevant to their use in this urban forest strategy. Words in bold in the descriptions indicate that they themselves are defined within the Glossary.

Baseline context	Used within the **Tree Planting Predictor™** tool, it refers to a set of metrics that describe the: study area, current **canopy cover**, **canopy rate of change**, and current **plantable space**. These metrics are applied, unchanged, to all **planting scenarios** modelled.
Business as usual (BAU) planting scenario	This **planting scenario** reflects Council's current average **planting rate**s and **planting mix**es (assisted by state government grants)**.** When modelled, this planting scenario demonstrates what will happen to total canopy cover if no changes are made to the existing planting programs.
Canopy	Multiple tree **crown**s growing in specified area.
Canopy cover	The total amount of the study area covered by tree **crowns** as viewed from aerial imagery. May be expressed as an area (e.g. m^2 or km^2) or proportion (%) of the study area.
Canopy cover target	A quantifiable and time-based goal **canopy cover** for a given area. Targets can vary depending on land use and/or typology and may be applied at different spatial scales. For this Urban Forest Strategy, the canopy cover target is 30% canopy cover by 2050 across the Woollahra Municipal Council area.
Canopy rate of change	The average annual change in **canopy cover** within the study area. This value may be positive (i.e. average increase in canopy cover) or negative (i.e. decrease in canopy cover).
Crown	The foliage cover of a single tree.
Establishment success rate	The proportion of trees planted each year that survive the initial 1-3 years of establishment. Surviving trees are assumed to survive to maturity.
Growth parameter	The **crown** size at planting, years to maturity, and **crown** size at maturity of a given **tree type/size**. This variable is customised for each **tree type/size** and region of interest.
Growth profile	The trend in **canopy cover** change over modelled years as new trees are planted and existing trees grow or are lost.
Planting mix	Used in developing **planting scenarios** within the **Tree Planting Predictor™** tool. It refers to a specific combination of different **tree categories** (e.g. 30% very small trees, 30% small trees, 20% medium trees, 15% large trees, 5% very large trees).
Plantable opportunity	**Plantable space** that meets the criteria of having $1m^2$ of contiguous plantable space located at least 5m from the next plantable opportunity or current tree canopy.
Planting rate	Used in developing **planting scenarios** within the **Tree Planting Predictor™** tool. It refers to the total number of trees to be planted per year within each tenure type.
Planting intensity	Used in developing **planting scenarios** within the **Tree Planting Predictor™** tool. It refers to the change in **planting rate** year-to-year. For example, a constant planting intensity means that the same planting rate is applied each year. Comparatively, a front-loaded planting intensity means that the number of trees planted per year will be greater in the initial years of planting that in the later years.

Planting scenario

Planting scenarios are a specific combination of tree species (i.e. **planting mix**), number of plantings per year (i.e. **planting rate**), and **planting intensity.** By varying the **planting mix, planting rate,** and **planting intensity**, we can explore tree planting program requirements needed to achieve a **canopy cover target**.

Plantable space

Currently un-treed bare ground or grass areas considered to have potential for planting a tree. The modelled area of plantable space would need to be ground-truthed to determine the actual plantable space (e.g. areas mapped as plantable may not be given constraints not apparent through spatial analysis, such as underground/overhead utilities).

Street Tree Prioritiser™

A powerful modelling tool developed by Edge Environment that uses spatial analysis with machine learning algorithms to identify **plantable opportunities** within defined areas of interest prioritise tree plantings based on **plantable opportunities** combined with **canopy cover**, urban heat, and **social vulnerability**.

Social vulnerability

Social vulnerability refers herein to vulnerability to urban heat. Data was provided by the Australian Bureau of Statistics (ABS) using the 2016 Socio-Economic Indexes for Areas (SEIFA) Index of Relative Socio-economic Disadvantage (IRSD)[1], assigned using Statistical Areas Level 1 (SA1)[2] data.

Tenure types

Two land tenure types were defined for this project based on land ownership and management: (1) public (includes State government land); and (2) private. All land within the Woollahra Municipal Council area was allocated to one of these tenure types for the purposes of analyses herein.

Tree category

Five categories of trees are used in the **Tree Planting Predictor™** tool. The categories group together different tree species based on similarities in their **growth parameters**. Faster growing trees tend to have a smaller **crowns** at maturity, whilst slower growing trees tend to have larger **crowns**. Average **growth parameters** for each tree category applied herein were customised in consultation with Council to suit local growing conditions.

Tree Category	Average Years to Maturity	Average Crown Spread at Maturity
Very small	5	2m
Small	10	4m
Medium	15	6.5m
Large	20	11.5m
Very large	30	25m

Tree Planting Predictor™

An excel-based modelling tool developed by Edge to aid decision-makers in setting **canopy cover targets**. Through a series of algorithm models based on several input variable parameters, the tool estimates the aggregate **growth profile** of new and existing tree plantings within a given area.

[1] https://www.abs.gov.au/websitedbs/censushome.nsf/home/seifa

[2] https://www.abs.gov.au/statistics/standards/australian-statistical-geography-standard-asgs-edition-3/jul2021-jun2026/main-structure-and-greater-capital-city-statistical-areas/statistical-area-level-1

Urban forest	All vegetation, including trees, growing within the Woollahra Municipal Council area, irrespective of tenure type. Our Urban Forest Strategy focusses on increasing tree cover, with increased urban greening efforts being recognised as an important complementary action.
Urban greening	The total vegetation cover within an area including, but not limited to: trees, grass, shrubs, planter beds, and green walls. Efforts to increase and improve urban greening across our Council area will help to improve the overall functioning and health of our urban forest.

PART 1.
BACKGROUND

OUR MUNICIPALITY

Woollahra Municipal Council (hereafter 'Council') is in the eastern suburbs of Sydney, New South Wales. The Council area is bounded by Sydney Harbour in the north, Waverley Council in the east and south, Randwick Council in the south, and the City of Sydney in the south and west. Being adjacent to the Sydney CBD, the municipality is densely populated, with a resident population of 53,891 (as of 2023), equivalent to 4,399 people per square kilometre.

Despite the highly urban nature, the region contains a reasonable amount of open space, and supports a range of diverse ecosystem elements, including wooded sandstone slopes and gullies, coastal heaths, and inland freshwater systems.

Our Native Plant Communities

Soil type is an important determinant of vegetation communities. Key characteristics of different soil types that impact the plants that can grow upon them include nutrient quantities, drainage, and depth. Twelve soil landscape groupings occur within our Council area (Annex A). The most dominant soil landscape grouping is the Hawkesbury (ha) grouping, covering more than 26% of the Council area (Annex A). The top five most dominant soil landscape groupings covering 87% of the Council area and are broadly described as erosional, colluvial, and aeolian landforms (Annex A).

Given the dominant Hawkesbury soil landscape grouping within our Council area, pre-European native plant communities would have been characterised by native trees including: Red Bloodwood (*Corymbia gummifera*), Narrow Leaf Stringybark (*Eucalyptus oblonga*), Scribbly Gum (*Eucalyptus haemastoma),* Brown Stringybark *(Eucalyptus capitellata),* and Old Man Banksia *(Banksia serrata)* on the exposed crests, and Blackbutt (*Eucalyptus pilularis),* Sydney Blue Gum *(Eucalyptus saligna),* and Water Gum *(Tristaniopsis laurina)* in the sheltered gullies.

Our bushland areas provide vital pockets of habitat that support a diversity of native plants and animals, including several threatened species. The remnant bushland areas in Woollahra are predominantly composed of vegetation categorised as Sydney Coastal Sandstone Headland Heath and Sydney Coastal Sandstone Foreshores Forest. To help protect and restore this vegetation Council staff and volunteers carry out bush regeneration at Cooper Park, Parsley Bay Reserve, Gap Park, Trumper Park, and Harbour View Park. Where these bushland reserves connect with our parks, backyards, and street trees they create important corridors for native wildlife to move across our area[3].

Woollahra's *Biodiversity Conservation Strategy*[3] also identifies 10 Key Habitat Areas (KHAs) within the LGA. These areas support most of the LGA's native vegetation and habitat for native fauna, including threatened species such as the Powerful Owl (*Ninox strenua*), Grey-headed Flying-fox (*Pteropus poliocephalus*), and various species of microbat.

The retention and continued rehabilitation of Woollahra's KHAs is crucial to protecting and enhancing biodiversity in the municipality. The implementation of this UFS along with Council's Street Tree Master Plan will support the conservation of these areas. It will also strengthen linkages between KHAs to enhance habitat connectivity for wildlife. This UFS will also have positive indirect impacts on biodiversity, such as helping to mitigate impacts of climate change, urban heat, and improving water quality.

[3] Further detail provided in our Biodiversity Conservation Strategy 2015-2025, available at: https://www.woollahra.nsw.gov.au/environment/bushland_and_biodiversity

Our Land Tenure – Ownership and Management

The majority of land (64%) within our municipality is privately owned and managed (Figure 1), with this trend holding true within each suburb, with the exception of Watsons Bay where public land is the dominant land tenure (80%), though this land is primarily managed by State government agencies rather than local Council. This dominance of private land means that Council is limited in the physical area available to directly influence canopy cover through tree plantings on public (Council) land. The potential space available for planting trees (i.e. plantable space) on Council owned and managed land is most limited by the need to provide and maintain open (non-treed) recreational space in our public parks and sports fields (see Part 3). Collaborative efforts between Council, State government, and the private sector will therefore be required to have significant impacts on growing our urban forest.

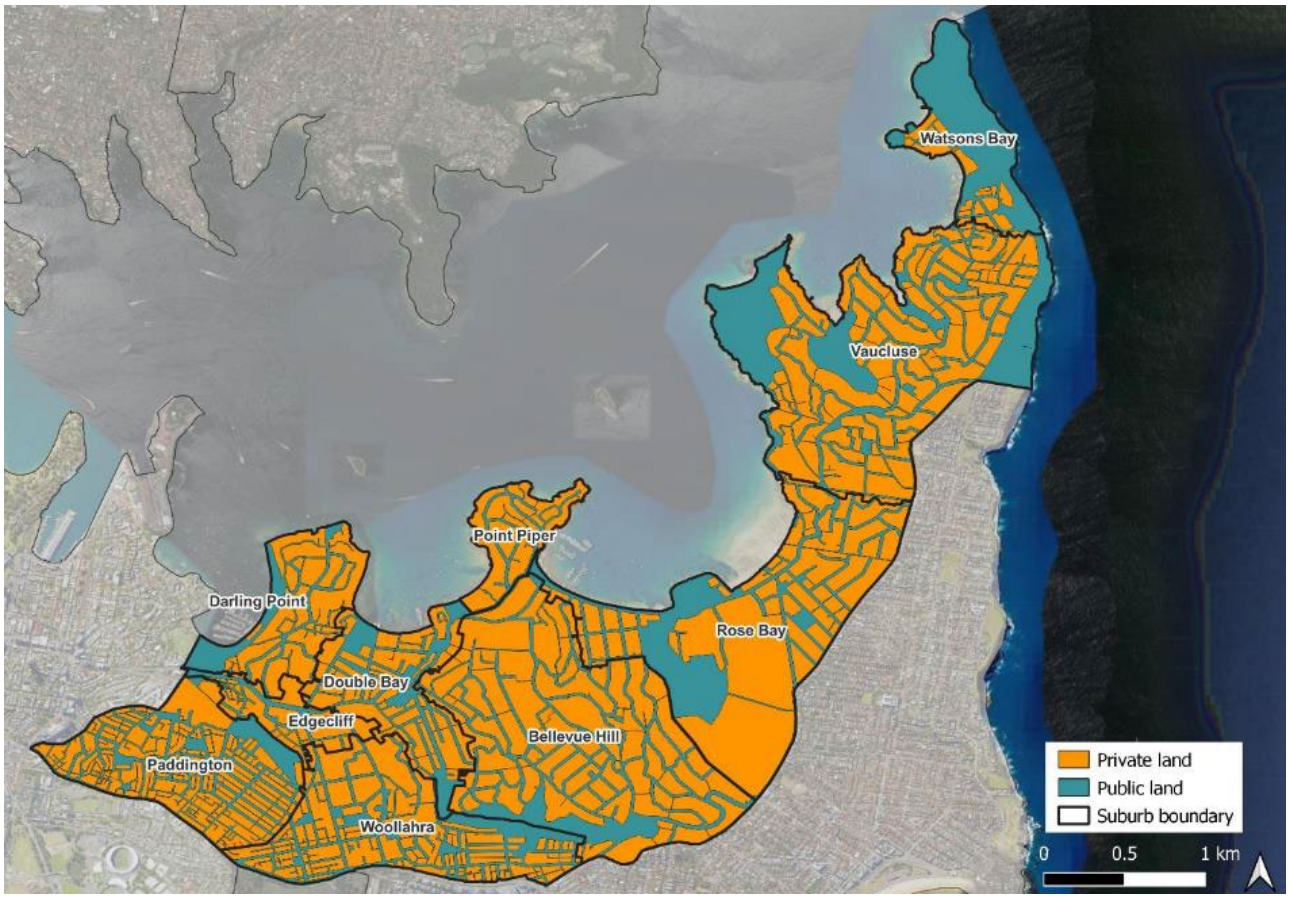

Figure 1. Public and private land tenure within Woollahra Municipal Council. Noting that public land as shown here also includes State government owned and managed land (e.g. South Head which is part of Sydney Harbour National Park).

DEFINING OUR URBAN FOREST

Our urban forest is more than just trees on public land. It comprises all vegetation growing within our Council boundary, including on private lots, along residential streets, and within our bushland reserves and parks (Plate 1). Further, our urban forest includes single trees and groups of trees, green grassy spaces, shrubs, garden plantings, planter beds, green roofs and walls, and even the soils that support our vegetation.

Plate 1. Examples of vegetation comprising our urban forest.

Whilst our urban forest includes all vegetation, we recognise that trees provide the greatest combination of beneficial services (Table 1). This is why our urban forest strategy focuses on protecting and growing the urban tree cover within our municipality. However, we recognise that complementary urban greening efforts, focused on other vegetation elements (e.g. roof gardens, shrubs, green walls, grassed areas), will also be important for providing native wildlife resources, improving erosion control and stormwater quality, and enhancing the functioning and health of our urban forest. Additional non-vegetation mechanisms (e.g. green shade structures and water sensitive urban design such as permeable paving) will further contribute to the health and functioning of our urban environment.

ACTION:

Investigate non-tree urban greening initiatives and enhanced planning controls. For example, greening for Heritage Conservation Areas and other relevant new development and greening for public spaces.

BENEFITS PROVIDED BY OUR URBAN FOREST

Our urban forest provides a multitude of services that benefit our community, environment and economy (Table 1), and is one of the few assets that appreciates in value over time.

Table 1. Key beneficial services provided by urban trees.

Environmental Benefits

Carbon storage and sequestration

As trees naturally sequester and store carbon, growing the urban forest is a nature-based solution to removing carbon from the atmosphere

Reduced urban heat

Trees cool the urban environment through shading surfaces from ultra-violet radiation and cooling the air through evapotranspiration

Reduced air pollution

Trees trap airborne pollutants on their leaves and branches and return oxygen back to the atmosphere

Improved water quality

Trees intercept rainfall, helping to reduce stormwater flows and filter runoff entering waterways

Support wildlife diversity

Trees provide habitat shelter, connectivity, and foraging resources for a range of native vertebrate and invertebrate animals

Social Health and Well-being Benefits

Reduced noise pollution

Trees buffer the sounds of the urban environment, reducing noise pollution

Improved mental health

Trees in urban environments help to decrease stress, depression, and anxiety

Improved physical health

Urban trees are known to improve physical health, such as through improved air quality and by encouraging physical exercise in cool, shaded, attractive areas

Encourages community connectedness

Green, attractive spaces benefit communities by encouraging more outdoor activity through the provision of cool, shading spaces to meet, and play

Economic Benefits

Increase property values

'Leafy suburbs' demand higher land values than those less-treed areas

Tree-lined streets and well-maintained treed gardens enhance land value

Reduced energy costs

Tree shading helps alleviate summer heat reducing the need for energy-consuming air conditioners

Enhanced local economies

Tree-shaded retail precincts attract higher rates of consumer spending particularly during hot, summer conditions

Aesthetic Benefits

Sense of place

Trees create a 'sense of place' and provide a distinctive character to an area

Cultural connections

Trees can have cultural significance and reflect architectural and historical periods of development

City attractiveness

Trees help create attractive and desirable places to live, work, and visit

URBAN FOREST STRATEGY CONTEXT

Strategic Framework

A suite of guidance documents form the legislative framework that inform tree management and protection within our Council area (Figure 2). This framework helps to set the strategic direction for tree management and inform Council and the community about tree planting maintenance and removal requirements. Managing trees in accordance with this framework allows Council to align regulatory requirements with policy and planning instruments and develop objectives, levels of service and lifecycle management strategies just as it does for other infrastructure assets in the public domain.

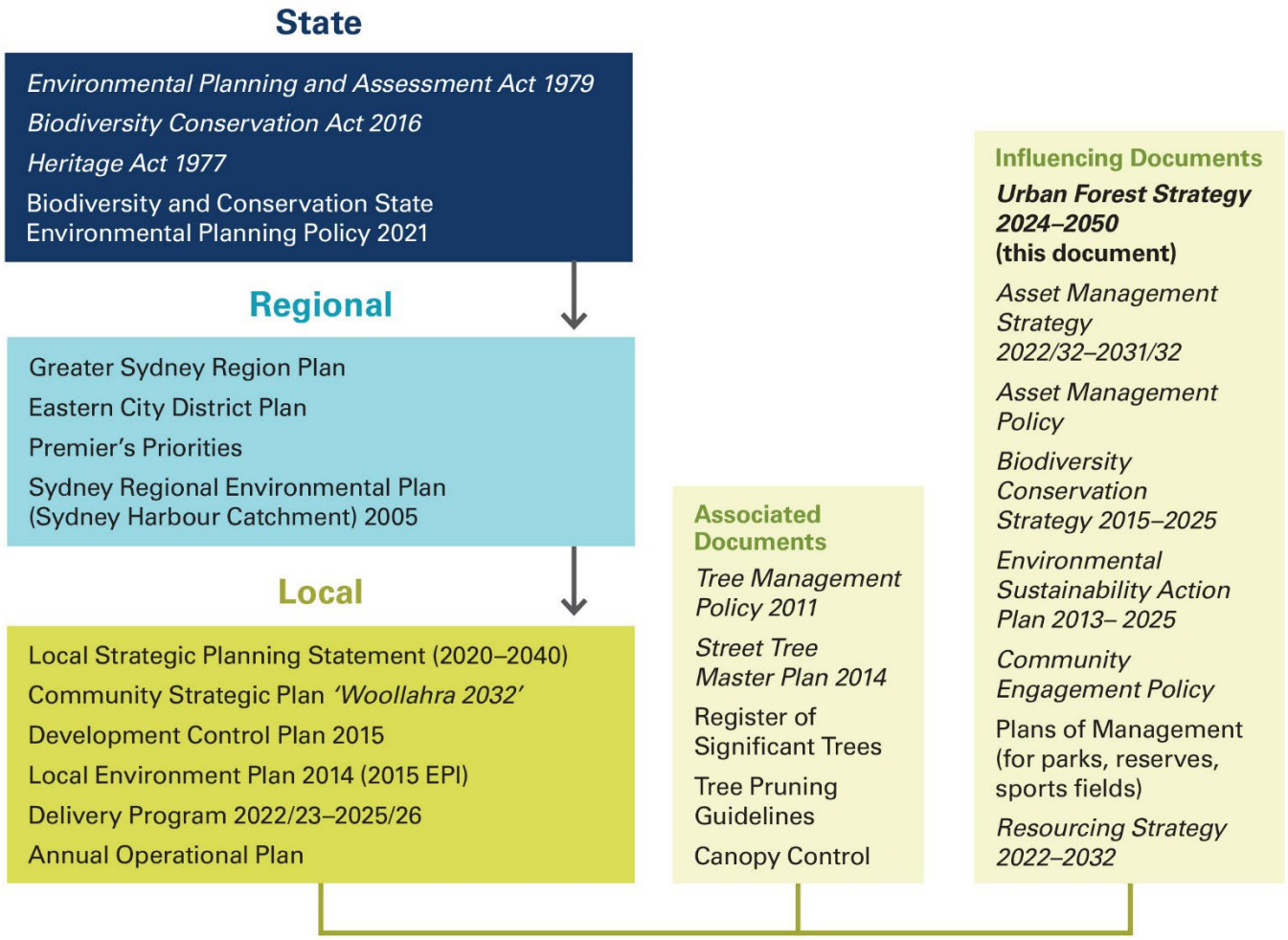

Figure 2. Strategic context within which this Urban Forest Strategy will align.

Regional Context

The growing global focus on increasing urban forest cover has led to many urban land managers establishing ambitious canopy cover targets. Ambitious targets are often developed with good intentions yet without clear understanding of what is needed to achieve the target in terms of planting capacity, tree numbers, quantity, species and financial commitment.

Targets will also vary from Council to Council and will depend on a variety of factors such as: existing canopy cover, land uses and tenure, available resourcing, community and Council priorities and perceptions, and context-specific restrictions (infrastructure, views). Accordingly, Councils must set targets that are specific and relevant to their location and community, and with the following considerations:

- The capacity of local conditions and land use types to accommodate tree canopy – the relative proportions of streets, parks and other built or open spaces is a major influence on capacity;
- Geographical and climatic limitations – this will affect the type of trees able to grow well and may also influence how much canopy can be supported;
- Minimum canopy cover requirements – for social, community or health outcomes based on current research;
- Resources available – to implement planting programs but also to manage plantings over their lifetimes; and
- The timeframe in which the canopy target is to be delivered.

Within our surrounds, the NSW State government has committed to a target of 40% canopy cover across the Greater Sydney region by 2036, and our neighbouring local councils are also in varying stages of their urban greening journey.

Our Urban Forest Strategy provides the context and target for our canopy cover, together with the evidence-base and plan for achieving this target (see Part 3).

OUR APPROACH

Urban forestry is an increasingly common approach for the holistic management of trees in urban areas. A primary focus is measurement and management of tree canopy. This is a shift from traditional arboriculture which focused on the management of individual trees. The model of urban forestry sustainability[4] recognises trees as critical collective infrastructure, which is valued as a continuous resource, irrespective of ownership boundaries.

Urban forests are crucial for the liveability, sustainability, productivity, and resilience of humans in urban areas. The benefits of urban forests are well studied and have long been known to provide important ecosystem services such as cooling, stormwater management, air pollution removal, and oxygen production. Whilst previously less well understood, ongoing research in recent years has been highlighting the human health, wellbeing, and social benefits provided by urban trees.

For example, research undertaken in Australia[5] found that neighbourhoods with at least 30% tree canopy cover were correlated to adults having lower chances of developing: diabetes (by 31%); psychological distress (by 31%); cardiovascular disease (by 21%); and cardio

[4] Clark JR *et al.* (1997) A model of urban forest sustainability. *Journal of Arboriculture* 23(1): 17-30. Available from: https://www.naturewithin.info/Policy/ClarkSstnabltyModel.pdf

[5] Astell-Burt T, Feng X (2019) Association of Urban Green Space With Mental Health and General Health Among Adults in Australia. *JAMA Network Open* 2(7): e198209. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6661720/

hypertension (by 21%). Of note, urban green spaces with open grass did not provide the same benefits as tree canopy. The growing awareness of such benefits has led to evolving best practice recommendations for urban forest design and planning, underpinned by ensuring equitable access to urban trees and high-quality green spaces[6].

Our approach to developing this Urban Forest Strategy is to focus initially on increasing tree canopy cover as a way of maximising benefits provided by our urban forest. This Urban Forest Strategy is a high-level document which sets out specific actions for our goals and targets. Best practice requires setting goals and targets which are ambitious but achievable. Canopy targets are a great way to set our ambitions for delivering canopy and measuring our performance over time. It also helps Council transition from measuring the performance of individual trees to focusing on the collective benefits that our urban trees provide[7].

Our Urban Forest Strategy (including the establishment of our canopy target and other recommendations) was developed using a strong evidence-base. Key aspects applied in developing our Strategy include:

- desktop reviews including: our soil types and plant communities; best practice urban forest planning and management; and ecosystem service benefits;
- using spatial data to quantify and examine spatial and temporal trends across our LGA and suburbs: land tenure; current canopy cover and hard surfaces cover (built infrastructure); land cover change over time; urban heat and social vulnerability;
- interrogating and analysing our existing public tree inventory (~17,500+ public trees) regarding tree age and species diversity;
- applying the Tree Planting Predictor (TPP) tool to: establish a realistic canopy cover target; and quantify the planting, establishment cost, and space requirements to achieve the target; and
- applying the Street Tree Prioritiser (STP) tool to: quantify and prioritise potential planting locations (i.e. plantable opportunities) on public land which would require minimal site modifications; and generate a prioritised annual planting plan to maximise benefits of tree plantings to urban heat and social vulnerability.

Our approach and the resulting recommendations provide us with a solid foundation planting plan, with our main priority being to plant a substantial number of trees in the coming years, to allow them time to grow and mature by 2050.

INTERNAL COLLABORATION

Much as our urban forest is a shared asset between Council and our community, therefore it must be viewed internally as a shared asset across Council departments. Within Council there will be key teams and champions driving planning and management of the urban forest. However, drivers, issues, and interventions relating to the urban forest will impact all Council departments to varying degrees, so it will be important that planning and management of the urban forest is multidisciplinary and has shared responsibilities.

This UFS includes recommendations (see Part 4) that specifically focus on strengthening the communication and collaboration within and between Council departments to ensure the urban forest and greening initiatives are a key consideration in all relevant projects at the initial concept/planning stages.

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[6] 3:30:300 Rule: https://iucnurbanalliance.org/promoting-health-and-wellbeing-through-urban-forests-introducing-the-3-30-300-rule/

[7] Hopwood A. *et al.* (2021) Greener Neighbourhoods Guide. Department of Planning, Industry and Environment, NSW Government. Available at: https://www.dpie.nsw.gov.au/__data/assets/pdf_file/0011/486128/Greener-neighbourhoods-guide-2021-12.pdf

CELEBRATING OUR SUCCESSES

Whilst urban land managers are now focused on similar targets of protecting and increasing the urban forest, **every municipality is at a different point in their urban greening journey**. Our urban greening journey is well underway, though we acknowledge it is still a work is progress. Whilst protecting and growing an urban forest is fraught with challenges, and setbacks can and do occur, it is important to **acknowledge and celebrate our successes and achievements to date**. In addition to our alignment with leading best practice planting and management principles (see Annex B), the following is based on external review of our approaches together with internal feedback from Council staff.

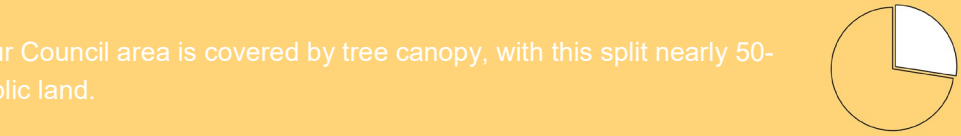
- **Plantings:** we include a high proportion of large trees in our current planting mix. This is a relatively higher proportion than many other municipalities and will help us to reach our canopy cover targets more efficiently. Our Street Tree Management Plan also supports the benefits of planting larger trees where possible.
- **Culture:** there is a strong focus from Council on protecting and increasing canopy cover and the urban forest, and the internal culture and messaging supports a united approach.
- **Guiding Documents:** we have a suite of management documents that support our tree planting and management efforts. In particular, our Street Tree Master Plan (STMP) has helped to set the vision and objectives for growing our tree canopy and maintaining a healthy urban forest prior to development of this Urban Forest Strategy (UFS). With some revisions to the species planting palette (to ensure consideration of long-term climate resilience), the STMP will continue to provide important support for the implementation of this UFS.
- **Funding:** we have had recent success in receiving recent State government grants which have enabled us to plant more advanced trees with a longer establishment period, giving a boost to our urban forest targets.
- **Quality:** our Council staff and contractors are highly qualified and passionate and provide thorough and professional tree planting and management in accordance with best practice standards.
- **Planting strategy:** we implement street planting projects with high success rates through improvements to site and species selection, quality establishment and follow-up maintenance practices, and data capture; park plantings that include full plant communities to create more diverse habitats (e.g. Christison Park, Cooper Park).
- **Proactive tree management:** we undertake a cyclic inspection regime and monitor public tree health and condition and maintain trees as required.
- **Significant public places:** our iconic parks, avenues, and bushlands are protected and managed to create green corridors that increase biodiversity across our suburbs and contribute to threatened species conservation.
- **Public tree protection:** our tree teams are focused on protecting existing trees, particularly our high value trees subject to impacts as part of development applications or Tree Works Application (TWA).
- **Private tree protection:** we have undertaken extensive research into what capacity new developments can achieve in terms of canopy cover and have proposed canopy cover targets for certain development types; amendments to our DCP 2015 will help increase private canopy cover as part of urban developments.
- **Establishment success:** We have a very high success rate for establishment of newly planted trees.

PART 2. OUR URBAN FOREST

AT A GLANCE[8]

64% of land is privately owned and managed. 88% of our public land is comprised of roads (50.9%), parks (31.3%), and bushland (1.2%).

27.4% of our Council area is covered by tree canopy, with this split nearly 50-50 on private vs. public land.



Our urban forest includes more than **17,500** Council public trees (excluding bushland trees). The suburb with the highest number of trees is Bellevue Hill (3,535), and the fewest is Edgecliff (283).

277 different species are represented by our public trees. The three most dominant species are: Queensland Brushbox (*Lophostemon confertus*) (11.8%), Water Gum (*Tristaniopsis laurina*) (6.2%), and Jacaranda (*Jacaranda mimosifolia*) (3.7%).

47% of our public trees are mature trees, with a further 39.2% being semi-mature. 13.5% are young trees and 0.3% are over mature.

47.3% of our public trees are in good or very good condition, with a further 45.4% being in fair condition. 7.3% are in poor to very poor condition.

78% of our public trees grow along our streets, representing 52% of our total canopy cover. The remaining trees grow in our parks (41.4%) and bushlands (2.1%).

Each year, our public trees …

…clean our air by removing more than **6,700kg** of air pollutants

…help combat climate change by absorbing carbon each year equivalent to removing **304 cars** from our roads.

… help clean our waterways and mitigate flooding by filtering rainfall and reducing run-off by **656,500** 10L buckets worth.

An estimated **35,000** additional trees are under private ownership.

[8] Tree level information based on public tree assets only.

CURRENT URBAN FOREST

Canopy Cover

Our urban forest provides **canopy cover across nearly 28%** of our Council area. Amongst our suburbs canopy cover proportions are relatively similar, with cover ranging from 22.8% in Point Piper to 32.3% in Woollahra. However, given the difference in size in our suburbs, this means that certain suburbs actually comprise more of our urban forest then others, with Vaucluse containing 22.2% of the Council's total canopy area and Edgecliff containing only 2.2% (Figure 3).

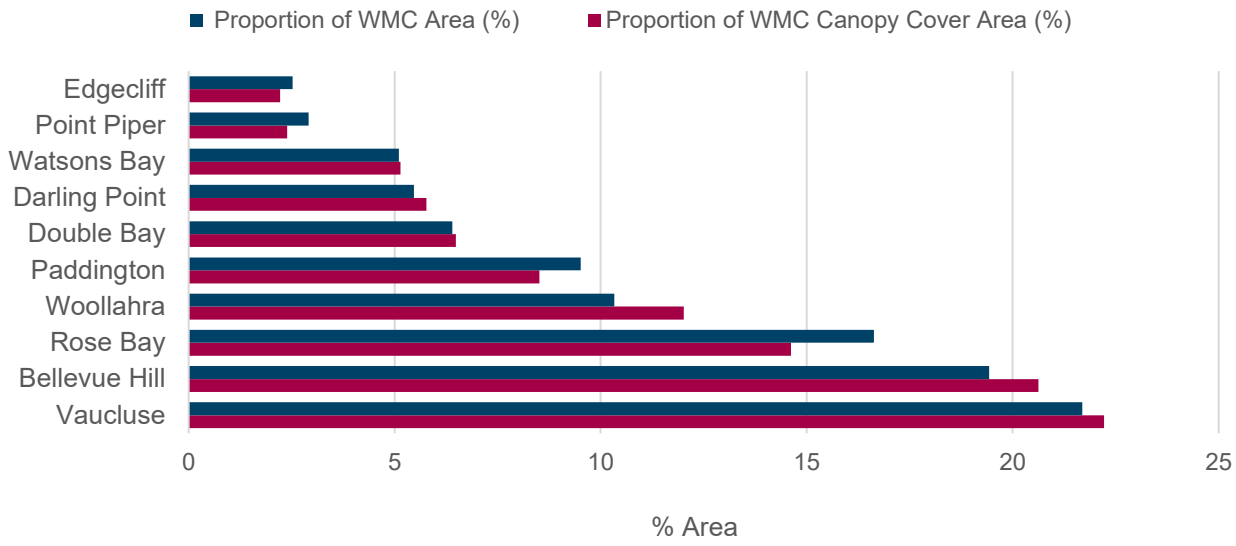


Figure 3. Contribution by each suburb to Council's (WMC) total canopy cover area, relative to the proportion of the Council area covered by each suburb.

Tenure Trends

As of 2023, there is a roughly 50-50 division of our canopy cover across private and public tenure, with 50.2% occurring on private land, and 49.8% on public land (Figure 4). Of the canopy cover on public land alone, 95.3% is found within our road corridors and public parks (including bushland areas) (Figure 4).

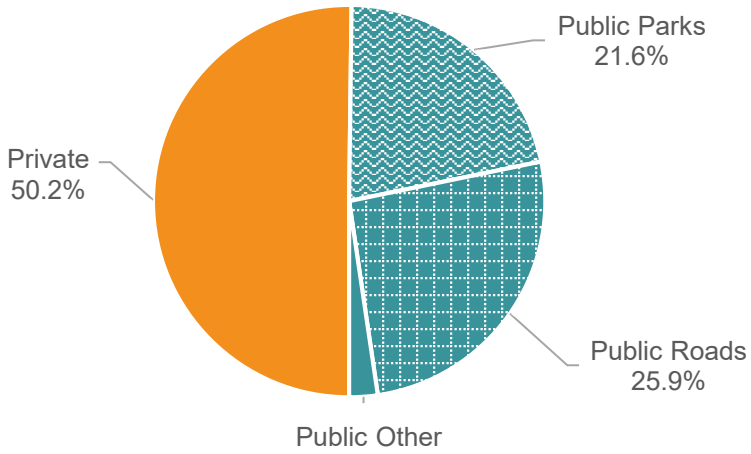


Figure 4. Canopy cover distribution by tenure and public land use type.

Diversity

Diversifying our urban forest is a key mechanism for building resilience against future climate change. Of particular importance is both species diversity (to enhance genetic resilience) and age diversity. Analysis of our tree inventory data allows for insight into the species and age diversity of our public trees at the Council-wide and suburb levels.

Species diversity

Santamour's Diversity (also known as the 10-20-30 rule) is an accepted guideline for minimum species diversity targets to reduce the risk of catastrophic tree loss due to pests and diseases, and other species-specific threats (e.g. changing climate conditions). The rule posits that an urban tree population should include **no more than 10% of any one species, 20% of any one genus, or 30% of any family**.

Assessing our public tree inventory against this rule highlights a need for us to diversify the species comprising our urban forest. Across our Council area, we exceed both the family and species thresholds, with more than 30% of our urban comprised of species within the Myrtaceae Family, and more than 10% of our species being Queensland Brushbox *(Lophostemon confertus)* (Table 2). This means that we risk losing large proportions of our urban forest from impacts that negatively influence these taxa such as Myrtle Rust. However, as the Myrtaceae family does contain a very broad range of Genera and species it will be difficult to diversify at the Family-level.

Our Street Tree Masterplan (STMP) also acknowledges the species diversity ideals, and whilst our current diversity is partially due to legacy issues associated with historical tree plantings, diversifying our species selection into the future has been considered in the STMP.

Trends across suburbs vary, with suburbs exceeding diversity thresholds for at least one species, Genus, or Family (Table 2). Only Darling Point, Edgecliff, Point Piper, and Watsons Bay fall below all diversity thresholds, meaning their urban trees are likely to be more resilient. Bellevue Hill is at particular risk from a species diversity perspective, with their trees exceeding each of the species, Genus, and Family thresholds. Particular attention should be paid to diversifying the plantings here.

ACTION:

Undertake strategic review of species list within STMP with consideration to climate risk and increased species diversity

Table 2. Santamour's Diversity assessment of public trees across the Council area and within each suburb. For each location, the dominant Family, Genus, and species is shown with the proportion of the location's tree population for which it represents. Cells highlighted yellow indicate that Santamour's Diversity threshold has been exceeded (i.e. 10% for species, 20% for Genera; and 30% for Families).

	Family	Family %	Genus	Genus %	Species	Species %
Council-Wide	Myrtaceae	40.4%	*Lophostemon*	11.8%	*Lophostemon confertus*	11.8%
Bellevue Hill	Myrtaceae	47.3%	*Lophostemon*	22.1%	*Lophostemon confertus*	22.1%
Darling Point	Myrtaceae	26.5%	*Ficus*	13.0%	*Ficus microcarpa*	7.7%
Double Bay	Myrtaceae	37.1%	*Lophostemon*	14.5%	*Lophostemon confertus*	14.5%
Edgecliff	Myrtaceae	26.9%	*Eucalyptus*	8.5%	*Sapium sebiferum*	8.1%
Paddington	Myrtaceae	37.5%	*Tristaniopsis*	11.7%	*Tristaniopsis laurina*	11.4%
Point Piper	Myrtaceae	25.7%	*Olea*	7.9%	*Olea europea*	7.9%
Rose Bay	Myrtaceae	47.8%	*Lophostemon*	15.7%	*Lophostemon confertus*	15.7%
Vaucluse	Myrtaceae	40.4%	*Lophostemon*	9.2%	*Lophostemon confertus*	10.7%
Watsons Bay	Myrtaceae	27.4%	*Ficus*	14.7%	*Banksia integrifolia*	9.2%
Woollahra	Myrtaceae	38.6%	*Platanus*	10.3%	*Platanus x acerifolia*	8.8%

Age and condition diversity

Mature trees comprise nearly half (46%) of our existing public tree population, with a further 38% being semi-mature and entering the mature life phase in the coming years (Figure 5). Whilst most of our public trees are in fair to very good condition (Figure 6), including more than 90% of our mature trees, we recognise that declining tree health is a natural process of tree aging, and that a range of age classes in varying conditions is not unusual in an urban forest context.

The progression of the mature tree population into the final growth stage (over-mature) will require an increase in associated tree management costs and an increase in tree removals as tree risk considerations become more prevalent. Further, although semi-mature trees which currently represent 38% of the tree population will help to reduce the loss of canopy cover associated with the removal of over-mature and senescent trees, increasing the proportion of young trees will be necessary to maintain and enhance the quality of the public tree population over the long-term.

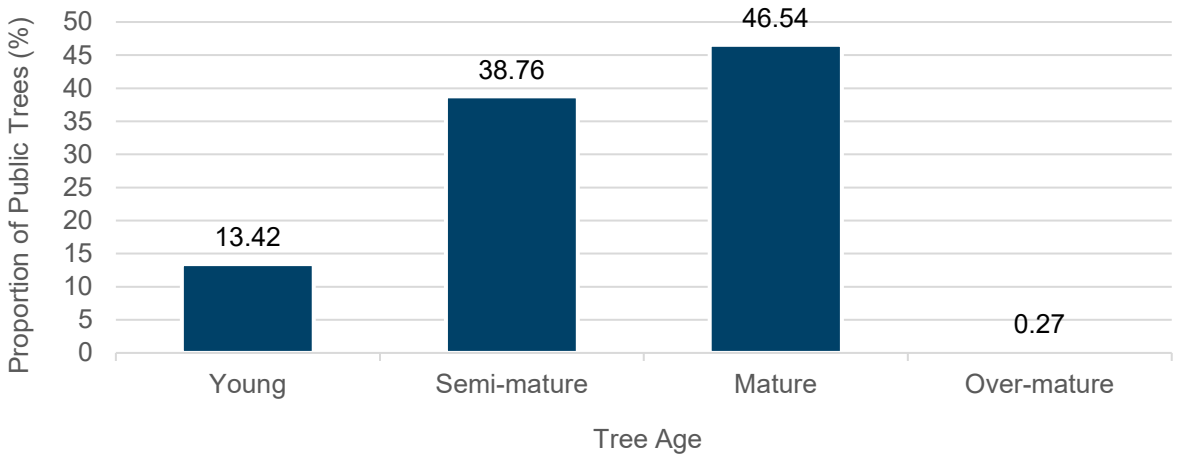


Figure 5. Diversity of ages represented by our public tree population.

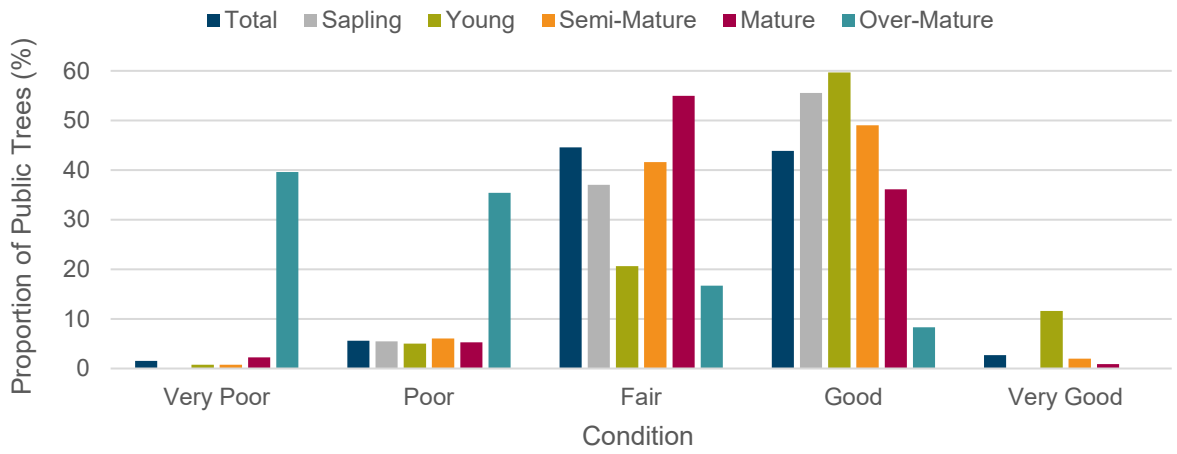


Figure 6. Diversity of condition represented by our public tree population.

To bolster the inherent resilience of our urban forest, our approach should focus on proactively diversifying tree ages and maximising tree health. Reviewing our tree's age and condition together provides insights into potential required management actions (Figure 7). For example: mature trees in fair to very good condition should be monitored and maintained as required; over-mature trees or young trees in reduced condition should be more regularly assessed and replaced where appropriate. Succession planting[9] should be considered where feasible for semi-mature or mature trees in poor condition, as well as over-mature trees in fair or better condition.

ACTION:

Adopt a method for assessing age and species diversity based on current best practice and research (e.g. on age/species composition)

Based on this assessment of our public tree age and condition diversity, monitoring and more regular maintenance is recommended for more than 90% of our trees (Figure 7). Darling Point has the greatest proportion (9.16%) of its trees requiring assessment to help direct management actions. Vaucluse, followed by Rose Bay, Watsons Bay, and Woollahra have the greatest proportions of replacement plantings recommended; and Rose Bay followed by Vaucluse also have the greatest need for succession plantings. These findings highlight priority locations for management actions to help improve resilience within our urban forest.

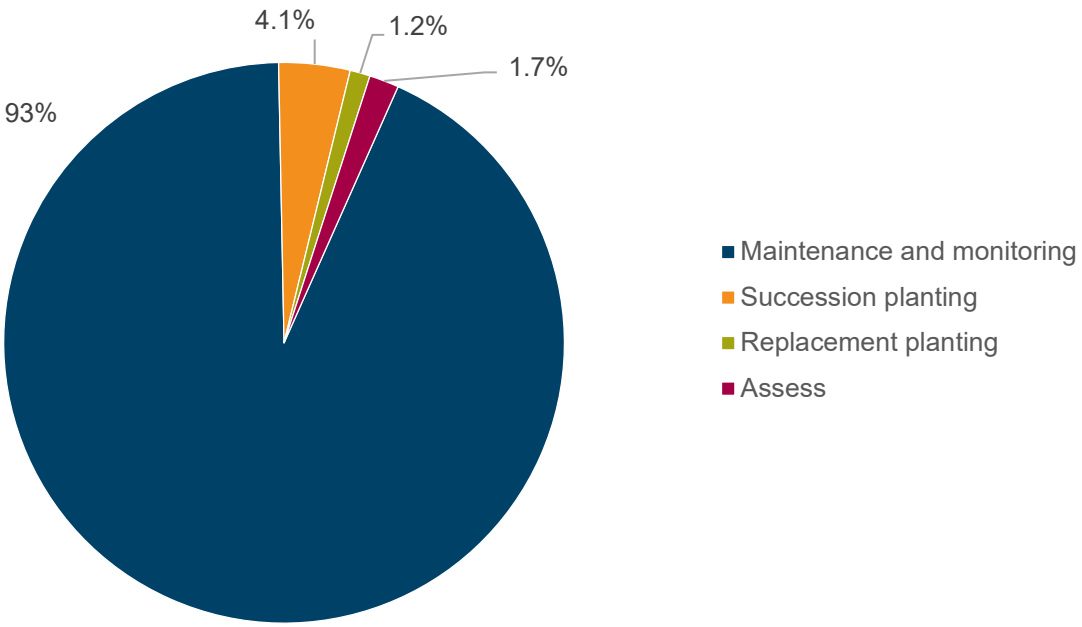


Figure 7. Recommended management actions (where feasible) for our public trees.

[9] Succession planting refers to the process of planting a young tree near a tree that is likely to be removed in the near future (e.g. within 5-10 years). In doing so, the young tree has time to establish and become semi-mature before the older tree is removed. This helps to minimise impacts of tree removals (e.g. on urban heat, wildlife, aesthetics).

LAND COVER CHANGE

Council-wide Trends

Land cover change has been pronounced across the entire Council area over the last 10 years. We have experienced **canopy cover loss of 2.52%** (307,428m^2) (Figure 8), equivalent to an area just larger than Edgecliff, or **just over 16 Sydney Cricket Grounds** worth. We have also experienced **decreasing plantable space and increasing hardscapes** in largely equal, though opposite, measure (-2.14% and +1.57%, respectively) (Figure 8). The loss of plantable space (260,815.75m^2), means that the potential area available to plant trees and other vegetation has declined by an area equivalent to nearly 14 Sydney Cricket Grounds.

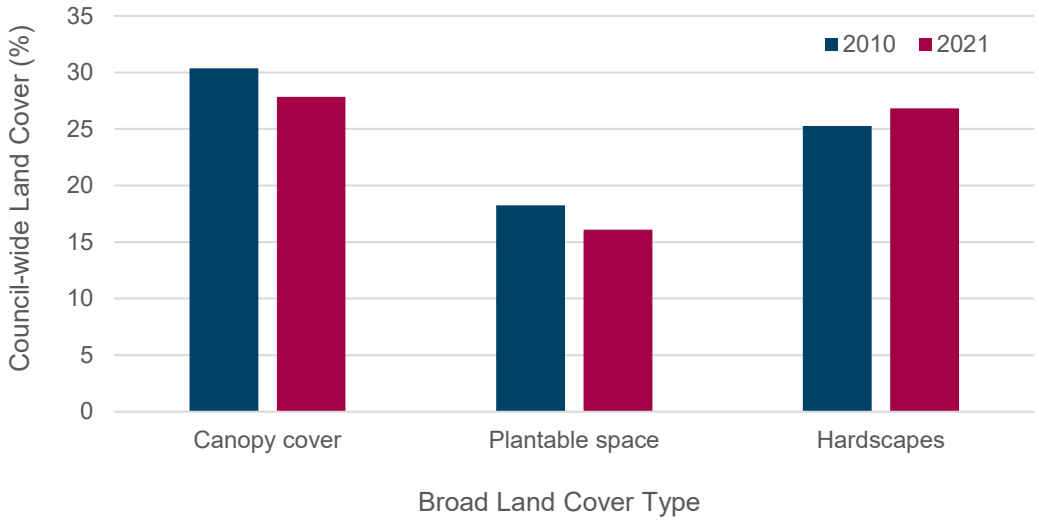


Figure 8. Change in broad landcover types across the Council area between 2010 and 2021.

The main driver of this land cover change has been urban development, particularly residential infill development, which usually results in the conversion of canopy cover and/or plantable space to sealed, hard surfaces (Figure 9). This means that whilst canopy cover is lost, so too is the available area to plant a new tree, making it increasingly difficult to offset, let alone grow, our urban forest (see Part 3).

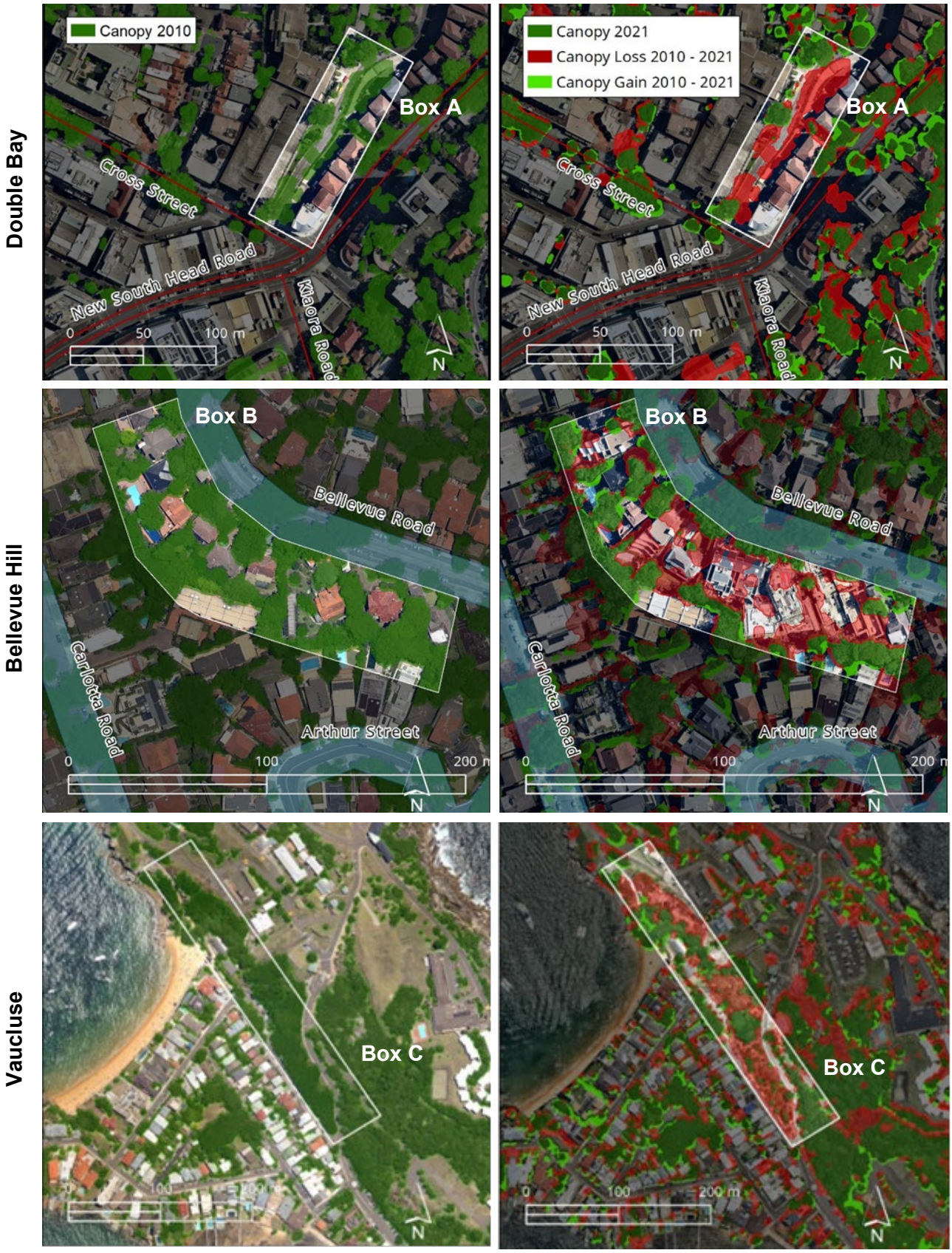


Figure 9. Examples of canopy cover losses in three locations, showing (left images) canopy cover in 2010 and (right images) canopy change in 2021. Examples show canopy losses due to: (Box A) public infrastructure works; (Box B) private residential infill; (Box C) State government weed removal.

Suburb Trends

Current patterns of land cover

Patterns in land cover vary between suburbs (Figure 10). Edgecliff and Point Piper, for example contain substantially more of their **canopy cover** on private land (68% and 69.2%, respectively), leaving these suburbs at higher risk of canopy loss due to development. Comparatively, Watsons Bay, Paddington, and Vaucluse, all have more of their canopy cover on public land (85.1%, 58%, and 55.9%, respectively), demonstrating clear opportunities for protection of public urban forest in these suburbs.

The proportions of **plantable space** on public land is greater in Darling Point, Double Bay, Vaucluse, and Watsons Bay, meaning these suburbs represent the greatest opportunities for increased public tree plantings (Figure 10). Comparatively, within the other suburbs, plantable space is greater on private land, meaning these suburbs may represent opportunities for collaborating with private land owners to help increase canopy cover across the Council area.

Change over time

Between 2010 and 2021 every suburb experienced a loss of **canopy cover**, contributing to the overall loss across the whole Council area (Figure 11a, Annex C). This loss was predominantly driven by losses on private land, with the exception being Watsons Bay where most canopy cover loss occurred on public land resulting from State government required management of declared (weed) tree species. Canopy losses also occurred on public land in most suburbs, with the exceptions being Bellevue Hill, Edgecliff, Paddington, and Rose Bay (Figure 11a). In these four suburbs, canopy cover on public land increased over the last decade, though these gains were outpaced by losses on private land resulting in overall canopy losses.

Changes in **plantable space** (Figure 11b) showed similar trends to canopy cover across suburbs, with losses occurring in all suburbs except Point Piper, where a small increase in plantable space occurred. Losses of plantable space occurred primarily on private land, with the exceptions of Rose Bay and Watsons Bay. Drivers of plantable space tend to be more dynamic than canopy cover and may increase due to land clearing (of canopy or buildings for example), and similarly may decrease because a development has occurred or potentially because a tree has been planted or simply matured to cover more land area with its crown.

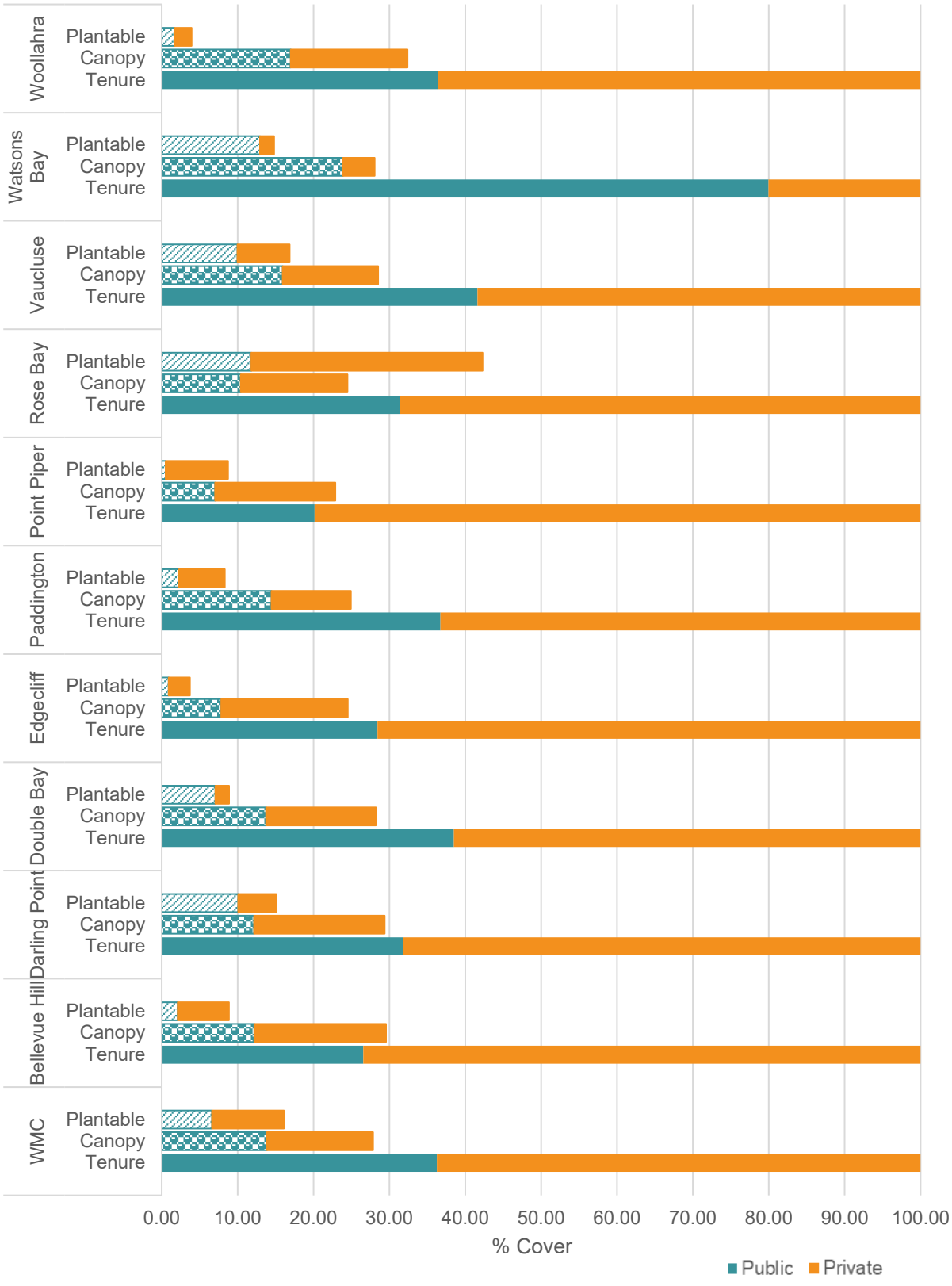


Figure 10. Proportions of private and public land tenure within the Council area (WMC) and each suburb, as well as proportions of canopy cover and plantable space on private vs public land in area.

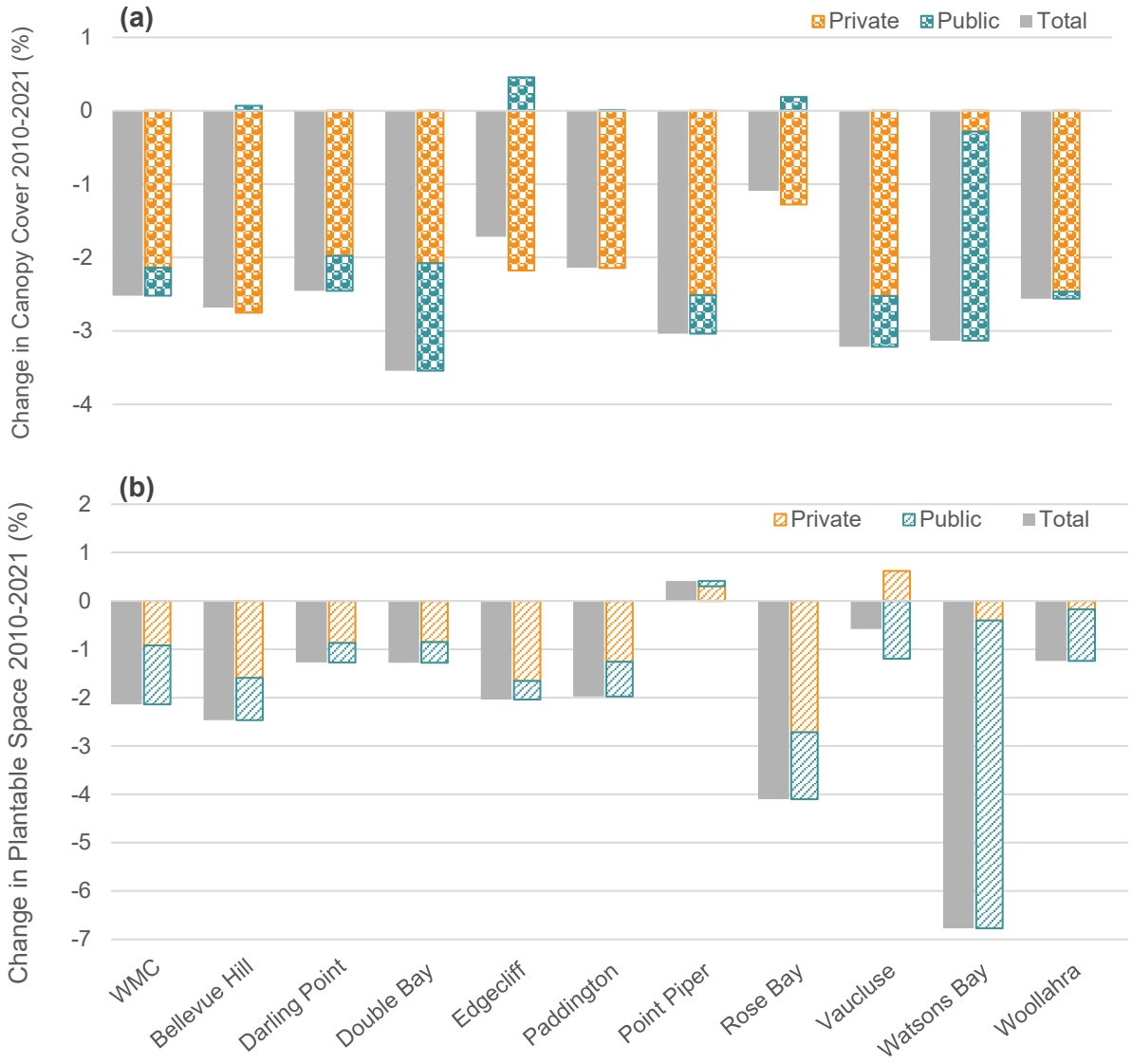


Figure 11. Change in (a) canopy cover, and (b) plantable space, on public and private land, within each suburb and the whole of Council area (WMC), between 2010 and 2021.

URBAN HEAT

Many factors influence the best locations for planting trees. Given the cooling benefits provided by urban trees, urban heat is increasingly becoming a leading factor in deciding where to plant new trees in order to obtain the greatest benefits. Urban heat islands represent parts of the urban landscape where heat accumulates to a greater extent than other areas. While small areas of hard surfaces can create localised hot spots at the scale of a few metres, heat islands refer to larger areas of accumulated heat at the block or neighbourhood scale. Urban heat islands are usually 2ºC warmer than a comparative area, with extreme heat islands being warmer by 4ºC or more.

Interrogation of the NSW thermal dataset[10] has been undertaken to quantify urban heat across our Council area as a way of informing priority planting locations. Our Council area falls within an extreme urban heat island of Sydney, with average relative temperatures 5ºC above baseline temperatures (Table 3). Despite falling within a defined UHI, we are comparatively one of the cooler regions within the State given our proximity and exposure to water and cooling coastlines (Figure 12).

There is a clear temperature gradient moving from cooler temperatures along our coastlines and increasing further from the water; though some locally cool spots are evident further from the coastlines alongside heavily vegetated public green spaces, such as Cooper Park and Trumper Park (Figure 12). This trend means that our coolest suburbs are those with the highest proportion of coastlines, including: Watsons Bay, Point Piper, and Vaucluse, respectively. However, even with the cooling influence of coastline, all suburbs were at least 2°C above baseline temperatures, and so within a defined urban heat island. Paddington was our hottest suburb with an average temperature 6.57 °C warmer than baseline, followed by Woollahra, Edgecliff, Double Bay, Bellevue Hill, and Rose Bay which all measured more than 5°C above baseline temperature (Table 3).

Heat also varied within suburbs. Of particular note was one very hot area that aligned with the top hottest 20% of State. This very hot area comprised the shopping district in Double Bay, specifically along the north side of New South Head Road between Bay Street and Cross Street and measured an average 8.72°C above baseline temperatures (Figure 12).

Whilst our Council area is relatively cool compared to the rest of the State, the urban heat island effect experienced here will still have implications for our community's health and well-being[11]. Without the implementation of cooling actions, such implications will be further exacerbated by climate-change driven temperature increases. Efforts to cool our Council area will benefit from prioritising cooling mechanisms within the hottest areas, where feasible.

[10] Urban Heat Island (UHI) to Modified Mesh Block 2016 dataset is derived from Landsat satellite thermal imagery. It provides the relative surface temperature of lands across the entire state and calculates the average surface temperature within each ABS Census mesh block unit. Mesh block units are the smallest geographic areas defined by the ABS and are broadly characterised land use types (e.g. residential, commercial, parks)

[11] Tong S. *et al.* (2021) Urban heat: an increasing threat to global health. *The BMJ*, 375: n2467. doi: https://doi.org/10.1136/bmj.n2467

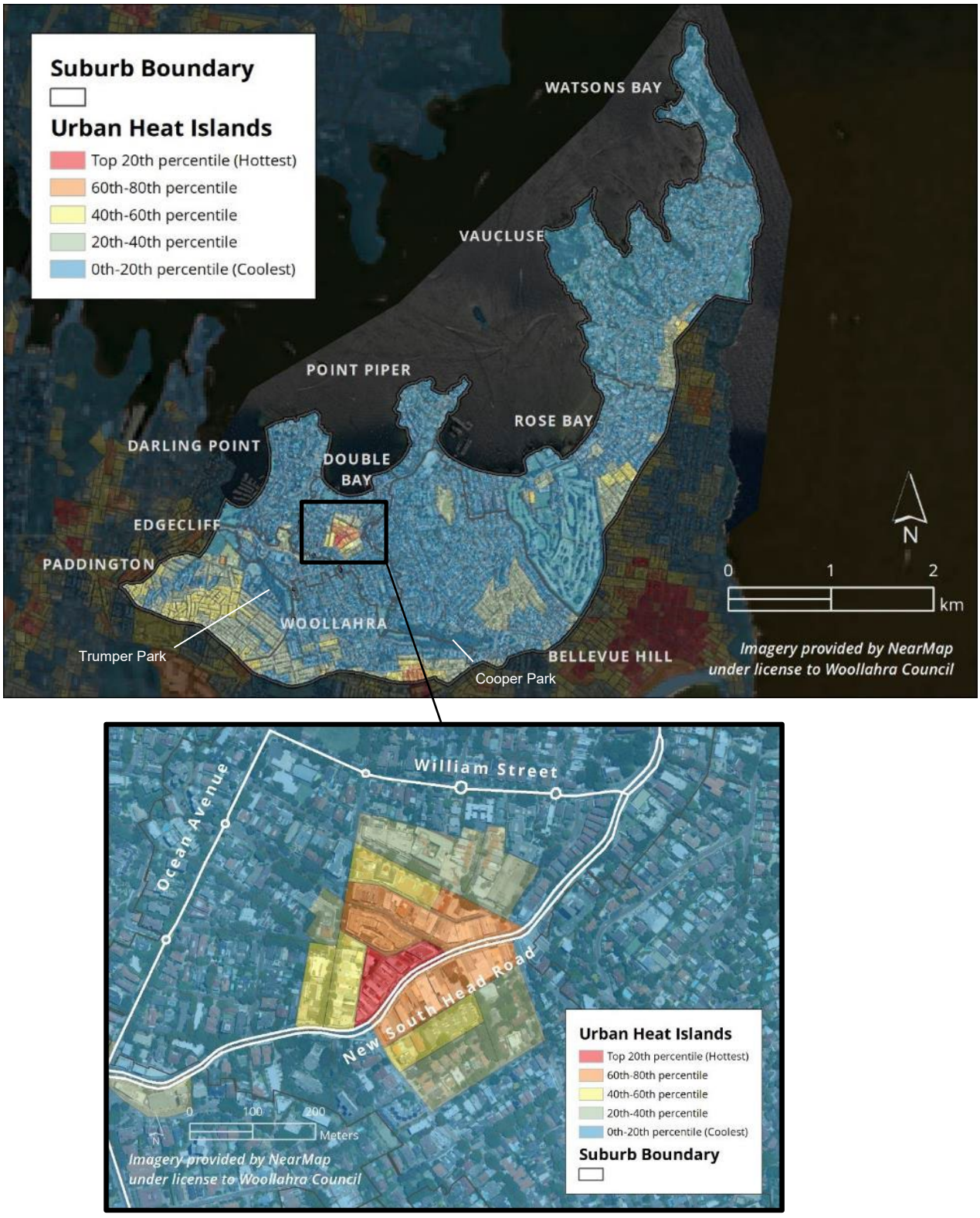


Figure 12. Urban heat islands across Woollahra Municipal Council, relative to NSW State-wide averages. Magnified box shows details of our hottest area, aligning with the Double Bay retail district.

The NSW Heat Vulnerability Index (HVI) dataset provides an examination of the impact of urban heat on community members, particularly those least able to deal with its impacts. The HVI ranks areas based on their exposure, sensitivity, and adaptive capacity in responding to urban heat. Exploring HVI across our Council area further highlights the benefits of being nearer the coastline with its prevailing cooling influence suppressing heat exposure and therefore limiting vulnerability in the coastline-adjacent suburbs (Table 3, Figure 13). Further away from the coast heat vulnerability increases, with Paddington being the suburb with the highest community vulnerability. The exceedingly warm Double Bay business district is also a likely source of heat vulnerability, with the high level of urban heat in this location driving an increased level of heat vulnerability for people in the area.

Table 3. Relative mean surface temperatures across each suburb, compared to their heat vulnerability index rank, and the total amount (m^2) and proportion of canopy cover in each suburb. Suburbs are ordered from highest to lowest heat vulnerability index.

Suburb	Relative Mean Surface Temperature (°C)	Heat Vulnerability Index (score)	Heat Vulnerability Index (rank)	2021 Canopy Cover	
				(m^2)	(%)
Edgecliff	5.71	2.52	1	75,345.25	24.52
Rose Bay	5.16	2.04	2	496,438.75	24.48
Woollahra	5.90	2.01	3	408,157.50	32.39
Double Bay	5.55	1.83	4	220,335.75	28.22
Point Piper	3.69	1.83	5	81,295.50	22.88
Paddington	6.57	1.4	6	289,214.25	24.92
Bellevue Hill	5.41	1.37	7	700,580.00	29.56
Darling Point	4.18	1.27	8	195,952.25	29.38
Vaucluse	4.08	1.21	9	754,510.75	28.52
Watsons Bay	2.27	1	10	174,546.25	28.06

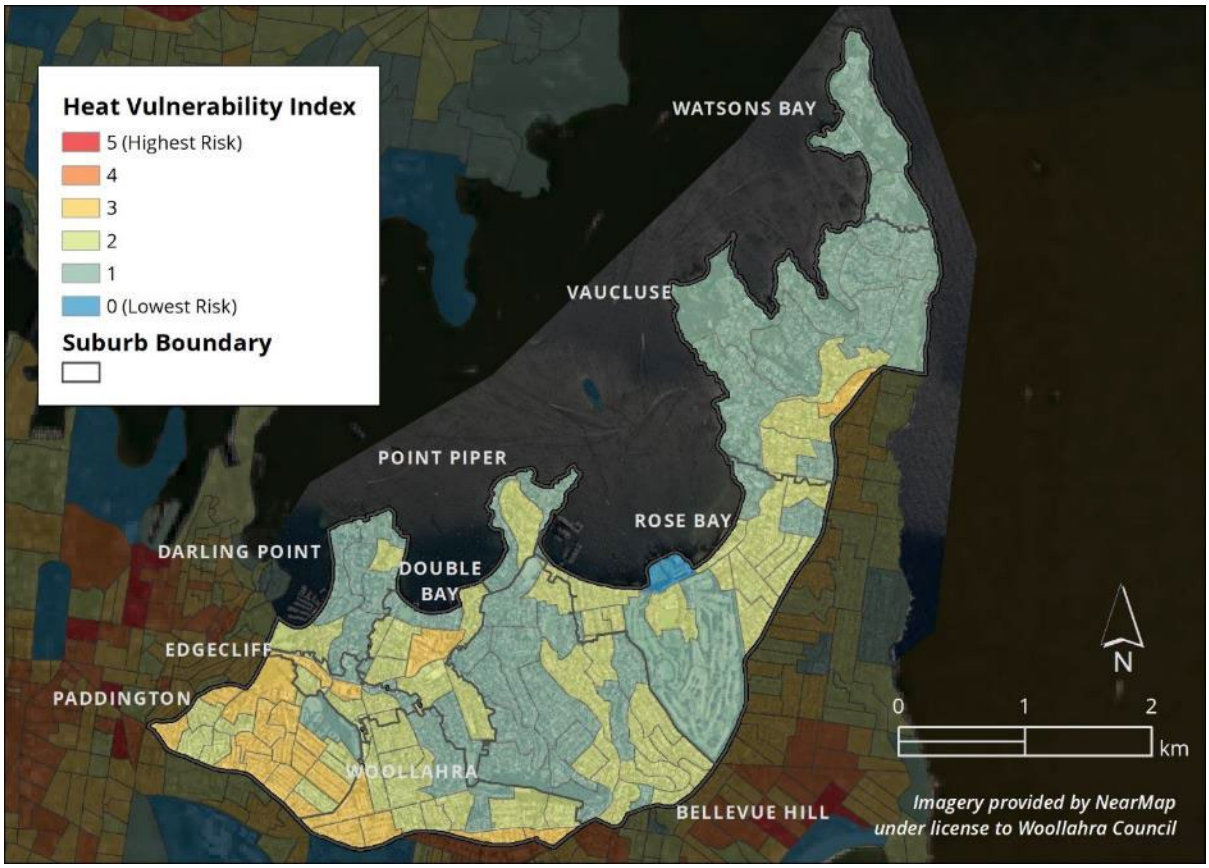


Figure 13. Heat vulnerability index (HVI) ranking across Woollahra Municipal Council.

Surface temperatures and canopy cover tend to be directly correlated in most urban environments. However, the significant cooling our coastal suburbs experience from the Harbour dilutes these usual strong correlations, with suburbs such as Point Piper having the lowest canopy cover but also the second lowest surface temperature. As such, if the intent of tree plantings is to produce a more thermally comfortable and pleasant environment, then prioritising suburbs with the highest surface temperatures will generate those benefits more efficiently than targeting low canopy areas. Considering these aspects of surface temperature and heat vulnerability, prioritising plantings in suburbs with the highest surface temperatures and HVI ranks would preferentially focus on Paddington, Woollahra, Edgecliff, Double Bay, and Bellevue Hill (Table 3).

PART 3. GROWING OUR URBAN FOREST

OUR CANOPY COVER TARGET

Summary

Our initial objective was to match the NSW Government's target of a 40% canopy cover across our Council area. However, our analysis showed that this target was unrealistic due to the following factors:

- we would need to plant 32,681 trees across both public and private land, with a peak planting rate of 3,662 trees in each of five consecutive years; and
- we do not have enough plantable space across the Council area (including public and private land) to plant the number of trees needed to achieve the target of 40%.

Based on this, we undertook further analyses and determined the following ambitious though more realistic target:

- we have set an ambitious but achievable **target of 30% canopy cover for the Woollahra LGA by 2050**. Under the scenario modelled, in addition to achieving our 30% target by 2050, we would reach a peak canopy cover of 31.3% in 2061 (Figure 14). However, this scenario assumes increased plantings will commence as of 2025, and no change to current background rates of canopy loss. Full details of the TPP modelling approach are provided in Annex E.
- we have identified 8,101 plantable opportunities on public land, which represents approximately 60% of the plantings required to achieving the 30% target;
- we recognise that private property has a significant role to play in meeting the target (Figure 15). Development works which require Council consent or a permit are the most useful mechanisms Council has for increasing canopy on private land. We are currently developing our DCP canopy controls, which at the time of writing this UFS was with the Department of Planning and Environment in the review process. We also need to further establish canopy controls for HCA.

ACTION:

Once private canopy controls are finalised, establish specific targets for parks, streets, and private property

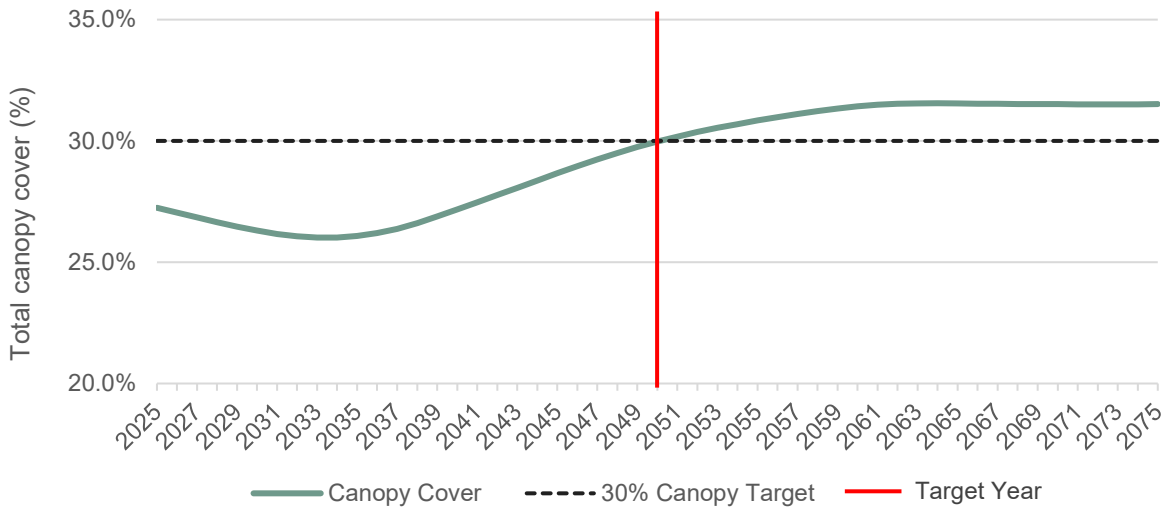


Figure 14. Canopy cover growth curve under the selected TPP scenario (see Annex E).

How Many Trees Are Needed?

Growing our canopy cover from our current 27.44% to 30% (Figure 14) may not appear to be a significant increase. However, using the Tree Planting Predictor (TPP) tool[12] to compare different planting scenarios, we found our **30% target by 2050 will not be achieved using our current planting approach.** Rather, the following changes need to occur to achieve this target:

- **Plant more trees:** our target considers our current rate of canopy cover loss. To achieve the canopy cover target[13] we will need to **plant 13,410 trees** across the Council area over the next 25 years (i.e. 2025 to 2049, inclusive) (Figure 15);
- **Alter our planting species mix:** larger trees provide greater contributions to the overall canopy cover of our urban forest. By increasing the mix of larger trees, we can more rapidly achieve our canopy cover target. To achieve our target, we need to plant more medium to very large trees, increasing from Council's current BAU proportion of 74% to at least 78.5% (Table 4; Figure 15). Larger trees also take longer to mature, hence the need to front-load our planting intensity. Council will establish a new annual planting BAU upon the 5 or 10 year review; and
- **Increase our planting efforts:** our target also considers our current planting efforts. To plant the number of trees needed to achieve our target, we will need to significantly increase planting efforts to an average of 530 trees per year across the Council area (Figure 15; Table 4). This is more than 2.5 times Council's current (business as usual, BAU) average annual planting effort. However, not all plantings will occur on public (Council) land, as only 8,101 plantable opportunities were identified on public land, representing just 60% of the required plantings;
- **Front-load our plantings:** planting intensity on public land will need to be greater in the initial 9 years of planting (starting in 2025) in order to maximise the growth time available for trees to mature by 2050 (Figure 16; Table 4). The front-loaded effort aims to fill all current plantable opportunities on public land by 2035. Beyond this year, Council will continue to conduct replacement plantings (for removed trees) and also seek to create additional Tier 2 and 3 plantable opportunities on public land (Figure 17). A consistent effort of planting on private land will be relied upon to achieve the canopy cover target (Figure 16).
- **Increase financial investment:** increasing the number of trees planted on public land will require an increase in financial investment by Council for planting, establishment, and management. Filling the 8,101 plantable opportunities on public land equates to a total of $14.8M - approximately 1.5 times more investment than that allocated based on BAU planting rates (Table 4). This figure is for the procurement, planting and establishment costs of trees and does not include staffing or increased maintenance costs for tree management and associated infrastructure.

[12] Developed by Edge Impact, www.edgeimpact.global.

[13] Based on the 'more large trees' planting mix modelled (see Annex D).

Table 4. Target planting scenario compared to our business as usual planting approach on public land (see also Annex E). Also shown here is the proposed Council (public land) contribution to annual plantings assuming a constant average private land planting rate of 206 trees per year (Figure 15).

	BAU Scenario (public land)	Target Scenario (public + private land)	Council Planting Contributions^ (public land)
Species mix	Very small trees 0% Small trees 26% Medium trees 22% Large trees 48% Very large trees 4%	Very small trees 5% Small trees 16.5% Medium trees 26.5% Large trees 37% Very large trees 15%	Very small trees 5% Small trees 16.5% Medium trees 26.5% Large trees 37% Very large trees 15%
Annual new plantings rate (to 2050)	Per year average: 200 trees Peak planting rate: 200 trees/year Minimum planting rate: 200 trees/year	Per year average: 516 trees Peak planting rate: 1,343 (2029-2033) Minimum planting rate: 168 (2036-2050)	Per year average: 324 trees Peak planting rate: 1,137 (2029-2033) Minimum planting rate: 70 (2034)
Annual new plantings effort (to 2050)	200 trees per year	2025: 550 trees planted 2029: 4514 trees planted 2032: 8542 trees planted 2035: 10892 trees planted 2050: 13410 trees planted *Cumulative (public and private) planting*	2025: 344 trees 2026: 482 trees (40% increase) 2027: 653 trees (36% increase) 2028: 868 trees (33% increase) 2029-2033: 1,137 trees (31% increase) 2034: 70 trees (*by which time all current modelled public plantable opportunities will be filled*)
Canopy cover @ 2050	24.2%	2050: 30.2%	2050: 30.2%
Associated investment* 2025-2050 (excludes CPI)	$9.1M#	Not calculated as cost for tree plantings on private land not included.	$14.8M (for public tree plantings and establishment only – does not included required associated maintenance)

* based on an average per tree establishment cost of $1,827.50 (see Annex E).

BAU Scenario incorporates the additional State government funding grants (Greener Neighbourhoods)

^ Assuming a constant planting rate of 206 trees per year on private land.

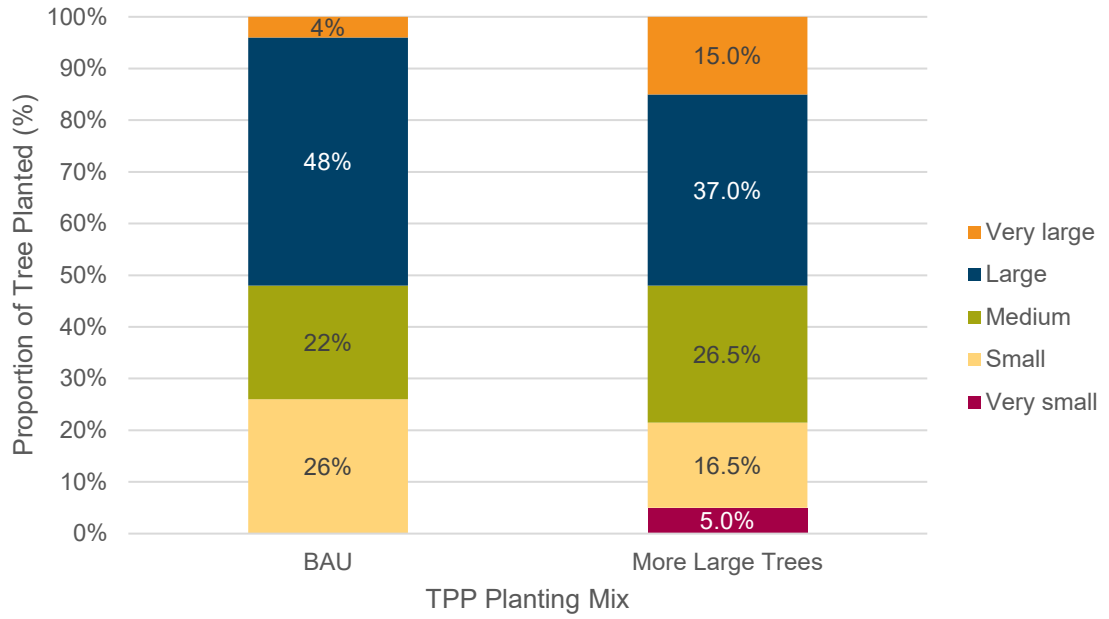


Figure 15. Proportion of tree sizes (very small, small, medium, large, very large) comprising the 'business as usual' (BAU) and 'more large trees' planting mixes modelled in the TPP (see Annex E).

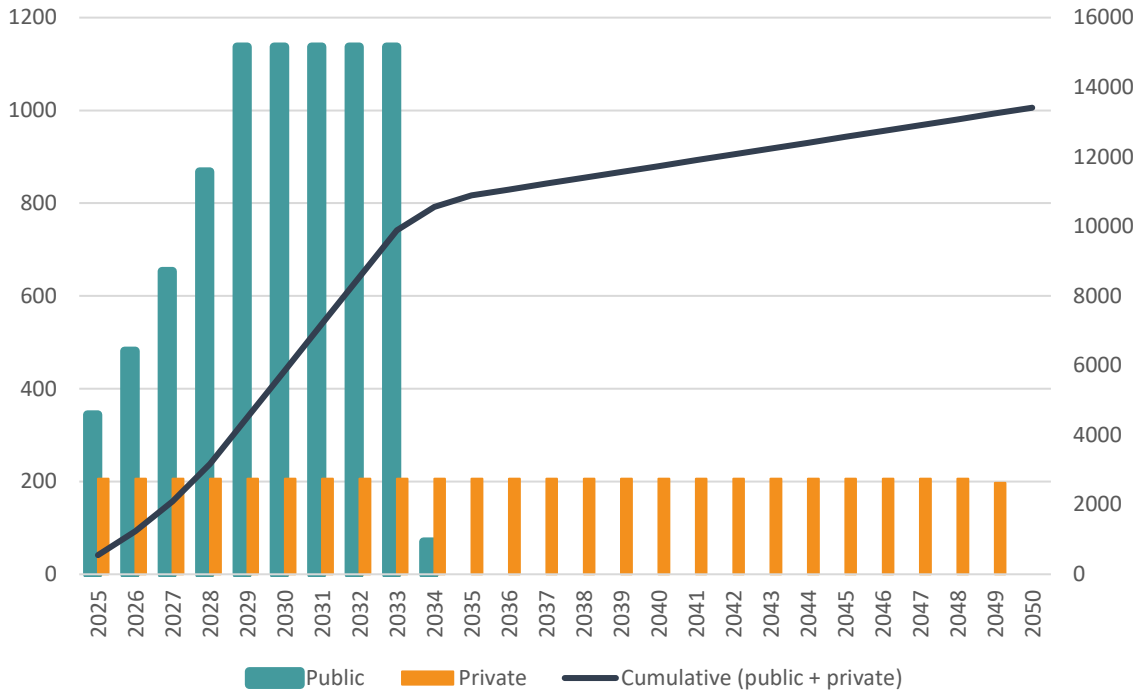


Figure 16. Planting effort modelled to achieve 30% canopy cover by 2050 (see Annex E). Shown here are the achievable Council plantings on public land, assuming a consistent private land planting contribution of 206 trees per year. Also shown are the total cumulative plantings across public and private land. Note by 2034, assuming all current plantable opportunities on public land are filled.

Do We Have Enough Space to Achieve Our Target?

Reaching our canopy cover target also requires an understanding of how much space will be needed to meet the planting requirements. We **need 13,410 trees to be planted** to achieve our 30% target. We used the Street Tree Prioritiser (STP) tool[14] to determine that there are 20,264 plantable opportunities across our Council area (both public and private), of which **8,101 plantable opportunities are on public land** (Annex F, Figure F1). This suggests that whilst **we have enough capacity across our LGA** to accommodate the trees that will need to be planted to achieve our target, only 60% of plantings can currently occur on public land.

Further, some of the public plantable opportunities fall within land owned and managed by other government agencies and institutions, meaning Council will need to collaborate with these organisations to promote tree plantings in these areas. The remaining plantable opportunities across the LGA are on private land. This highlights the **critical need for collaborative planting efforts on public and private land** if our target is to be achieved.

Whilst the STP has modelled current plantable opportunities, it is possible the additional opportunities could be created on public land once all the current public planting opportunities are planted. This additional capacity could be explored on public land through actions such as converting concrete paths to plantable space and installing in-road planting spaces.

Increasing Canopy on Public Land

To achieve the target, public plantable opportunities will need to be maximised within the first nine years of planting. Further, our public land here also includes State Government owned and managed land. Accordingly, achieving the canopy cover target on public land will require a combination of approaches, including:

- increasing plantable opportunities by reimagining what constitutes plantable space (i.e investigate Tier 2 and 3 plantable opportunities);
- maximising the use of medium to very large trees wherever possible (e.g. installation of aerial bundled cabling to allow for larger tree plantings under power lines); and
- cultivating partnerships and collaborations with other government agencies and institutions.

Where do we need to prioritise our tree plantings?

To help maximise the beneficial impacts of our plantings on urban cooling and community well-being, we used the STP tool to **prioritise public plantable opportunities** by: canopy cover, plantable opportunities, urban heat, and community vulnerability (Annex F).

This analysis showed that high priority public plantable opportunities are generally well spread across our Council area (Annex F, Figure F5). Bellevue Hill and Vaucluse have a moderately higher density of high priority opportunities, whilst coastal areas tend to contain lower priority opportunities on account of the water-front cooling reducing their urban heat values (see Part 2). As a result, Watsons Bay, Point Piper, and Darling Point have the fewest high priority plantable opportunities (Annex F). Of the top 100 highest priority plantable opportunities, Paddington has 23, Vaucluse 20, Bellevue Hill and Woollahra each have 19, Rose Bay has 11, and Double Bay, Edgecliff, Watsons Bay, and Darling Point have 8 combined.

[14] Developed by Edge Impact (www.edgeimpact.global), this analysis is based on aerial imagery interpretation and further on-ground site assessments would be needed to confirm site suitability for plantings.

Within our suburbs, Bellevue Park and the Royal Hospital for Women Park were the highest priority planting areas. Both areas have a large number of plantable opportunities (both above 95th percentile), and both have high relative heat island scores, though the Bellevue Park received a higher social vulnerability score giving it top priority over Royal Hospital for Women Park (Annex F).

Our ***road reserves*** offer one the **most impactful locations** for tree plantings as these are often the areas in which people most frequently encounter trees. Of the highest 100 priority opportunities, 78 fall within road reserves. Victoria Road in Bellevue Hill has the highest planting priority of all road reserves (Annex F). Planting trees in the 52 plantable opportunities along this road would likely increase the walkability on this area.

Whilst plantings in our road reserves may make the biggest day-to-day impact on people's lives, such plantings can prove challenging given the numerous limitations and competition for space (e.g. sidewalk and driveway crossover infrastructure, overhead and underground utilities, site lines, vehicle clearance). The STP modelling of plantable opportunities identifies our Tier 1 plantable opportunities – those that are the easiest and most cost-effective to plant (Figure 17). Just over half (54%) of our road reserves have no Tier 1 plantable opportunities, either because they are already well planted, or they are dominated by sealed surfaces that inhibit tree plantings. Once we have exhausted these Tier 1 opportunities, additional though more difficult and costly Tier 2 and Tier 3 plantable opportunities will need to be considered (Figure 17). Though the need for this is 10+ years away, these considerations should be socialised now to facilitate long-term planting objectives.

ACTION:

Investigate opportunities and cost-benefit of creating more plantable opportunities on public land

Figure 17. Examples of Tier 1-3 plantable opportunities[15].

[15] Image adapted from: Los Angeles Urban Forest Equity Streets Guidebook (2021), prepared by CAPA Strategies. Available at: https://www.cityplants.org/wp-content/uploads/2021/05/LA-Urban-Forest_Streets-Guidebook_FINAL_REVISED.pdf

Our ***parklands*** offer the **greatest opportunities for plantings** on public land, and Bellevue Park's 125 plantable opportunities are identified as having the highest planting priority. The large open spaces of parklands often have considerable capacity for additional tree plantings, and it is also here that larger trees can more readily be planted. However, our public open spaces also have competing interests, such as provision of open grassy areas for sports and recreation.

ACTION:

Prepare Tree Management or Planting Plans for iconic parks, focusing on planting and maintenance requirements

Of the three ***bushland*** areas assessed, all rank as medium or low priority largely due to the lower heat associated with higher vegetation cover together with lower social vulnerability within these areas. Nevertheless they provide an available, economical and ideal environment for tree establishment and should be targeted early.

Annual prioritised planting plan

Combining the outputs from the TPP and STP modelling allows us to develop a prioritised annual tree planting plan which will see us plant in the hottest areas with the highest concentrations of social vulnerability (Annex F). The prioritised planting schedule to achieve our canopy cover target emphasises first year plantings (assumed to be 2025) within:

- Bellevue Park and Royal Hospital for Women Park;
- three major roads: Victoria Rd, New South Head Rd, and Old South Head Rd; and
- three smaller roads: Bundarra Rd, Bunyula Rd, and Latimer Rd (Figure 18).

In subsequent years plantings become much more distributed across the Council area.

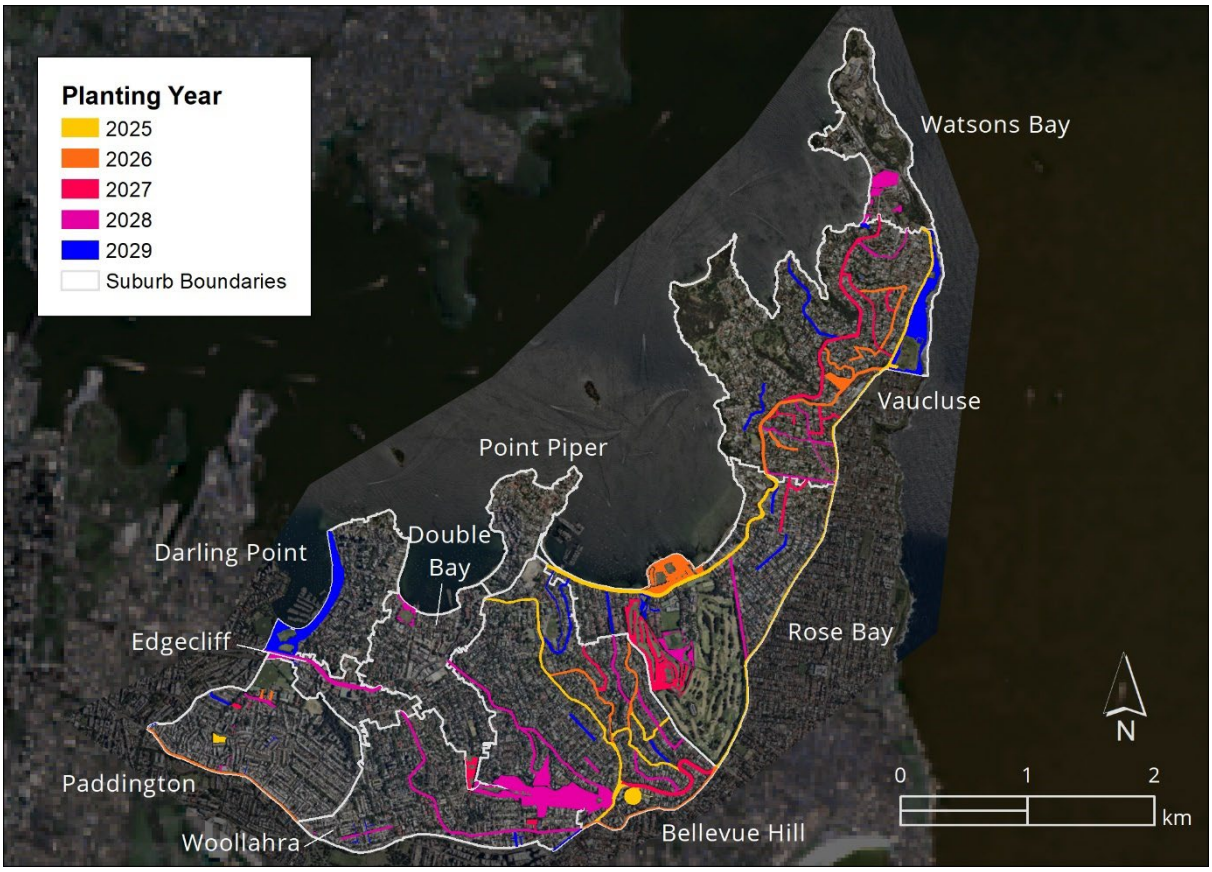


Figure 18. Annual prioritised planting plan showing just the first 5 years of plantings.

Increasing Canopy on Private Land

Whilst Council cannot directly implement plantings on private land, there are two main avenues by which we can influence plantings:

1. Canopy control

Our analyses herein show the greatest losses in canopy cover have been on private land (see Part 2). This is also the land that we do not directly control. Accordingly, there is a need for new planning controls that balance the reasonable development aspirations of private land owners against the public necessity of supporting a healthy urban forest.

ACTION:

Review enablers and barriers of tree plantings and retention on private land

Our Strategic Planning and Place Department are currently progressing such controls for both the R2 Low Density Residential and R3 Medium Density Residential zones where dwelling houses, semi-detached dwellings, or dual occupancies are proposed. At the time of writing this UFS, these proposed controls were with the Department of Planning and Environment in the review process. They will require applicants to accommodate existing and proposed canopy coverage in the design of infill development. These controls have been informed by detailed site modelling to help us understand what can be reasonably achieved. If successfully implemented, the controls will support increases in canopy cover on private land and contribute to the broader objectives of the Urban Forest Strategy.

Urban renewal is an opportune time to make considered decisions on retaining high value trees and reinforcing the canopy for the future. The Canopy Control (when adopted) will include the retention and planting of new trees.

ACTION:

Explore greening controls and initiatives to suit Heritage Conservation Areas and zoning typologies where a canopy control alone may not be appropriate for the land use.

Trees are a finite resource and removal is necessary at some stage in their lifecycle. We have a range of considerations and assessment tools which align with industry best practice and Australian Standards to use as a guide on tree retention and renewal. When necessary, tree removal is always a last resort, and this should be used as an opportunity to renew the canopy cover.

2. Advocacy (private)

A portion of land throughout our Council area is owned by other government agencies and institutions such as NSW National Parks and Wildlife Service and public and private schools. There is a need for new opportunities to be found for increasing canopy cover on these properties that isn't reliant on Development. There is opportunity here for Council to develop engagement strategies to inform and empower these landowners to increase canopy. Information sharing and advice are some ways where Council can assist.

ACTION:

Foster new opportunities for collaborative planting efforts on land owned and managed by other government agencies and institutions

CHALLENGES TO GROWING OUR URBAN FOREST

The dynamic nature of urban environments, together with competing land uses and climate change impacts, makes protecting and growing our urban forest challenging. With challenges though comes opportunities to change, adapt, and build more resilient places for our community to live and grow. To do so requires understanding the suite of challenges that inhibit our ability to protect, grow, and manage our urban forest on public and private land.

Land tenure and management

The challenge: Most of our Council area is privately owned and managed land, where we have limited influence over new tree plantings. Further, for the purposes of this Strategy land owned or managed by State Government agencies was considered as public land, though implementing tree planting programs on such land may be restrictive and will require collaboration with the State Government.

Since 2010, our canopy cover has declined by 2.5%. A disproportionate amount of this loss (nearly 85%) has occurred on private land, despite privately owned and managed land covering only 64% of the Council area and containing just over 50% of Council's total canopy. A key driver of canopy loss on private land is urban infill development, and development pressures are set to increase with our Local Housing Strategy 2021 setting a target of 1,200 new dwellings by 2036. Whilst it is possible to achieve complementary outcomes between development and tree retention/planting, this requires doing development differently and prioritising tree retention and planting within development designs. Traditional infill development approaches tend to build boundary to boundary, replacing green space with built surfaces incompatible with substantial landscaping, let alone large tree retention or planting.

The opportunities: There are multiple ways that we can start to better engage with the private sector to encourage tree planting and retention on private land. Once adopted, our Canopy Control amendments to the DCP are one example of planning controls that can influence private tree canopy. Other engagement options may include, for example: Council advice/support for private land-owner tree plantings and management (e.g. planting and management guides, provision of additional green waste collection services); incentives for demonstrated tree protection/plantings or public acknowledgement of private landowner efforts (e.g. "urban forester" awards/property placards).

Climate change

The challenge: Projections indicate that the Greater Sydney region will face increasingly hotter and drier conditions, and extreme weather events such as heat waves and droughts, and storms and flooding becoming more intense and frequent. Such impacts have significant implications for the long-term health, resilience, and management of our urban trees and biodiversity. Yet these impacts also heighten the need for increasing urban greening and tree cover as a way of helping to: mitigate climate change; conserve wildlife; and protect communities from extreme heat and flooding events.

The opportunities: To minimise risks, we can take action to adapt our urban forest to a rapidly changing climate. Such actions will include: species selections that consider climate-resilience and wildlife requirements; evidence-based prioritisation of plantings to target urban heat; increased tree plantings to help decrease stormwater runoff and improve water quality; and ambitious targets and urban designs that aim to grow the urban forest and work towards equitable distribution across our Council area.

Pests and diseases

The challenge: Climate change may also exacerbate risks to our tree population from pests and diseases. This may result from the changing environmental conditions increasing the vulnerability of our trees to existing pests and diseases, or from the emergence and proliferation of new pests and diseases. Some of these pests and diseases may prove difficult or impossible to treat and eradicate.

ACTION:

Prepare a public consultation strategy for public tree plantings and legacy tree species renewals

The opportunities: The opportunity to future-proof our urban forest against pests and diseases will involve diversifying the species composition of plantings and improving the biodiversity and growing conditions for our urban green spaces.

Aging tree population

The challenge: Our urban forest contains some of the oldest trees in the Greater Sydney region, including remnant trees and bushland habitats that provide insights into the natural vegetation of the area before European settlement. Whilst older trees and long-established habitats provide significant ecosystem services, ageing trees in particular present complexities for management due to an increased risk of injury or damage by branch or tree failure as they decline. In addition to natural ageing (senescence), our urban trees face a multitude of extreme stressors (e.g. water availability, built infrastructure, human uses) which can negatively influence their health/condition and prematurely shorten their lifespan.

ACTION:

Investigate options for management and planned renewal of key species and locations to create a new legacy of public tree plantings

The age and health/condition diversity of our current urban forest (see Part 2) means that over the next 10-20 years, our urban forest will be a largely ageing population with potentially shorter lifespans than usual.

The opportunities: An integral part of managing an ageing tree population is succession or inter-generational plantings that allow newly planted trees to reach at least a semi-mature age before declining trees are lost. This sort of forward planting helps to minimise canopy cover loss that is experienced with traditional replacement plantings.

Community perceptions

The challenge: We have a diverse resident community who hold a range of attitudes and interests towards trees. People's perceptions of trees can significantly support or impede our urban canopy goals. Our community plays an important role in greening our urban landscape through decisions about their own gardens. Achieving our canopy cover targets will only be possible through community support and a collaborative approach to tree protection and planting on public and private land. Whilst many of our residents have indicated strong support for tree plantings, negative perceptions still abound relating to issues associated with fear/risk, mess/nuisance, and obstruction of Harbour views.

The opportunities: To help understand and address community concerns and expectations around trees and the urban forest, we will expand our community engagement activities. Our activities will aim to improve resident's awareness and understanding about the benefits provided by trees and our actions and targets for growing the urban forest. Understanding the behavioural change, barriers and enablers relating to urban trees on public and private land is an important part of this process.

Technology

The challenge: To effectively plan and manage the urban forest requires a sound understanding of the current urban forest cover and trends over time, as well as the individual trees comprising the urban forest. Whilst urban forest cover and trends over time can be readily measured using desktop-based spatial analyses, knowledge about the individual trees requires a ground-based tree inventory to be undertaken, which can be a lengthy and costly process. For each tree, the minimum information collected should include: species, age, size, condition, and location (which is currently collected by our database system).

ACTION:

Investigate an improved Asset Management System to allow for further analysis of urban forest data and to increase efficiency of management operations

The opportunities: This information can then help to quantify and better understand the ecosystem services provided by the urban forest. Tree inventory information on existing and newly planted trees should be captured in an improved and appropriate tree-specific asset management system (AMS). Leading tree AMS's allow not only data storage and sorting, but also provide spatial mapping outputs, and facilitate maintenance, management, and planting planning (e.g. Forestree, TreePlotter, TreeAM) [16].

Resourcing

The challenge: Planting and managing the urban forest, together with community engagement, requires substantial funding and operational resourcing. An improved urban forest also requires substantial increases in funding for maintenance of roads, footpaths, and drains. Whilst urban trees are increasingly viewed as an urban asset, funding and resourcing for urban forest planning, management and engagement is often inadequate to achieve targets. Limited resources are commonly identified as a key factor inhibiting urban forest planning, planting, management, and engagement programs.

The opportunities: The canopy cover target and planting program provided in Part 3 of this Strategy provides the evidence-base for increasing resource commitments within our long-term financial plan. This analysis indicates that to achieve even small increases in canopy cover will require significantly more trees and investment than is provided as part of the current planting programs and resourcing.

[16] https://forestree.app/ (Australian developed software with national application); https://planitgeo.com/treeplotter/ (American developed software with global application); https://www.treeassetmanager.com/about-us/ (American developed software with US application).

Part 4.
RECOMMENDATIONS

GUIDING PRINCIPLES FOR IMPLEMENTING THE STRATEGY

Five principals have been established to provide the framework for implementing this UFS and achieving our canopy cover target:

1. Plan;
2. Grow;
3. Protect;
4. Fund; and
5. Engage.

These principles will guide development of an Implementation Action Plan (including estimated costs) which will provide the detail needed to support implementation of the UFS, its targets, and the Principles below. A critical part of implementation will be regular monitoring and review to ensure we remain on track for achieving our target. Monitoring and review should be undertaken every five years over the life of the UFS.

PLAN

This principle builds on key findings presented in this Strategy and will be critical is implementing in the earliest stages of the Strategy lifetime. Actions associated with this principle will:

- specify species selections that will diversify our urban forest and meet planting specifications of the TPP;
- establish tree stock requirements and ensure availability by providing long lead times to suppliers;
- refine priority locations within private lands and identify key approaches for engaging the private sector around collaborative tree planting efforts;
- require development of specific action plans that should address as a minimum:
  - priority planting areas of Bellevue Park, Royal Hospital for Women Park, Victoria Rd, New South Head Rd, and Old South Head Rd;
  - plantable opportunity creation and activation (e.g. replacement of sealed surfaces to allow for tree plantings);
  - private tree planting incentives scheme, to outline approaches to encourage greater tree plantings and retention on private land; and
  - define a 5-year review process for assessing the Strategy and measure how its tracking towards the targets.
- develop an internal Council Urban Forest Working Group, with representatives from different Council departments and teams. This Working Group will champion the urban forest strategy within Council and ensure integration of the UFS into the concept and planning stages of various projects.

GROW

This principle relates to the strategic and on-ground actions required to "put trees in the ground" to achieve our target. Actions associated with this principle will:

- establish the operational and on-ground actions needed to implement the Strategy. This will include consideration of: purchasing, site preparation, planting schedules and techniques, watering requirements and frequency, initial and top-up mulching, weeding, rubbish removal, and staking
- consideration should also be given to new-to-market products that may help alleviate resourcing demands and improve establishment successes (e.g. Water Sensitive Urban Design technologies, TreeCoach staking, and Cocoons for watering)
- amend our current vegetation planning controls to modify the level of protection for existing trees within our Development Control Plan. This will help to identify trees as a key constraint in all development types and to manage and regulate vegetation clearing conditions, deep soil provision, and canopy replacement requirements. Policy reform can be used to improve protection mechanisms that contribute to meeting our canopy target by mitigating tree loss

PROTECT

This principle relates to the effective protection of existing tree assets on public and private land. Actions associated with this principle will:

- focus on minimising or reversing the canopy loss on public, and especially, private land;
- apply a range of regulatory and operational measures aimed at protecting vegetation on both public and private land;
- include revision and strengthening of compliance frameworks and penalties to better protect trees and discourage removals as part of developments or vandalism;
- identify ways to reduce risk through maintenance and monitoring

FUND

This principle relates to ensuring adequate budgets are available in the long-term financial plan to implement actions and achieve our canopy cover target. Actions associated with this principle will:

- identify avenues for securing additional investment required for tree plantings and establishment;
- provide estimates and cost-benefit analyses for complementary actions that can help achieve our target (e.g. incentives to reduce canopy loss on private land, replacement of sealed surfaces to create planting locations);
- provide a costed scoping of additional staff resourcing that will be needed to increase the planting rate and effort as required to meet canopy cover targets;
- refine costings accounting for annual CPI increases; and
- identify alternative funding opportunities to help offset Long Term Financial Plan required commitments (e.g. grants and revenue from non-compliance penalties).

ENGAGE

This principle relates to connecting the community to the urban forest, this strategy, and the ensuing action plans. Actions associated with this principle will:

- establish clear communication plans specific to tree awareness and engagement;
- research and determine barriers and enablers to positive behaviour change relating to trees
- encourage a co-design process around tree plantings and decision-making (e.g. designing streets and parks, input into species selections);
- offer opportunities for collaborative projects that better connect Council and community. Such projects may also help to reduce resourcing demands for planting/maintaining trees through promoting community foresters/tree stewards; and
- celebrate and outwardly acknowledge resident tree champions.

SUMMARY IMPLEMENTATION RECOMMENDATIONS

The following recommendations should be included in development of the Implementation Action Plan.

PLAN	
Recommendation	**Timeframe**
Improve Asset Management System to allow for further analysis of urban forest data and to increase efficiency of management operations	Short-term
Review species list within Street Tree Master Plan with consideration to climate risk and increase diversity based on current best practice ad research	Short-term
Prepare a public consultation strategy for public tree plantings and legacy species renewals	Short-term
Explore non-tree greening and cooling mechanisms including initiatives such as: roof gardens, green shade structures, permeable paving shrubs, green walls, and grassed areas. As well as exploring controls to suit Heritage Conservation Areas and zoning typologies where a canopy control alone may not be appropriate for the land use.	Medium-term
Investigate options for management and planned renewal of key species and locations to create a new legacy of public tree plantings.	Medium-term
Acquire urban forest canopy data in 5-year intervals to review and ensure deliverables are being met	On-going
Develop targets (post-first planting phase) based on land use areas i.e. street/park/private to assist all stakeholders in meeting targets	Medium-term and on-going
Prepare Tree Planting Plans for iconic parks and priority locations (planting locations /maintenance)	Short-term
Review planting capacity for hardscape plantings (paths/roads/plazas) following exhausting all plantable opportunities.	Medium-term
Develop an internal Council Urban Forest Working Group, with representatives from different Council departments and teams.	Short-term

GROW	
Recommendation	**Timeframe**
Refine on-ground operation requirements for increase in planting	Short-term
Secure tree stock and ensure availability by providing long lead times to suppliers	Short-term and on-going
Prioritise the planting (STP) and establishment of trees to ensure canopy targets are being achieved.	Short-term and on-going
Implement LEP Canopy Control	Upon adoption and ongoing

PROTECT

Recommendation	Timeframe
Investigate options for strengthening compliance to ensure controls and conditions are enforceable	Short-term and on-going
Identify ways to reduce new tree mortality and maximise tree establishment rates through maintenance and monitoring	Short-term and on-going
Continue to apply industry best practice to ensure longevity of tree stock	Short-term and on-going
Continue to collaborate with departments within Council to prioritise tree protection and retention in projects	Short-term and on-going
Review other components of DCP to assess and prioritise deep soil /canopy cover in developments.	Medium-term

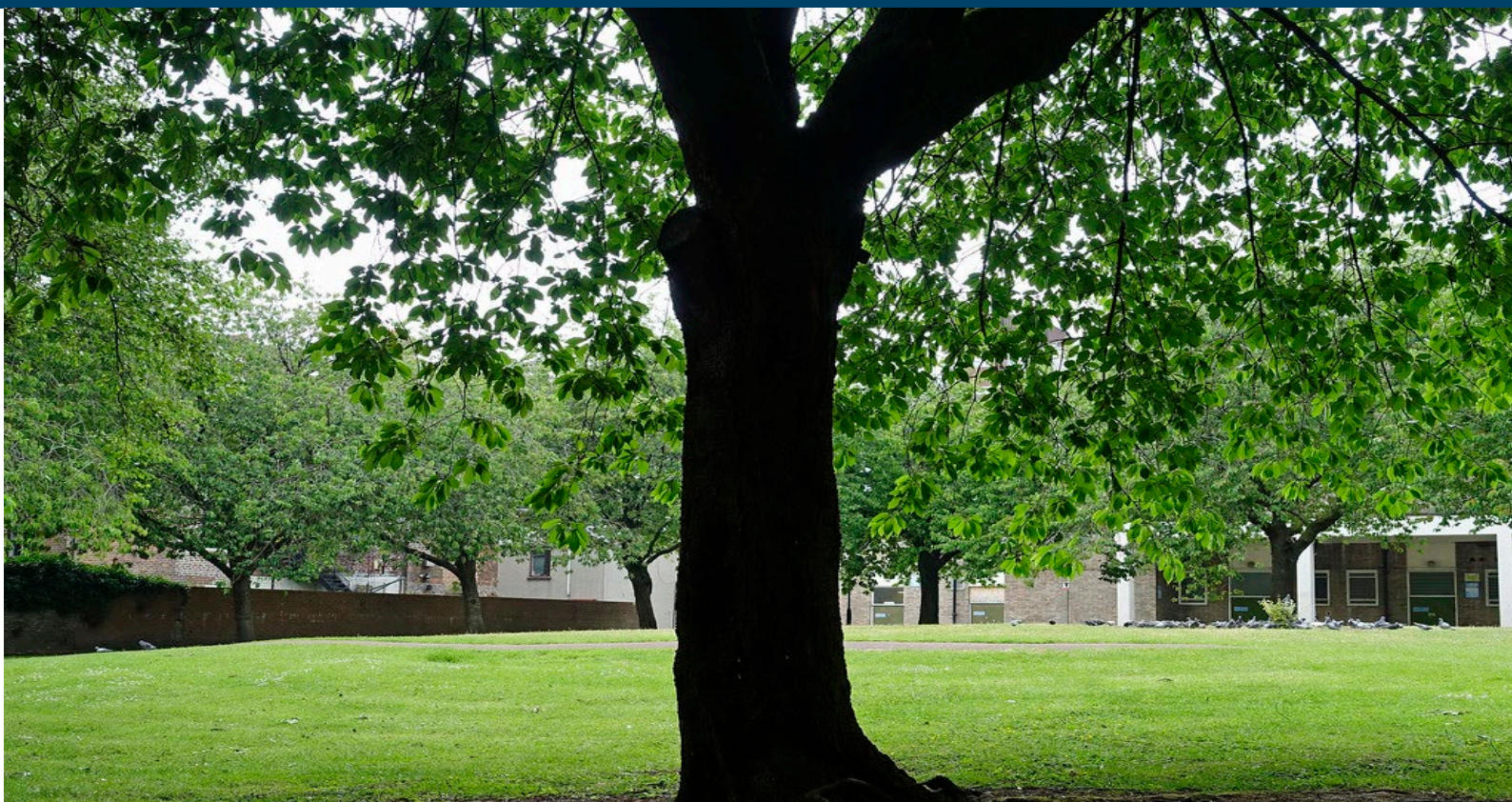
FUND

Recommendation	Timeframe
Continue to identify avenues for securing additional investment required for tree plantings and establishment (e.g. grants)	Short-term and on-going
Undertake cost-benefits analysis for complementary actions to help achieve our target (e.g. creation of Tier 2 and Tier 3 plantable opportunities)	Medium-term and on-going
Refine financial resourcing requirements to include additional staff and ongoing maintenance costs, as well as CPI increases	Short-term and on-going
Implement public consultation for public tree planting	Short-term and on-going
Celebrate and outwardly acknowledge resident tree champions	Short-term and on-going

ENGAGE

Recommendation	Timeframe
Enhance community engagement of the importance of trees	Short-term and on-going
Inform and involve the community with tree projects	Short-term and on-going
Implement public consultation for public tree planting	Short-term and on-going
Encourage individuals and organisations to take an active role in tree planting and care	Short-term and on-going
Collaborate with other agencies and institutions to enhance canopy cover	Short-term and on-going
Continue on-going communication with Ausgrid on their clearance pruning guidelines and reforms to minimise canopy loss.	Short-term and on-going

PART 5. ANNEXES



Annex A. Soil Landscape Groupings and their Landforms within the Woollahra LGA

Soil type is an important determinant of vegetation communities, meaning our soils are the foundations of our urban forest. Key characteristics of different soil types that impact the plants that can grow upon them include nutrient quantities, drainage, and depth. The greater Sydney region has two major soil types: sandy soils derived from Hawkesbury sandstone, and clay soils derived from shales or volcanic rocks.

Soil landscape groupings describe areas comprised of similar soil types and characterised by specific landscape attributes. Understanding the soil landscape grouping of an area helps to define the features, land use and management limitations, and land use potential, including the type of vegetation that can grow in different areas. Twelve soil landscape groupings occur within our Council area (Figure A1, Table A1). The top five most dominant soil landscape groupings covering 87% of the Council area and are broadly described as erosional, colluvial, and aeolian landforms (Table A1).

The most dominant soil landscape grouping is the Hawkesbury (ha) grouping, covering more than 26% of the Council area (Figure A1). Examples of this soil landscape grouping is found in all suburbs within the Council area (Figure A1).

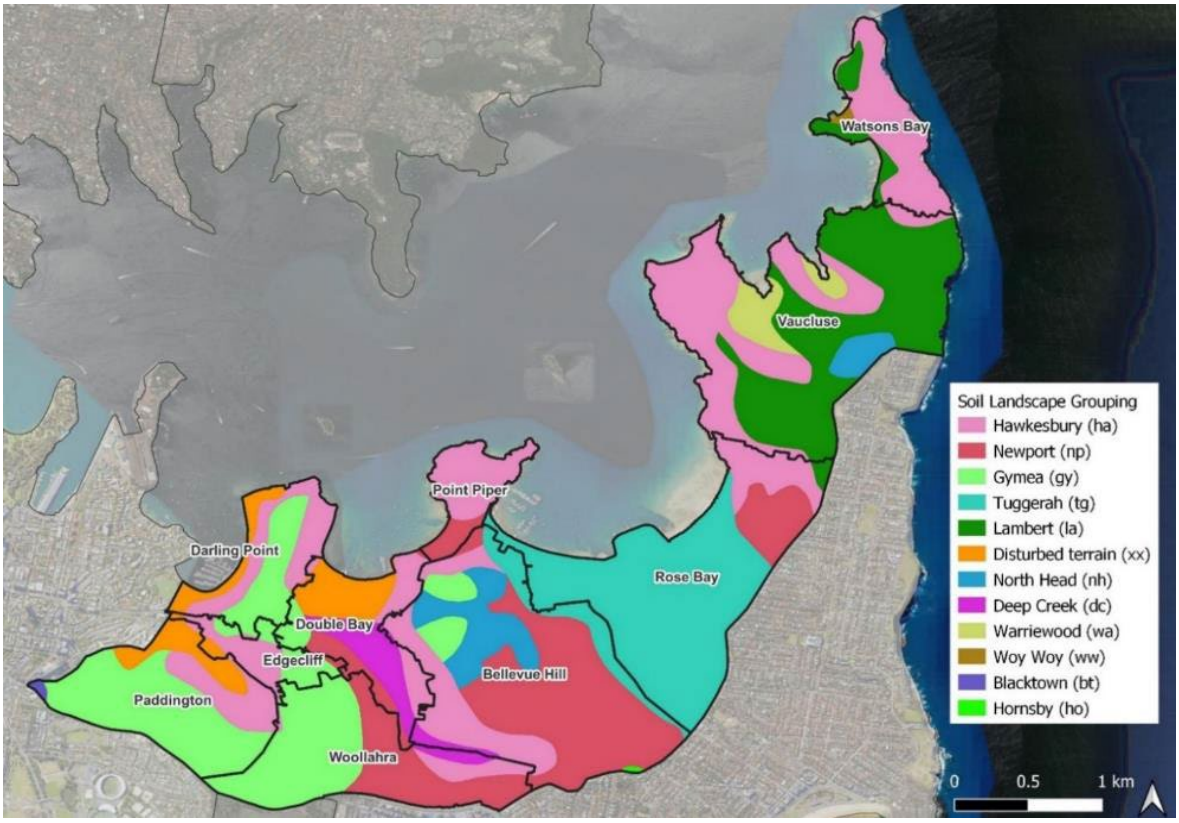


Figure A1. Soil landscape groupings with Woollahra Municipal Council.

Table A1. Descriptions of soil landscape groupings mapped within the Woollahra Municipal Council (WMC) area[17].

Name	Code	Landform Type	Characteristics	Proportion of Council Area
Hawkesbury	ha	Colluvial	• Rugged rolling to very steep hills with exposed ridges and sheltered valleys on Hawkesbury sandstone • Mostly uncleared open dry sclerophyll woodland and tall-open wet sclerophyll forest • Characteristic native trees include: [on exposed crests] *Corymbia gummifera, Eucalyptus oblonga, Eucalytpus haemastoma, Eucalyptus capitellata, Banksia serrata*; [in sheltered gullies] *Eucalyptus pilularis, Eucalyptus saligna, Tristaniopsis laurina* • Occurrence within WMC: all suburbs	26.84%
Newport	np	Aeolian	• Gently undulating plains to rolling rises of Holocene sands mantling other soil materials or bedrock • Extensively cleared low eucalypt woodland, scrub, and open heathland • Characteristic native trees include: *Banksia aemula, Banksia integrifolia, Corymbia gummifera, Angophora costata, Allocasuarina torulosa, Eucalyptus punctata, Eucalyptus tereticornis, Eucalyptus glaucina, Eucalyptus racemosa* • Occurrence within WMC: Bellevue Hill, Woollahra, Double Bay, Point Piper, Rose Bay, Edgecliff	16.75%
Gymea	gy	Erosional	• Undulating to rolling rises and low hills on Hawkesbury Sandstone • Extensively cleared dry sclerophyll woodland and open forest • Characteristics native trees include: C*orymbia gummifera, Corymbia eximia, Eucalyptus haemastoma, Eucalyptus capitellata, Banksia serrata, Eucalyptus sieberi, Eucalyptus piperita, Angophora costata* • Occurrence within WMC: Paddington, Woollahra, Edgecliff, Darling Point, Double Bay, and Bellevue Hill	16.51%
Tuggerah	tg	Aeolian	• N-S oriented coastal dunefields with moderately inclined slopes • Extensively cleared open, dry sclerophyll forest and Angophora woodland • Characteristic native trees include: *Angophora costata, Eucalyptus piperita, Banksia aemula* • Occurrence within WMC: Rose Bay, Bellevue Hill	14.57%

[17] Adapted from: © State Government of NSW and Department of Planning and Environment 2009; accessed October 2022; https://datasets.seed.nsw.gov.au/dataset/soil-landscapes-of-the-sydney-1-100000-sheet557e2

NSW DPIE (2015-2023), Soil and Land Information System (SALIS), Version 5.1.4. Accessed January 2023, https://www.environment.nsw.gov.au/Salis5app/Main/Account/Login

Lambert	la	Erosional	• Undulating to rolling rises and low hills on Hawkesbury Sandstone • Mostly uncleared low heathlands and scrublands, with small stands of low eucalypt woodland • Characteristic native species include: *Allocasuarina distyla, Banksia ericifolia, Hakea teretifolia.* Within small stands of eucalypt woodland, characteristics trees include: C*orymbia gummifera, Eucalyptus leuhmanniana, Corymbia eximia, Eucalyptus haemastoma, Angophora bakeri* • Occurrence within WMC: Vaucluse, Watsons Bay, Rose Bay	12.38%
Disturbed terrain	xx	Disturbed	• Mostly flat and hummocky terrain extensively disturbed by urbanisation and human activity • Original vegetation completely cleared and replaced by exotic turf species – weeds generally abundant • Occurrence within WMC: Double Bay, Darling Point, Paddington	4.28%
North Head	nh	Aeolian	• Gently undulating dunefields of wind-blown sands on coastal headlands • Native heathland and scrub mostly cleared • Characteristic native species include: *Acacia longifolia, Aacacia ulicifolia, Leptospermum laevigatum, Westringia fruticosa, Monotoca elliptica* • Occurrence within WMC: Bellevue Hill, Vaucluse	3.79%
Deep Creek	dc	Alluvial	• Flat to gently undulating floodplains draining the Hawkesbury Sandstone • Partly cleared tall open woodland, weed infested tall wet sclerophyll forest, and rainforest • Characteristic native trees include: *Angophora costata, Corymbia gummifera, Banksia serrata, Eucalyptus piperita, Eucalyptus saligna, Eucalyptus elata, Eucalyptus pilularis, Tristaniopsis neriifolia, Tristaniopsis laurina, Pittosporum undulatum, Callicoma serratifolia, Backhousia myrtifolia, Cyathea australis, Dicksonia antarctica* • Occurrence within WMC: Double Bay, Woollahra, Bellevue Hill	2.51%
Warriewood	wa	Swamp	• Flat to gently undulating swales, depressions, and infilled lagoons on Quaternary sands • Extensively cleared sclerophyll scrub and woodland • Characteristic native trees include: *Melaleuca quinquenervia, Banksia integrifolia, Casuarina glauca, Eucalyptus robusta* • Occurrence within WMC: Vaucluse	1.63%
Woy Woy	ww	Marine	• Flat to gently undulating non-tidal beach ridges on marine sands	0.12%

			• Extensively cleared open-woodland with some scrub patches • Characteristic native trees include: *Banksia integrifolia, Banksia serrata, Banksia aemula, Corymbia gummifera, Angophora costata, Angophora floribunda* • Occurrence within WMC: Watsons Bay	
Blacktown	bt	Residual	• Gently undulating rises on Wianamatta Group shales and Hawkesbury shale • Mostly cleared wet sclerophyll and dry sclerophyll • Characteristic native trees include: *Eucalyptus saligna, Eucalyptus pilularis* • Occurrence within WMC: Paddington	0.10%
Hornsby	ho	Residual	• Gently undulating rises to steep low hills on deeply weathered basaltic breccia • Mostly cleared wet sclerophyll to rainforest • Characteristic native trees include: *Eucalyptus saligna, Eucalyptus acmenoides, Eucalyptus pilularis, Allocasuarina torulosa, Doryphora sassafras, Ceratopetalum apetalum, Callicoma serratifolia* • Occurrence within WMC: Bellevue Hill	0.05%

Annex B. Best Practice Tree Management

The way urban trees are planned and managed has evolved over time. Historically urban tree plantings and management were undertaken from a purely aesthetic perspective, to help soften harsh architectural buildings and infrastructure. These days however, urban trees are recognised as a critical urban asset, providing a range of services essential to the wellbeing and resilience of people, environments, climate, and local economies. This shift in perspective has changed how urban trees are managed, moving away from individual tree management within a particular area, to managing trees collectively as vital components of the urban forest.

Keeping pace with evolving best-practice requires proactive and adaptive management approaches that can also respond to the multiple challenges being faced now and into the future (see Part 4). This section highlights key considerations underpinning best-practice urban tree plantings and urban forest management (Figure B1) and explores how our current management approaches align. Aligning with the following considerations will help to ensure the 'right tree' is planted in the 'right place' in the 'right way'.

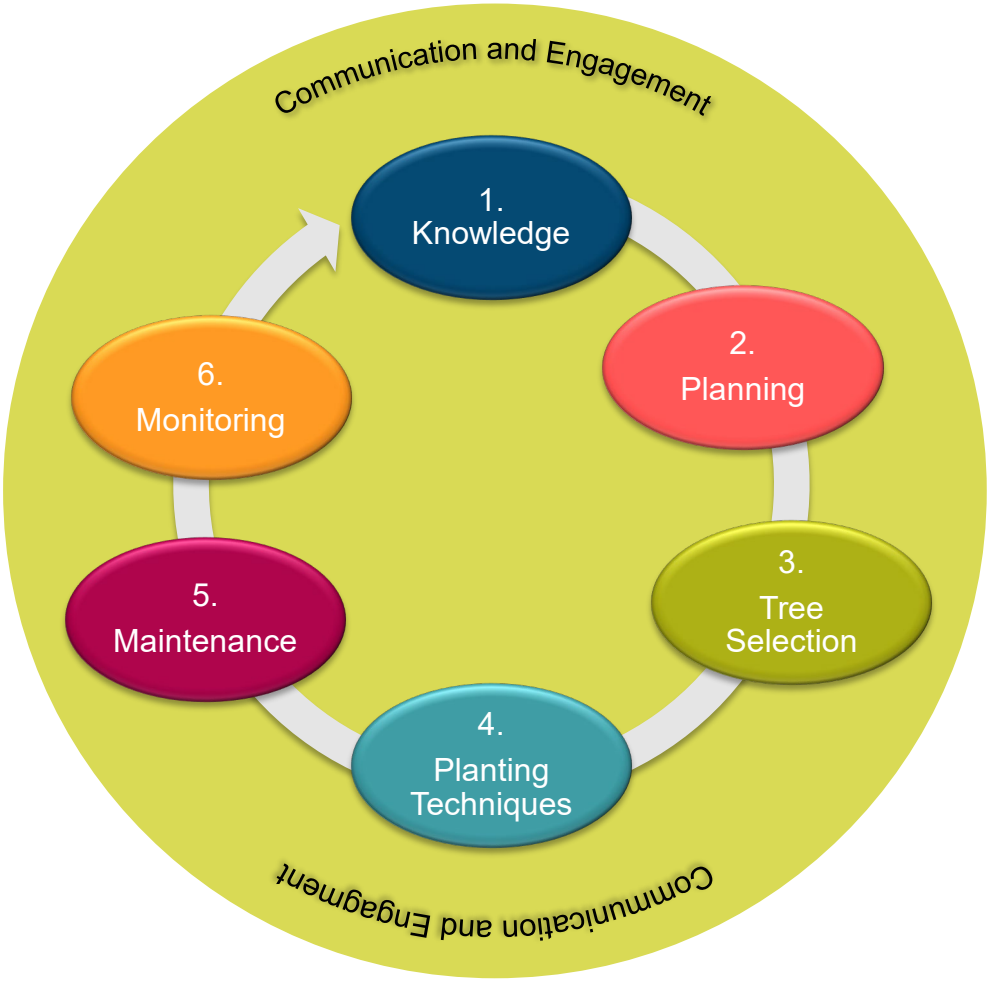


Figure B1. Best practice tree planting and management considerations.

1. Knowledge

To effectively plan and manage the urban forest requires a sound understanding of the current urban forest cover and trends over time, as well as the individual trees comprising the urban forest. Whilst urban forest cover and trends over time can be readily measured using desktop-based spatial analyses, knowledge about the individual trees requires a ground-based tree inventory to be undertaken, which can be a lengthy and costly process. For each tree, the minimum information collected should include: species, age, size, condition, and location. This information can then help to quantify and better understand the ecosystem services provided by the urban forest. Tree inventory information on existing and newly planted trees should be captured in an appropriate tree-specific asset management system (AMS). Leading tree AMSs allow not only data storage and sorting, but also provide spatial mapping outputs, and facilitate maintenance, management, and planting planning (e.g. Forestree, TreePlotter, TreeAM) [18].

2. Planning

As also outlined in our Street Tree Master Plan, tree planting programs should be underpinned by sound, evidence-based planning at two levels: strategic and site-based.

Strategic planning draws on knowledge of the urban forest and should aim to:

- establish a planting program that will meet canopy cover targets;
- ensure age and species diversity is maintained through consideration of intergenerational and replacement plantings, and minimising dominance of any one species, Genus, or Family through application of Santamour's Diversity guideline (see Part 2);
- prioritise tree planting locations to maximise co-benefits, particularly to urban heat mitigation and social vulnerability, but also to other aspects such as walkability and biodiversity; and
- create equitable access to trees and urban green spaces through application of the 3:30:300 guideline[19], which states every resident should be able to see at least three trees from their house, be within a neighbourhood with at least 30% canopy cover, and be no more than 300m from a high-quality public park or green space.
- where relevant, encourage and reward tree protection and planting as part of urban developments, and adhere to Standard Australia HB 214:2023 Urban Green Infrastructure – Planning and Decision Framework[20]

Site-based planning draws on knowledge of on-ground planting site suitability and should inform species selection and planting/maintenance requirements by considering aspects such as:

- proximity to overhead and underground utilities and services, buildings, and other infrastructure;

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[18] https://forestree.app/ (Australian developed software with national application); https://planitgeo.com/treeplotter/ (American developed software with global application); https://www.treeassetmanager.com/about-us/ (American developed software with US application)

[19] 3:30:300 guideline: https://static1.squarespace.com/static/5bbd32d6e66669016a6af7e2/t/6101ce2b17dc51553827d644/1627508274716/330300+Rule+Preprint_7-29-21.pdf

[20] Released in January 2023, this is the newest Australian Standard for urban green infrastructure within new greenfield and urban in-fill developments.

- safety requirements including line-of-sight and intersection offsets (for street plantings) and CPTED[21] principles particularly for park and walkway plantings;
- soil suitability relating to soil type, volume, and quality;
- available space below- and above-ground;
- engineering support and other infrastructure solutions, such as drainage and WSUD incorporation in planting pit designs, creation of planting spaces (e.g. protuberances, pocket parks, road islands), and installation of aerial bundled cabling for power lines;
- microclimate aspects (e.g. light conditions, heat, wind); and
- impact on vistas, such as Harbour views.

3. Tree selection

Species selection is a 'make or break' step, influencing: the success of planting projects; the resourcing efficiencies in establishing and maintaining trees; the ability to achieve canopy cover targets and resilient urban forests; and community support and collaboration. Species selection though can be difficult as there is no one perfect tree because urban areas and planting sites are highly variable and dynamic. Selecting species for plantings must consider:

- strategic targets and objectives;
- current and future climate suitability (e.g. as assessed using tools such as Which Plant Where[22]);
- site-specific conditions and limitations (current and future);
- resourcing availability and management requirements; and
- community perceptions and support.

Reviewing our current species list is also a recommendation of our Street Tree Master Plan. When species are selected for planting programs, it is important to ensure the trees are high-quality. Ensuring high quality stock is used in planting programs requires:

- sourcing trees that have been grown in accordance with AS 2303:2018 (Tree Stock for Landscape Use) and stock is assessed by suitably qualified personnel prior to purchase and planting;
- establishing growing contracts with stock suppliers to ensure enough quantity of the desired stock is available at the required time. This may require a 3-5 year lead time, highlighting the importance of the knowledge and planning stages for informing stock needs;

As supported by our Street Tree Management Plan, an aim should be to plant as large a tree in a space as possible – this refers to the tree's size at maturity, not the size at planting to provide the maximum number of benefits the community can receive. Larger pot sized (more mature) stock is often favoured despite initial higher purchase costs due to the perceived community value in stature which can reduce the likelihood of vandalism. Trees that have been grown at a nursery have preliminary formative pruning occur to crown and roots to optimise branching architecture at an early stage. However, it can at times be difficult to

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[21] Crime Prevention Through Environmental Design; for NSW CPTED principles, see also https://www.police.nsw.gov.au/safety_and_prevention/policing_in_the_community/safer_by_design

[22] https://www.whichplantwhere.com.au/

secure trees at a specific size to align with a target planting date. Research has also shown that planting smaller stock sized specimens has merit, with these trees tending to establish faster, attain larger sizes at maturity, and have greater integrity and resilience[23].

4. Planting technique

An essential element to increasing canopy cover is ensuring the high-quality stock thrives in its selected location in the long-term. This requires each tree to be planted at the 'right time' (i.e. during optimal planting seasons of Autumn to Spring), in the 'right way' (i.e. into good quality soil and using best practice techniques), and to receive regular maintenance. Correct plantings techniques will ensure planted trees are provided the best opportunity for establishment. Our Street Tree Master Plan includes a range of planting specifications for different planting scenarios, that adhere (where possible) to best practice considerations such as:

- hole size for planting: at least three times the diameter of the container is ideally provided to promote healthy and structurally sound root development. Further the depth of the hole should ensure the top of the root ball is level with the soil surface for optimised tree health and establishment. Deeper planted trees will lead to collar rot, and higher planted trees will compromise the integrity of the root ball;
- soil condition: based on knowledge of the planting site soil type and species-specific requirements, improvement of the soil through additives and organic matter should be incorporated as required; correct drainage should also be ensured to prevent excessive water retention; and the bottom of the planting hole should be consolidated to support the weight of the tree and prevent subsidence over time;
- root ball condition: stable trees are supported by strong roots that radiate from the base of the tree and occupy the root ball in an even branching distribution. Root pruning at planting is essential to promote root extension growth;
- establishment protection: protective staking using a 3-stake triangular configuration is recommended to provide protection to the tree during establishment. Newer products such as the TreeCoach System[24] are emerging as replacements for traditional 'wooden stakes', with research suggesting such systems can improve growth quality and establishment success rates;
- watering: should occur prior to planting to soak the root ball and then immediately following planting. The rate of water is dependent on the time of year planted and the pot size of stock. Creating a bund or bermed dish near the root ball edge can help direct water to the root ball during establishment. Emerging products such as the Cocoon Plant Incubator[25] can be incorporated into plantings to assist with ensuring water needs are met during establishment periods. Such products are especially useful where watering access is difficult, or resourcing is limited and are likely to become more common under hotter drier climate conditions.
- mulching: applied immediately following planting and topped up over time helps retain soil moisture, inhibits weedy competition, and replenishes soil organic matter as it

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[23] Gilman et al (2010) https://hort.ifas.ufl.edu/woody/documents/articles/GilmanHarchickPazAUF2010.pdf;

Watson (2005) http://ctufc.org/wp-content/uploads/2018/03/Establishment-and-Tree-Size.pdf

[24] https://naturalgrowthpartners.com.au/about-tree-coach/

[25] https://stratagreen.com.au/wp-content/uploads/2022/12/strata-green-stratagreen-cocoon-plant-incubator-brochure.pdf

breaks down. Mulch should extend 1.5-2.5m from the tree stem at a depth of 5-10cm. Coarse leaf mulch is generally the best option.

5. Maintenance

Managing and maintaining urban tree assets is essential for maximizing the lifespan of, and benefits provided by, the tree, as well as minimising potential negative impacts to people and infrastructure. All management actions should be recorded within the Tree AMS. Maintenance requirements and frequency will vary over the life of the tree, and adequate resourcing for ongoing monitoring, reporting, and arbor activity will be essential:

- establishment period (1-2 years, or 3-5years in more arid climates and during *El Nino* cycles): formative pruning, weeding, and mulching at scheduled times; removal or replacement of protective staking as required. Ensuring adequate water availability is essential for tree growth and underwatering can be as damaging as overwatering. As such, the amount and frequency of assisted watering will depend on the season and prior rainfall, stock size, soil type, local site conditions, and any watering support infrastructure installed as part of the tree planting (e.g. WSUD, irrigation, Cocoon Plant Incubator).
- Post-establishment growth and maturity period: public trees are inspected annually to determine pruning as required to ensure stable and vigorous growth and preventative pruning where a safety risk is identified. Pruning should adhere to Australian Standard AS 4373-2007 Pruning of Amenity Trees. Weeding and pest and disease control should be undertaken as required. Additional watering may be considered necessary during extreme drought conditions;
- Senescence period: increased monitoring and arbor activity is predicted aimed at minimising risks to people and infrastructure. Tree removal should be implemented as a last resort; some trees may be suitable for retention as standing habitat stags (e.g. hollow-bearing trees in bushland or open park settings). A tree/site assessment should be undertaken to determine suitability.

6. Monitoring

Regular, ongoing monitoring is an essential component of urban forest planning and management. Monitoring provides critical insights to inform whether actions and resourcing are suitable to achieve targets and objectives, and if not, what adaptations should be implemented. To be effective, monitoring should be regular, repeated, and should feed into an adaptive management framework and implementation plan.

7. Communication and Engagement

Understanding, planning, implementing, and monitoring tree planting programs must be underpinned by clear and interactive communication and engagement with a range of audiences, both within Council and outside of it. Internal Council communication and engagement relating to the urban forest is essential for ensuring consistent messaging and support of actions across all departments and levels. Communicating and engaging with external stakeholders and community members is also vital for garnering support and stewardship of public planting programs and encouraging collaborative efforts on private land. Best practice communication and engagement strives for inclusivity and representation of cultures and languages, belief systems, demographics, and impairments.

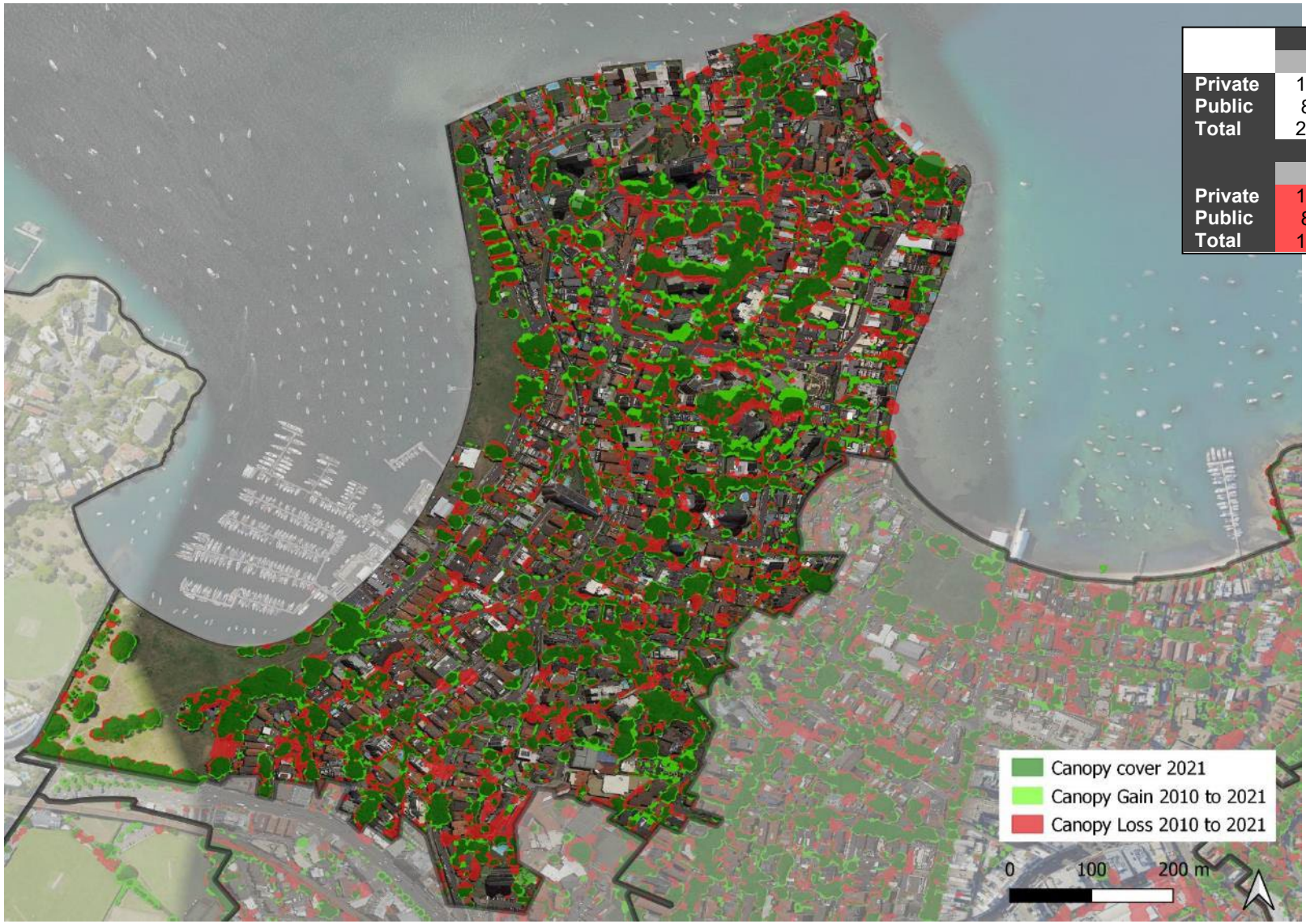
Annex C. Canopy Cover Change 2010-2021 for Each Suburb

The following provides, for each suburb, a summary and visual representation of canopy cover change between 2010-2021. Suburbs are listed in alphabetical order.

Bellevue Hill

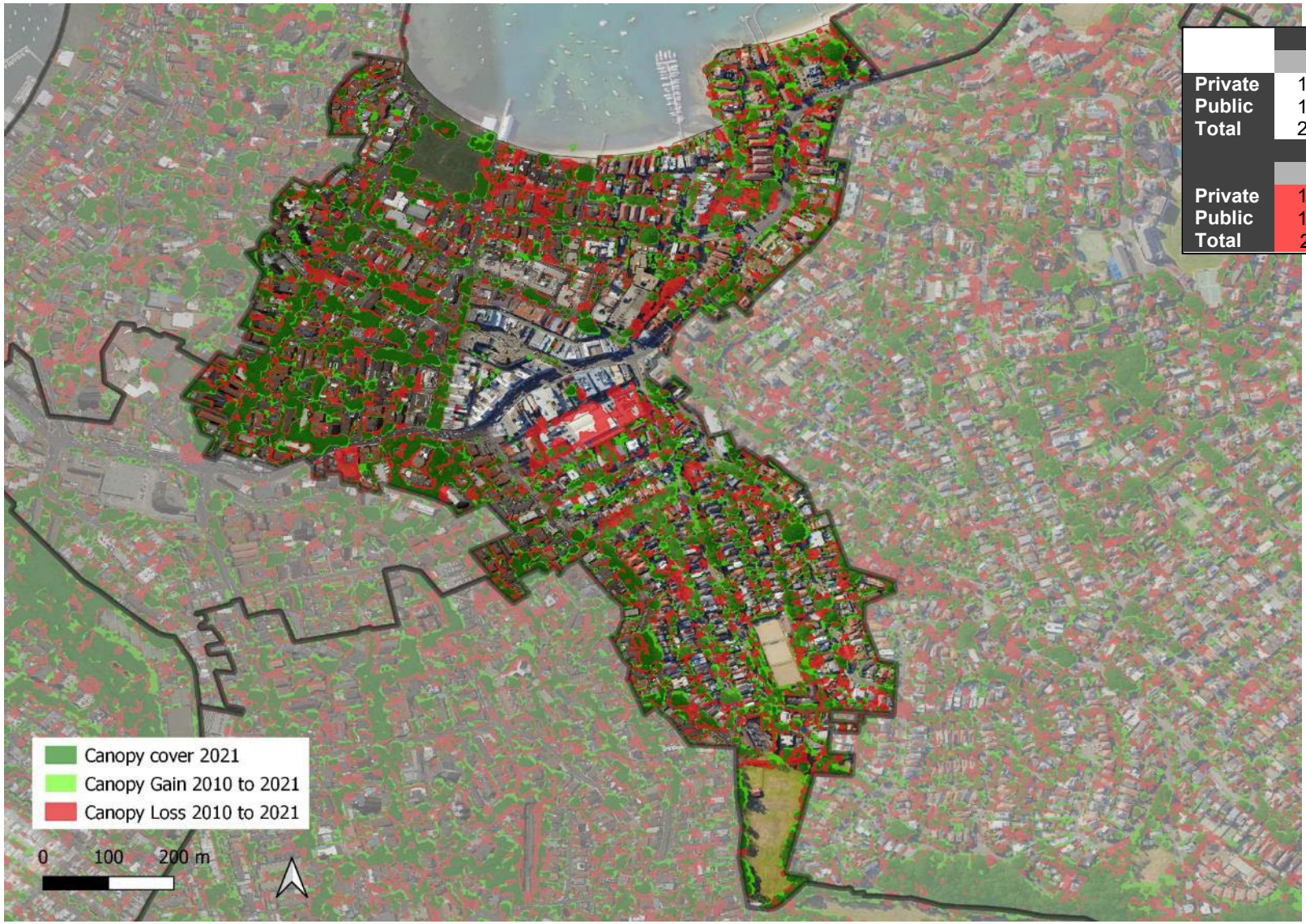
	Canopy Cover 2010	
	m²	% Suburb
Private	476,536.49	20.11
Public	287,618.76	12.13
Total	764,155.25	32.24
	Canopy Cover 2021	
	m²	% Suburb
Private	411,341.74	17.35
Public	289,238.26	12.20
Total	700,580.00	29.56

Darling Point



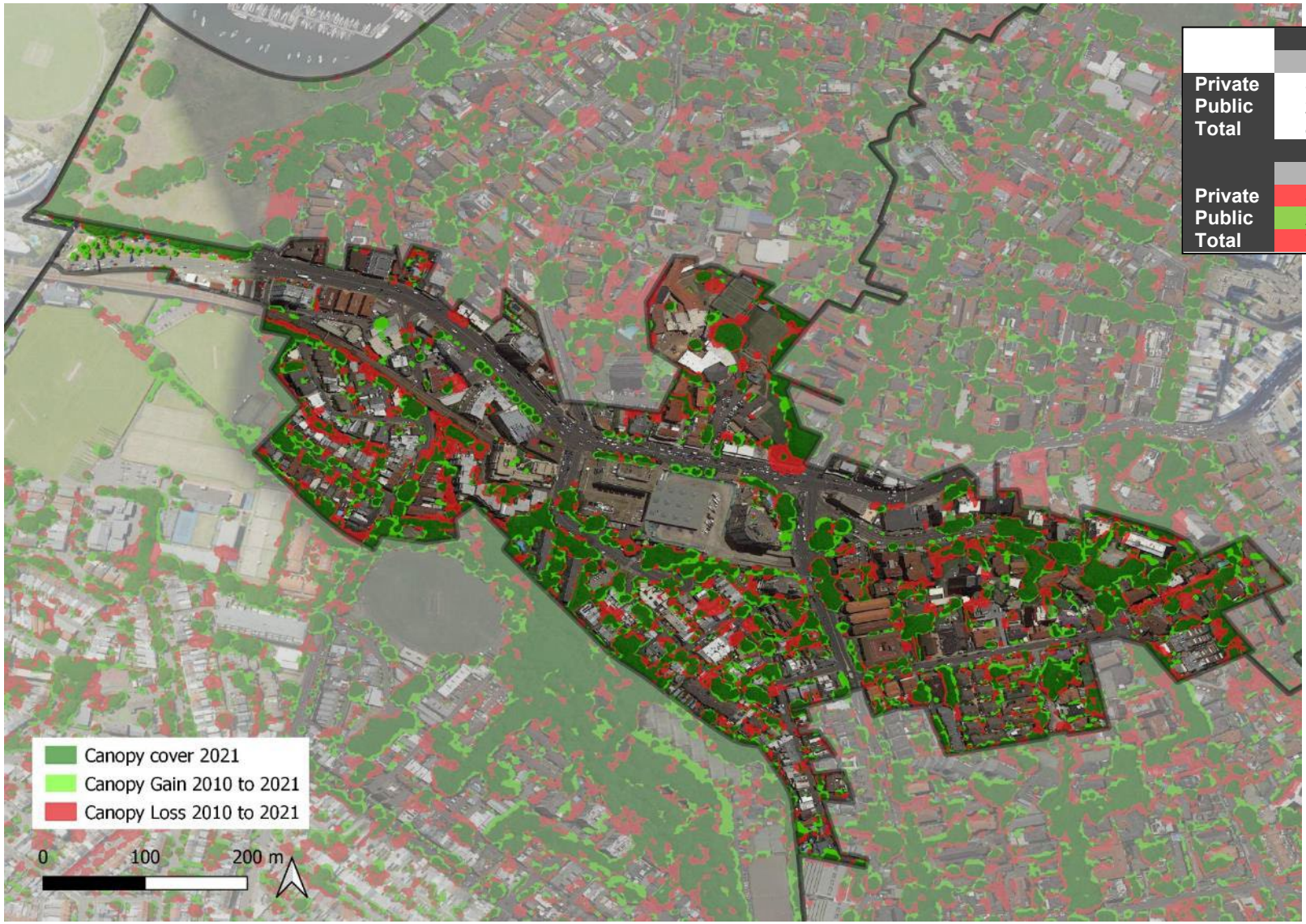
	Canopy Cover 2010	
	m^2	% Suburb
Private	127,955.00	19.18
Public	84,353.25	12.65
Total	212,308.25	31.83
	Canopy Cover 2021	
	m^2	% Suburb
Private	114,753.90	17.20
Public	81,198.35	12.17
Total	195,952.25	29.38

Double Bay



	Canopy Cover 2010	
	m^2	% Suburb
Private	129,164.72	16.55
Public	118,816.78	15.22
Total	247,981.50	31.76
	Canopy Cover 2021	
	m^2	% Suburb
Private	112,942.47	14.47
Public	107,393.28	13.76
Total	220,335.75	28.22

Edgecliff



	Canopy Cover 2010	
	m²	% Suburb
Private	57,922.68	18.85
Public	22,703.07	7.39
Total	80,625.75	26.23
	Canopy Cover 2021	
	m²	% Suburb
Private	51,233.11	16.67
Public	24,112.14	7.85
Total	75,345.25	24.52

Paddington

	Canopy Cover 2010	
	m²	% Suburb
Private	146,186.48	12.60
Public	167,846.02	14.46
Total	314,032.50	27.06
	Canopy Cover 2021	
	m²	% Suburb
Private	121,319.98	10.46
Public	167,894.27	14.47
Total	289,214.25	24.92

Point Piper

	Canopy Cover 2010	
	m²	% Suburb
Private	65,216.16	18.35
Public	26,873.09	7.56
Total	92,089.25	25.92
	Canopy Cover 2021	
	m²	% Suburb
Private	56,291.26	15.84
Public	25,004.24	7.04
Total	81,295.50	22.88

Rose Bay

	Canopy Cover 2010	
	m²	% Suburb
Private	311,103.65	15.34
Public	207,443.85	10.23
Total	518,547.50	25.57
	Canopy Cover 2021	
	m²	% Suburb
Private	285,150.78	14.06
Public	211,287.97	10.42
Total	496,438.75	24.48

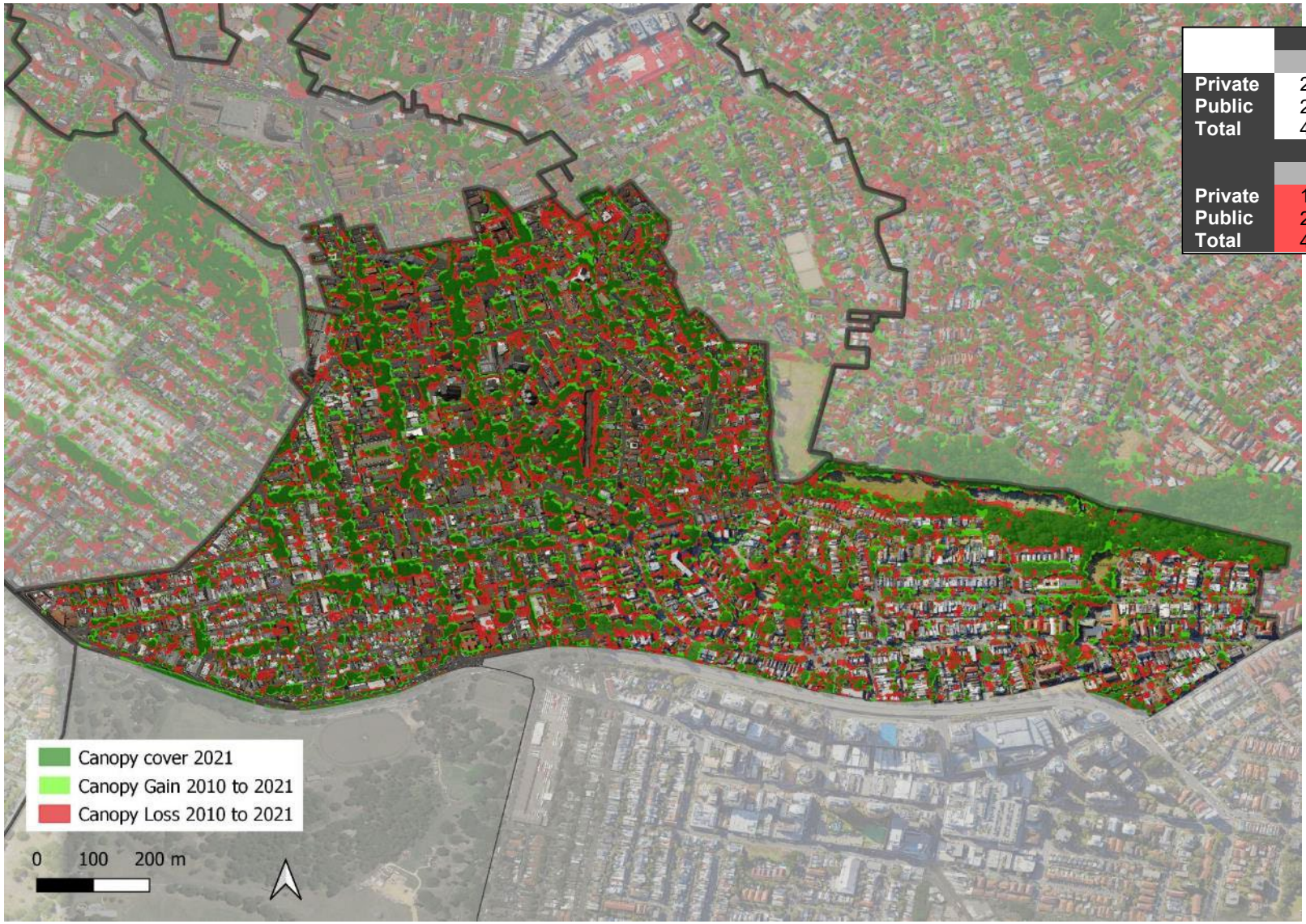
Vaucluse

	Canopy Cover 2010	
	m²	% Suburb
Private	399,589.19	15.10
Public	440,017.31	16.63
Total	839,606.50	31.73
	Canopy Cover 2021	
	m²	% Suburb
Private	332,758.19	12.58
Public	421,752.56	15.94
Total	754,510.75	28.52

Watsons Bay

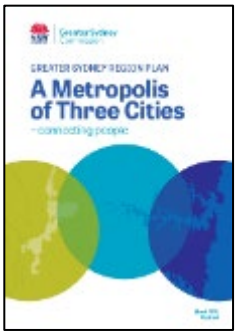
	Canopy Cover 2010	
	m²	% Suburb
Private	27,708.58	4.45
Public	166,326.42	26.74
Total	194,035.00	31.19
	Canopy Cover 2021	
	m²	% Suburb
Private	25,933.56	4.17
Public	148,612.69	23.89
Total	174,546.25	28.06

Woollahra

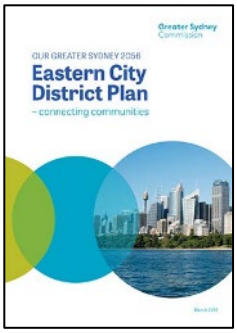


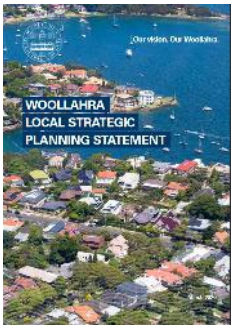
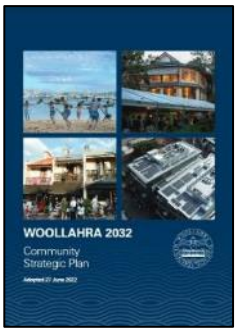
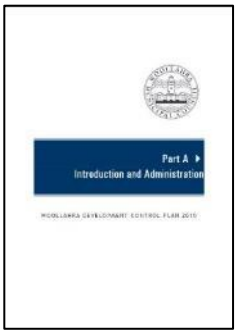
	Canopy Cover 2010	
	m^2	% Suburb
Private	224,976.62	17.85
Public	215,446.13	17.10
Total	440,422.75	34.95
	Canopy Cover 2021	
	m^2	% Suburb
Private	193,912.90	15.39
Public	214,244.60	17.00
Total	408,157.50	32.39

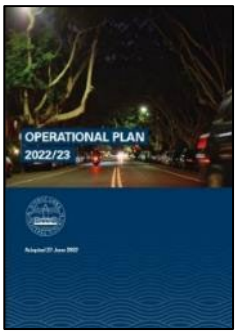
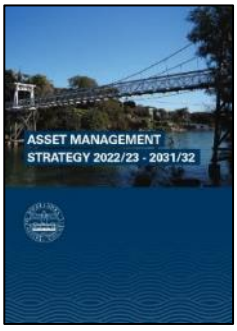
Annex D. State and Local Documents of Relevance to the Urban Forest Strategy

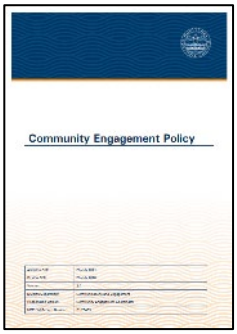
Document	Relevance to the Urban Forest Strategy
State Level	
Environmental Planning and Assessment Act 1979	Establishes the legislative requirements for all land use plans and developments in NSW.
Biodiversity Conservation Act 2016	The main legislation that protects ecological communities and threated species populations in NSW.
Heritage Act 1977	Provides legislative protection from development that may damage or destroy trees or other vegetation on, or remove any tree or other vegetation from, a heritage listed place or precinct.
Biodiversity and Conservation State Environmental Planning Policy 2021	Part of the new SEPP framework that consolidates 45 SEPPs into 11 to help simplify the State planning system. The Biodiversity and Conservation SEPP consolidates 11 now repealed SEPPs. The consolidation process is administrative only – it does not change the legal effect of the existing SEPPs. The Biodiversity and Conservation SEPP contains planning rules, controls, assessment frameworks and provisions that will help to protect, preserve, and enhance biodiversity within the State.
Regional Level	
Greater Sydney Region Plan 	The 40-year vision, framework and objectives for liveability, productivity, and sustainability across all of Greater Sydney. Implementation of the Plan is delivered through 5 District Plans, including the Eastern City District Plan which includes the Woollahra Municipal Council and eight other LGAs[26] . Sustainability Direction 8 - A City in its Landscape: - Objective 25: The coast and waterways are protected and healthier - 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, specifically that "A target has been set to increase tree canopy cover to 40 per cent, up from the current 23 per cent." - 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

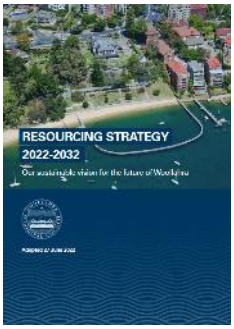
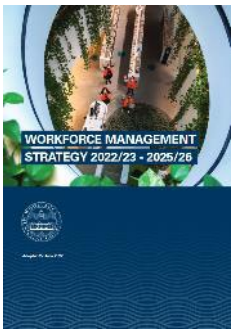
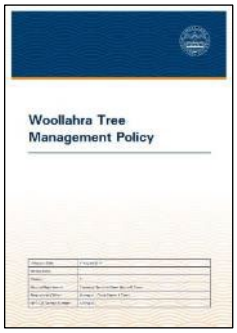
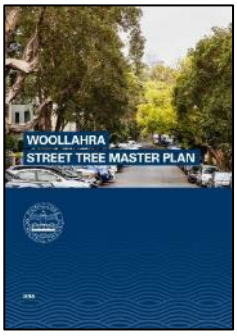
[26] Eastern City District Plan comprises the following LGAs: Woollahra Municipal Council, Bayside Council, Municipality of Burwood, City of Canada Bay, City of Sydney, Inner West Council, Randwick City Council, Strathfield Council, and Waverley Council.

Document	Relevance to the Urban Forest Strategy
Eastern City District Plan 	Provides the Eastern City District's implementation framework and priorities for delivering the Greater Sydney Region Plan. - Planning Priority E14 – Protecting and improving the health and enjoyment of Sydney Harbour and the District's waterways; o *Potentially relevant to: Action 60 relating to improving the health of catchments and waterways; and Action 61 relating to reinstating more natural conditions along waterways.* - Planning Priority E15 – Protecting and enhancing bushland and biodiversity - Planning Priority E16 – Protecting and enhancing scenic and cultural landscapes o *Potentially relevant to Action 64 relating to protecting views* - Planning Priority E17 – Increasing urban tree canopy cover and delivering Green Grid connections - Planning Priority E18 – Delivering high quality open space.
Premier's Priorities  	Greener public spaces: aims to enhance equitable access to green spaces through increasing the proportion of urban homes within 10 minutes' walk of quality green, open and public space by 10 per cent by 2023 Greening our city: aims to increase canopy cover across Greater Sydney region by planting 1 million trees by 2022.
Sydney Regional Environmental Plan (Sydney Harbour Catchment) 2005	Establishes the set of planning principles to be used in relation to development and the preparation of local planning instruments within the foreshores and waterways the Harbour. The principles aim to ensure better and consistent development decisions and include such issues as ecological and scenic quality, built form and design, maintenance of views, public access and recreation and working harbour uses. Of particular relevance to trees are: Part 5 (Heritage Provisions), Division 3, considers impacts to matters of Aboriginal heritage significance – including scarred and sacred trees Part 6 (Wetlands Protection) considers impacts to trees and other native vegetation

Document	Relevance to the Urban Forest Strategy
Local Level	
Local Strategic Planning Statement (2020-2040) 	Establishes the 20-year land-use vision and planning priorities for the local area, identifying the character and values that are to be preserved and how change will be managed into the future. Relevant planning priorities in the LSPS are: Planning Priority 11: conserving, enhancing, and connecting our diverse and healthy green spaces and habitat, including bushland, tree canopy, gardens, and parklands. - Action 56(b) is 'preparing and implementing an urban forest strategy' Planning Priority 14: planning for resilience so we adapt and thrive despite urban and natural hazards, stressors and shocks, including climate change.
Community Strategic Plan 'Woollahra 2032' 	Establishes Council's vision for the next decade and forms part of Council's Integrated Planning and Reporting Framework. The Plan provides the framework on which sustainability will be facilitated and delivered within the Council area. Of the four core focus areas underpinning the plan, the Urban Forest Strategy relates to the Environment focus area, which has a number of related goals. Those most direct relevance to the UFS are: - Goal 7: Protecting our environment o 7.1 Protect trees, streetscapes, natural landscapes and biodiversity including the protection and restoration of bushland areas. - Goal 8: Sustainable use of resources o 8.3 Prepare for and adapt to the impacts of climate change Additional goals of indirect relevance to the UFS are: - Goal 5: Liveable places o 5.3 Provide and maintain clean, attractive, accessible, connected and safe parks, sportsgrounds, foreshore areas and other public spaces and infrastructure such as roads, footpaths, bicycle facilities, stormwater drains and seawalls o 5.4 Reduce impacts of local flooding and improve floodplain risk management - Goal 6: Getting around o 6.1 Facilitate an improved network of accessible and safe active transport options.
Development Control Plan 2015 	Implements the LEP through detailed guidelines, objectives and controls for future development in the City. Of particular relevance for the UFS are: - Part E – General Controls for All Development o Chapter E3: Tree management

Document	Relevance to the Urban Forest Strategy
Local Environmental Plan 2014 (2015 EPI 20)	Implements the LSPS by providing the local environmental planning provisions for land in Woollahra. The Plan is itself implemented through the Development Control Plan 2015.
Delivery Program 2022/23 – 2025/26 	A 4-year plan that supports the aims and delivery of the medium-term goals within the Community Strategic Plan 2032. The Plan specifically identifies specific actions for achieving the goals outlined in the CSP.
Operational Plan 2022/23 	A new OP is developed each year to provide details on actions for delivering goals outlined in the Community Strategic Plan and Delivery Program. Actions identify specific projects, programs, and activities that will be undertaken in the coming year. The financial requirement for each action is also included in this Plan.
Asset Management Strategy 2022/23 – 2031/32 	A 10-year Strategy that outlines the current situation across the Woollahra area, identifies future goals/vision, and provides the framework for how to achieve the goals/vision. The strategy is implemented through the various Asset Management Plans.
Asset Management Policy	Establishes Council's approach to asset management and strategic alignment. The Policy is delivered through the Asset Management Strategy.

Document	Relevance to the Urban Forest Strategy
Biodiversity Conservation Strategy 2015-2025 	Provides the strategic framework for conserving, managing, and enhancing biodiversity across the Council area. The framework is based around objectives and targets that aim to enhance the protection, diversity, and resilience of biodiversity, and increase community awareness and engagement.
Environmental Sustainability Action Plan 2013-2025 	Provides the strategic direction for sustainability in Woollahra. The Plan identifies a series of sustainability targets related to five priority areas: energy and emissions, water, biodiversity, waste, and transport. The Biodiversity area is of most relevance to the UFS; it has the following targets: - 75% of bushland under regeneration by 2017 - 15% of bushland fully regenerated by 2017 The increased canopy cover target within the UFS is expected to have a positive impact on achieving the Energy and Emissions target related to reducing greenhouse gas emissions.
Community Engagement Policy 	Establishes Council's commitment to engaging the local community when developing policies, strategies and plans for the purpose of determining its activities, other than routine administrative and operational matters.
Plans of Management (for parks, reserves and sports fields)	The Plans of Management are local/site level documents that outline for public open spaces the: issues affecting the space, and how the space is intended to be used, improved, maintained, and managed into the future. Woollahra has Plans of Management for 25 of their parks, reserves, and sports fields.

Document	Relevance to the Urban Forest Strategy
Resourcing Strategy 2022-32 	Aims to deliver services that meet community expectations and aspirations in a sustainable manner, including planning for the management of assets such as open spaces and land, amongst other things
Workforce Management Strategy 2022/23 – 2025/26 	A 4-year strategy that shapes the capacity and capability of Council's workforce to achieve strategic goals and objectives. It ensures Council's workforce is capable of continuing to deliver high quality services to the community and deliver on Council's vision. Clear directives for workforce resourcing will be required to implement the Urban Forest Strategy.
Tree Management Policy 2011 	The policy defines the key principles and processes for maintaining public and private trees across the Council area. A key aim of the policy is to ensure best practice tree management is applied to improve the safety and wellbeing of the public, and of staff and contractors working on trees.
Street Tree Masterplan 2014 	A guide to aid in the planning, maintenance, and enhancement of street trees across the Woollahra area. The STMP provides guidelines for species selection and street tree design across the Council area, as well as for each of Council's 10 Precincts.

Document	Relevance to the Urban Forest Strategy
Register of Significant Trees 	Provides a list of trees located on private property and public land that are identified as significant within the Council and surrounding area. The register is comprised of 4 volumes.

Annex E. Tree Planting Predictor (TPP) Tool

Approach and Customisations

Edge Impact's TPP is an Excel-based tool that seeks to aid decision-makers in setting their canopy cover targets and plans. It is delivered through a paired workshop process (Figure E1). To capture local knowledge and customise the tool for the local context, the workshops involve the user's personnel/team involved in planning and delivery of urban forest/tree planting programs. The first workshop introduces the tool to the user team, establishes local context parameters, and defines current and desired tree planting program scenarios for modelling. The user is then issued with a request for information (RFI, see Table E1) and based on these responses, the preliminary modelling of defined scenarios is undertaken. The preliminary outputs form the basis of discussions and refinement in the second workshop. Following the second workshop the modelling is refined as needed to generate the final outputs.

Figure E1. Tree Planting Predictor process.

It should be noted that the TPP provides landscape scale forecasts of changes in canopy at a whole of study area scale (e.g. Council wide), and changes in canopy at smaller scales (e.g. neighbourhoods, roads) may vary due to site-specific factors such as, lines of sight, verge widths, and overhead and underground utilities.

Request for Information

The TPP modelling presents projections of canopy cover change over time based on different tree planting scenarios that are informed by a custom set of baseline conditions together with a custom set of planting variables (as determined from the RFI). This allows users to enter and directly compare multiple scenarios and their impacts on achieving future canopy cover targets.

Baseline conditions remain unchanged in all scenarios modelled and include the following parameter:

- Study area and zone areas (if relevant);
- Current canopy cover area;
- Canopy cover change;
- Plantable space area;

- Tree categories and their growth parameters;
- Planting success rates;
- Planting and maintenance costs; and
- Canopy cover target (if already established); and
- Irrigation duration.

Planting variables that are adjusted across planting scenarios can include:

- Species mix;
- Base planting number (i.e. number of trees to be planted in year 1); and
- Planting effort (i.e. proportional increases or decreases in the previous year's planting number).

The initial planting scenario modelled is always a "business as usual" (BAU) scenario using the information directly from the RFI. Planting variables are then adjusted to develop additional comparative scenarios and provide the evidence-base for planting requirements to achieve canopy cover targets.

Note

The change in canopy cover rate and plantable space area applied for Woollahra Municipal Council area was based on spatial analyses derived from NearMap's vegetation and surfaces AI Packs[27]. Establishment success rate was based on consensus from Council staff during the first TPP workshop. Establishment success rate set at 95%, meaning 5% of trees planted are not expected to survive the establishment period due to various reasons, such as: vandalism, stock condition, or inappropriate planting conditions. A cost to plant a tree was provided as a range, the average of this range was applied for modelling purposes (see Table E1).

[27] https://docs.nearmap.com/display/ND/AI+Packs

Table E1. Request for information (RFI) responses and notes for Woollahra Municipal Council.

Requested Information	Description	Response	Notes
Location of the site	Confirm the study region and any zones within that area	City of Woollahra	
Area of the study region (m^2)	The full geographical area that the analysis covers, encompassing all zones, if any.	City-wide (m^2): 12,197,337.78	
Area of specified zones (m^2)	Specified area/s within the broader study region. For example, different land tenures.	Public area (m^2): 4,421,277.86 Private area (m^2): 7,776,059.92	
Current canopy area (% or m^2)	The current coverage of tree canopy. Area is to be provided for the full study region and for each zone, if any.	City-wide: 3,396,376.25 m^2 Public Canopy (m^2): 1,690,738.38 Private canopy (m^2): 1,705,637.87	Current canopy cover is based on 2021. Note that this was adjusted for the TPP modelling by applying the average annual rate of change to provide a starting canopy cover as of 2023 of 3,347,244 m^2 (27.44%).
Plantable space (% or m^2)	The total area available for potential tree plantings. Area is to be provided for the full study region and for each zone, if any.	City-wide: 1,963,702.50 m^2 Public plantable (m^2): 809,048.60 Private plantable (m^2): 1,154,653.90	
Target canopy area (% or m^2)	Desired canopy cover area. Please note in the Column G whether the area is a **total** cover, or an **increase** in cover from the current amount. This can be one figure for the full study region or one target for each zone, if any.	None established, so test the following: 1. BAU 2. 30% 3. 40% (aligns with State target)	40% aligns with the State target but is it feasible with the plantable space available?
Date for future canopy target (Year: 20xx)	Future date by which the target canopy area should be achieved.	2050	This allows for up to 26 years of planting and growth. This is more realistic for achieving significant canopy gains than the State target year of 2036 which would only allow for a maximum of 12 years of growth for trees planted as of 2024, and less for those planted in subsequent years.
Net annual change of current canopy (%)	Average annual rate of change in canopy cover. Rate of change to be provided for the full study region, and for each zone, as relevant.	City-wide (m^2): -27,948 (0.75% loss) Public (m^2): -4,246.03 (0.24% loss) Private (m^2): -23,701.97 (1.21% loss)	Average annual rate of change is based on the change in canopy cover between 2010 and 2021.

Requested Information	Description	Response	Notes
Establishment success rate (%)	The percent survival of tree plantings during the planting year.	95%	
Establishment cost for plantings	Average cost to plant each tree. What is included in this average cost is up to you. Noting that the TPP modelling assumes establishment cost is the same for all tree categories, however, a different cost per size category can be provided if this is available.	$1,827.50	This costing considers: Tree purchase - 100L - $270 average; Planting -100L - $420 average; Watering and establishment - $975-$1300 (9-12 months) Total - $1665-$1990 *Annual CPI increases are not included in these costings.*
Irrigation (yes/no; duration)	Are planted trees irrigated? Please reply 'yes' or 'no' in Column F. If yes, please note the duration (i.e. number of years) that irrigation is applied.	N/A for this modelling project	No automated irrigation - Twice weekly hand watering during the establishment period. Cost has been included in the row above.
Species to be planted	Review the TPP default species list and crown sizes and indicate for an average planting year in your study area: - how many of each species you plant; - the species' crown spread at maturity (if different from the default values provided) If you plant a species that is not currently included in the TPP default list, please add details where indicated.	See Table E3 for Woollahra Municipal Council's planting list.	

Tree Categories

Five categories of trees are used in the TPP. The categories group together different tree species based on similarities in their average growth rates and crown spreads at maturity (Table E2). Faster growing trees tend to have a smaller crowns, whilst slower growing trees tend to have larger crowns at maturity. Average growth rates and crown spreads for each tree category are customised in consultation with the user to suit local growing conditions.

The tool collects and processes the variable parameters with the help over 500,000 calculations to determine the aggregate growth profile of new and existing plantings. First, the model determines the growth pattern of each type of tree and multiplies and sums these patterns according to the proposed planting schedule. The year-to-year development of the new and existing trees is then estimated, including any tree losses (e.g. success of new plantings and loss of pre-existing trees due to natural and human causes). The modelled output is presented in an excel-based dashboard for further analysis.

The dashboard of the TPP provides valuable insights into the results that ultimately helps in making better-informed decisions. It presents the absolute canopy growth profile for each scenario over the coming years, up to 50 years. It also shows a detailed growth canopy for each scenario, including a breakdown per land tenure and tree types. These results are presented and compared against the proposed targets. This level of granularity and detail allows users to test different variables against goals in real-time.

It should be noted that the TPP provides landscape scale forecasts of changes in canopy at a whole of council scale, and changes in canopy at a suburb or smaller scales may vary due to site-specific factors such as verge widths, overhead and underground utilities, and lines of sight.

Table E2. Tree growth parameters applied for TPP tree categories (very small to very large), including an example of a species from each tree Category.

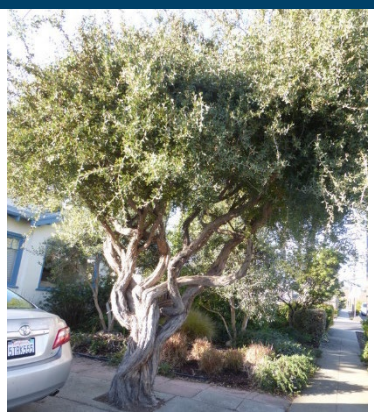
Category	Average Crown Spread (m) at Maturity	Years to Maturity	Example Tree Species	
Very small	2m	5	Coast teatree (*Leptospermum laevigatum*)	
Small	4m	10	Bottlebrush (*Callistemon citrinus x viminalis*)	
Medium	6.5m	15	Large-fruited Yellow Gum (*Eucalyptus leucoxylon ssp. megalocarpa*)	
Large	11.5m	20	Smooth Bark Apple (*Angophora costata*)	
Very large	25m	30	Moreton Bay Fig (*Ficus macrophylla*)	

Table E3. Tree species planted and average numbers of each planted per year under Woollahra Municipal Council's current BAU scenario. For each species, the TPP tree category is also shown.

Species	Common name	Average Number Planted Per Year	TPP Category
Angophora hispida	Dwarf Apple	2	Small
Angophra costata	Smooth Bark Apple	10	Large
Backhousia citriodora	Lemon Myrtle	8	Medium
Banksia integrifolia	Coastal Banksia	4	Medium
Buckinghamia celisissima	Ivory Curl Flower	10	Small
Ceasalpinia ferrea	Leopard Tree	10	Small
Corymbia eximia	Yellow Bloodwood	2	Large
Corymbia ficifolia	Red Flowering Gum	8	Medium
Cupaniopsis anacardioides	Tuckeroo	14	Large
Elaeocarpus eumundii	Quandong	2	Medium
Eucalyptus microcorys	Tallowwood	4	Large
Eucalyptus robusta	Swamp Mahogany	4	Large
Eucalyptus sideroxylon	Red Ironbark	4	Large
Ficus macrophylla	Moreton Bay fig	2	Very large
Flindersia australis	Crow's Ash	2	Large
Jacaranda mimosifolia	Jacaranda	16	Large
Koelreuteria bipinnata	Pride of China	2	Large
Lagerstroemia indica	Crepe Myrtle	8	Medium
Lophostemon confertus	Queensland Brush Box	26	Large
Platanus x acerifolia	London Plane Tree	6	Very large
Pyrus calleryana 'Chanticleer'	Chanticleer Callery Pear	2	Medium
Syzygium leuhmannii	Small-leaved Lillypilly	2	Medium
Syzygium paniculatum	Brush Cherry	2	Medium
Tristaniopsis laurina 'Luscious'	Water Gum	30	Small
Ulmus parvifolia	Chinese Elm	12	Large
Waterhousea floribunda	Weeping Lilly Pilly	4	Medium
Zelkova serrata	Japanese Elm	4	Medium

Planting Scenarios

The following baseline conditions were applied to all modelling scenarios:

	Total Council Area	
	m^2	%
Study area	12,197,337.78	100
Current canopy area	3,347,244*	27.44
Plantable space area	1,963,702.50	16.10
Net average canopy change per year	-27,948	-0.75
Establishment success rate	n/a	95

Planting scenarios are a specific combination of tree species (i.e. *planting mix*) and number of plantings per year (i.e. *planting rate*) applied to the TPP modelling. Planting rate is also assessed using different starting (year one) planting numbers to provide an indication of *planting effort*. The purpose of applying different scenarios is to investigate the impact on achieving the canopy cover target of changing the number of trees planted and/or the species mix planted.

Planting mixes (Figure E2)

1. *business as usual* (BAU): reflects Council's current planting programs, and is dominated by medium-large tree plantings (96%) with very few very large trees and no very small trees;
2. *more smaller trees*: imagines a focus on street tree plantings (given streets are a constrained environment, more smaller trees are likely to be the dominant size class). Hence, compared to BAU, the mix is dominated by small to medium trees (85%);
3. *more larger* trees: applies an envisaged average possible planting mix based on proposed planting mixes in public streets, parks, and bushland areas. This planting mix includes more very small tress than BAU, but also accommodates more very large trees and a higher overall proportion of medium to very large trees (78.5%).

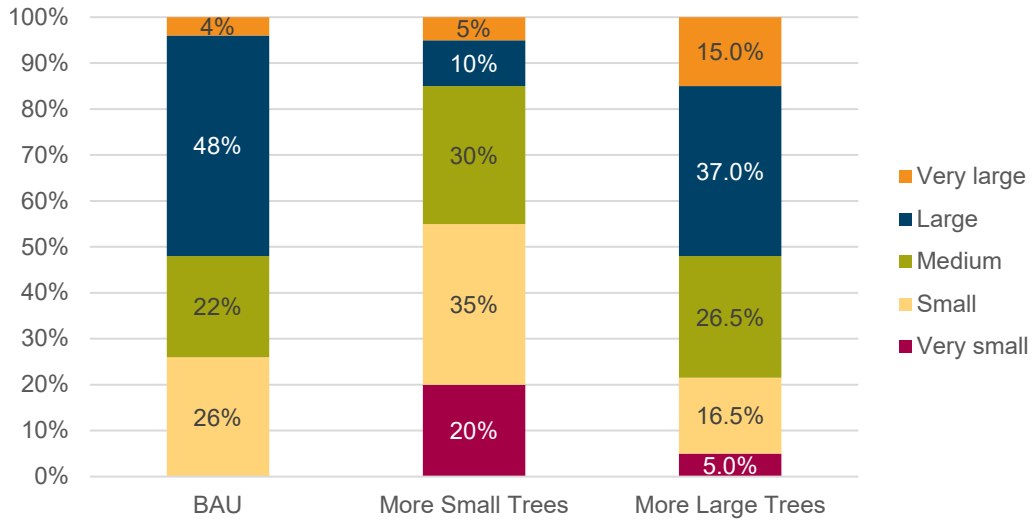


Figure E2. Planting mixes applied in TPP modelling, showing the proportions of very small to very large trees comprising each planting mix.

Planting rates

All planting rates assume planting beginning in 2025 (year one).

1. *Constant*: applies a constant annual planting rate over 25 years through to 2050 (Figure E3);
2. *Intensive front-loading*: applies a variable planting rate to 2050, with a focus on large increases in planting efforts in the first six years. Years two and three increase planting effort by 70% on the previous year's planting rate, with years four to six increasing by 50% on the previous year's planting rate. This planting effort is then reduced in years seven to nine by 70% on the previous year's planting rate and is then held constant for the remaining years.
3. *Moderate front-loading*: applies a variable planting rate over 12 years to 2036, with a focus on a moderate effort over the first eight years. Years two to five increase planting effort by 25% on the previous year's planting rate, with the year five planting rate being held constant over years six to nine, before a 50% decrease in planting effort is applied in each of years 10 to 12. The planting rate is then held constant for the remaining years.

Comparing these planting rates shows that in the short-term both front-loaded rates require more total tree plantings than the constant rate. For the intensive front-loading rate this remains true over the time period to 2050. However, by 2045, the total number of trees planted under the moderate-front loading rate matches that under the constant rate, with the constant rate approach then exceeding the moderate front-loading total plantings.

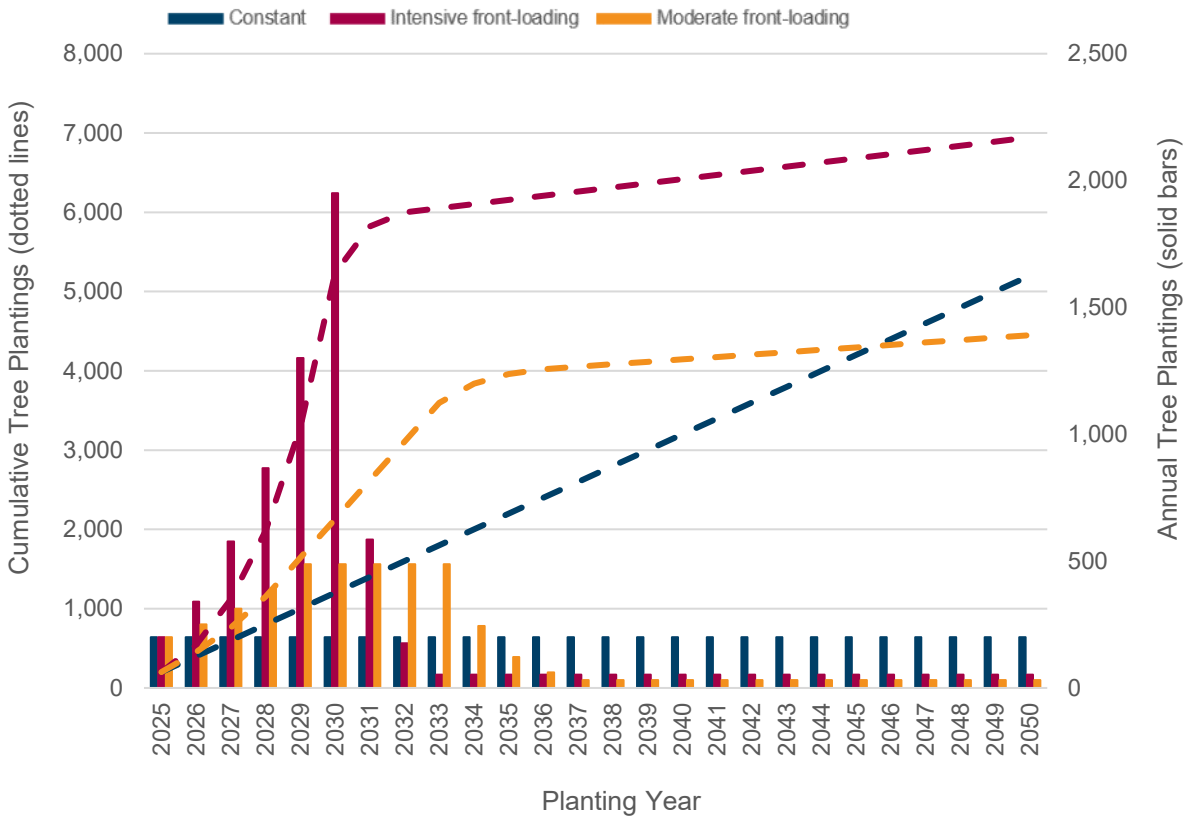


Figure E3. Comparison of planting rates, showing the cumulative number of trees planted over time (dotted lines) and the total number of trees planted per year (bars). Numbers provided are an example based on a year 1 (2024) planting rate of 200 trees (Council's current BAU rate).

For each planting rate, five different planting numbers for year one were also examined to reflect and explore different planting efforts: 200, 500, 1,000, 1,500, and 2,000 trees. This gave a combined total of fifteen combinations of planting rate + planting effort (Table E4).

Table E4. Planting rates and effort combinations modelled in combination with each planting mix to generate planting scenarios.

Planting Rate	Year 1 (2025) Planting Effort	# Trees Planted by 2030	# Trees Planted by 2050	Proportion of Trees Planted by 2030
Constant				
2025-2050: same number of trees are planted each year	200	1,400	5,400	26%
	500	3,500	13,500	26%
	1,000	7,000	27,000	26%
	1,500	10,500	40,500	26%
	2,000	14,000	54,000	26%
Intensive front-loading				
2025-2026: +70% increase on previous year; 2027-2029: +50% increase on previous year; 2030-2032: -70% decrease on previous year; 2033-2050: same number as previous year	200	5,821	6,998	83.2%
	500	14,554	17,494	83.2%
	1,000	29,107	34,989	83.2%
	1,500	43,661	52,483	83.2%
	2,000	58,215	69,978	83.2%
Moderate front-loading				
2025-2028: +25% on previous year; 2029-2032: same number as previous year; 2033-2036: -50% decrease on previous year; 2037-2050: same number as previous year;	200	2,618	4,480	58.4%
	500	6,545	11,199	58.4%
	1,000	13,090	22,398	58.4%
	1,500	19,635	33,597	58.4%
	2,000	26,180	44,795	58.4%

Planting costs

As advised by Council, to plant and establish one tree costs on average between $1,665 and $1,990. For the purposes of the TPP modelling the average of $1,827.50 was applied; annual CPI increases were not included.

This costing is based on a 100L tree and includes: tree purchase, planting labour, and watering and establishment maintenance for 9-12 months. It is noted though that the costs of tree planting and establishment can vary depending on aspects of specific to the planting location, such as: site conditions, proximity to other assets, constraints of the site, and requirements for consultation as prescribed by legislation. Costs can range to be 3-4 times the base cost if a higher order of resource requirements are applied such as root control devices, prescribed consultative measures, and soil amelioration.

In setting budgets and long-term financial plans these aspects should be recognised, and figures adjusted as required to reflect CPI increases and local site conditions and requirements. Further, it should be noted that the investment required by Council to achieve future canopy targets is not only influenced by the cost per tree, but also the number of trees planted per year, and the ability to spread plantings across tenure types other than public Council land.

Results

The following tables provide a snapshot summary of TPP outputs and costings for each of the planting mixes: BAU (Table E5), more small trees (Table E6), and more large trees (Table E7). Results in bold achieve either the 30% or 40% target by 2050. Highlighted scenarios are discussed as comparative case studies below.

Table E5. Summary of TPP model outputs for the 'BAU' planting mix.

		30% CANOPY COVER TARGET			40% CANOPY COVER TARGET		
Planting Rate	**Year 1 Planting Effort**	**Year Target Achieved**	**# Trees Planted by Target Year**	**Total Cost by Target Year ($)**	**Year Target Achieved**	**# Trees Planted by Target Year**	**Total Cost by Target Year ($)**
Constant	200	-	-	-	-	-	-
	500	-	-	-	-	-	-
	1,000	**2047**	**24,000**	**43,860,000.00**	-	-	-
	1,500	**2042**	**28,500**	**52,083,750.00**	2057	51,001	93,204,327.50
	2,000	**2039**	**32,000**	**58,480,000.00**	2051	56,000	102,340,000.00
Intensive front-loading	200	-	-	-	-	-	-
	500	**2041**	**16,309**	**29,804,697.50**	-	-	-
	1,000	**2036**	**31,302**	**57,204,405.00**	**2049**	**34,726**	**63,461,765.00**
	1,500	**2034**	**46,163**	**84,362,882.50**	**2041**	**48,928**	**89,415,920.00**
	2,000	**2034**	**61,551**	**112,484,452.50**	**2039**	**64,184**	**117,296,260.00**
Moderate front-loading	200	-	-	-	-	-	-
	500	-	-	-	-	-	-
	1,000	**2040**	**20,872**	**38,143,580.00**	-	-	-
	1,500	**2037**	**30,621**	**55,959,877.50**	2052	34,054	62,233,685.00
	2,000	**2036**	**40,523**	**74,055,782.50**	**2044**	**42,964**	**78,516,710.00**

Table E6. Summary of TPP model outputs for the 'more small trees' planting mix.

		30% CANOPY COVER TARGET			40% CANOPY COVER TARGET		
Planting Rate	**Year 1 Planting Effort**	**Year Target Achieved**	**# Trees Planted by Target Year**	**Total Cost by Target Year ($)**	**Year Target Achieved**	**# Trees Planted by Target Year**	**Total Cost by Target Year ($)**
Constant	200	-	-	-	-	-	-
	500	-	-	-	-	-	-
	1,000	-	-	-	-	-	-
	1,500	**2050**	**40,500**	**74,013,750.00**	-	-	-
	2,000	**2045**	**44,000**	**80,410,000.00**	-	-	-
Intensive front-loading	200	-	-	-	-	-	-
	500	-	-	-	-	-	-
	1,000	**2039**	**32,092**	**58,648,130.00**	-	-	-
	1,500	**2036**	**46,953**	**85,806,607.50**	-	-	-
	2,000	**2034**	**61,551**	**112,484,452.50**	**2046**	**67,871**	**124,034,252.50**
Moderate front-loading	200	-	-	-	-	-	-
	500	-	-	-	-	-	-
	1,000	-	-	-	-	-	-
	1,500	**2041**	**31,537**	**57,633,867.50**	-	-	-
	2,000	2038	41,133	75,170,557.50	-	-	-

Table E7. Summary of TPP model outputs for the 'more large trees' planting mix.

Planting Rate	Year 1 Planting Effort	30% CANOPY COVER TARGET			40% CANOPY COVER TARGET		
		Year Target Achieved	# Trees Planted by Target Year	Total Cost by Target Year ($)	Year Target Achieved	# Trees Planted by Target Year	Total Cost by Target Year ($)
Constant	200	-	-	-	-	-	-
	500	2058	18,501	33,810,577.50	-	-	-
	1,000	**2045**	**22,000**	**40,205,000.00**	2062	38,500	70,358,750.00
	1,500	**2041**	**27,000**	**49,342,500.00**	2052	43,500	79,496,250.00
	2,000	**2038**	**30,000**	**54,825,000.00**	**2048**	**50,000**	**91,375,000.00**
Intensive front-loading	200	-	-	-	-	-	-
	500	**2039**	**16,046**	**29,324,065.00**	-	-	-
	1,000	**2035**	**31,039**	**56,723,772.50**	**2044**	**33,409**	**61,054,947.50**
	1,500	**2034**	**46,163**	**84,362,882.50**	**2040**	**48,533**	**88,694,057.50**
	2,000	**2033**	**61,024**	**111,521,360.00**	**2038**	**63,657**	**116,333,167.50**
Moderate front-loading	200	-	-	-	-	-	-
	500	2052	11,351	20,743,952.50	-	-	-
	1,000	**2039**	**20,719**	**37,863,972.50**	-	-	-
	1,500	**2037**	**30,621**	**55,959,877.50**	**2046**	**32,681**	**59,724,527.50**
	2,000	**2035**	**40,218**	**73,498,395.00**	**2042**	**42,354**	**77,401,935.00**

Case Study 1: Business as usual (no change)

If no changes are made to the current planting programs or rates of canopy loss we will not only fail to increase our canopy cover but will fail to even maintain the current canopy cover amount (Figure E4). Under a BAU scenario, planting to 2050 will result in a 23.8% canopy cover, which is less than current canopy of 27.4%. This is because the current planting effort on public land is being outpaced by canopy losses (primarily on private land).

Under this scenario, by 2050 we will have planted 5,400 trees at a cost of $9,868,500.

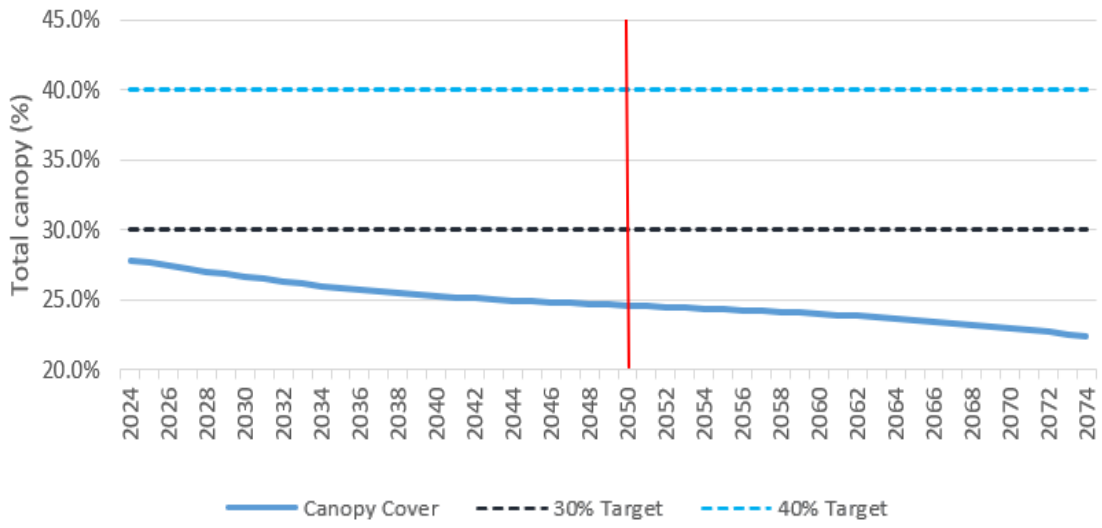


Figure E4. Projected canopy cover under a BAU scenario.

Modelling showed that to simply neutralise the current rate of canopy loss, assuming no changes in this rate of loss, we will need to plant at least 500 trees per year for the foreseeable future (Figure E5).

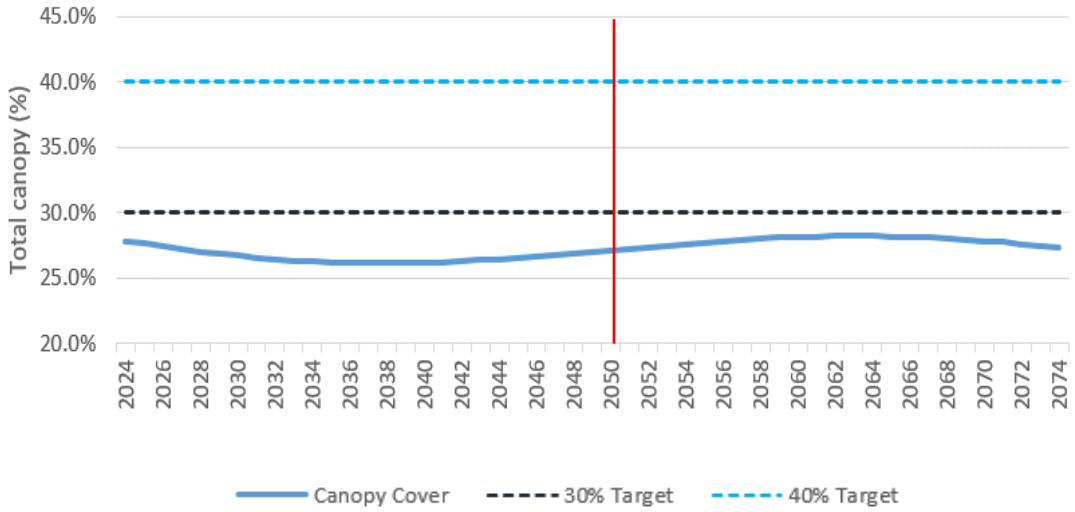


Figure E5. Projected canopy cover assuming a relatively neutral canopy cover over time.

Case Study 2: 40% canopy cover by 2046

This scenario achieves the desired **40%** canopy cover over the next 23 years **by 2046**; four years earlier than the proposed target year of 2050 (Figure E6). This scenario will also achieve a **30%** canopy cover target **by 2037** (Table E8). Of the 11 scenarios modelled that achieved the 40% target before 2050, this was also the most cost efficient.

Under this scenario the species planting mix is altered to 'more large trees', which is not significantly different to our current planting mix. However, we would need to significantly increase our planting rate and effort applying the moderately front-loaded planting rate and planting 1,500 trees in year one (2025), which is 7.5 times the current BAU rate of 200 (Table E8). From 2025 to 2028, we would need to increase our yearly planting effort by 25% each year, resulting in a **maximum planting effort of 3,662 trees per year from 2028-2032**. We would then hold this planting effort for four years to 2032. From 2033 to 2036 we would reduce our planting effort by 50% each year resulting in a planting effort of 229 trees per year as of 2036. This planting rate is then continued through to 2046, by which time **a total of 32,681 trees** would have been planted. **We do not have enough plantable space on public or private land to achieve this.**

A **total investment of $59,724,527.50** would be required (Table E8), which is more than $1.3M less than the next cheapest 40% scenario, and approximately $51.3M more than the current BAU scenario over the same time period. This scenario involves a peak planting effort of 3,662 trees per year in 2028-2030, which whilst high is still lower that the other 40% scenarios, some of which required nearly 20,000 trees to be planted in a single year. Under this scenario, we would have planted and invested 37.7% of the total required in the first five years, and more than 90% by 2036 (Table E8).

Whilst the investment may seem high, particularly compared to current investments in tree planting programs, it should be noted that this, like all scenarios, assumes: specific planting mixes, a constant background rate of canopy cover loss, and a 95% establishment success rate for new plantings. It may be possible to achieve these targets earlier and/or more cost efficiently if we were able to increase the proportion of medium-very large trees planted

and/or improve on issues that currently inhibit our planting efforts, such as the current average rate of canopy cover loss or our establishment success rate for new plantings. However, addressing such issues will also require additional resourcing and so the cost-benefits of aiming for such efficiencies should be carefully considered prior to actioning.

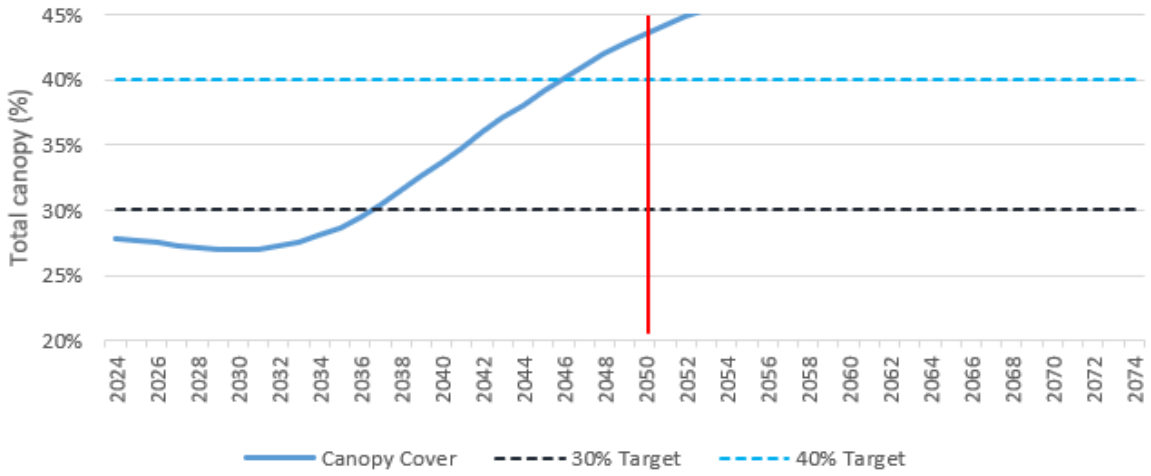


Figure E6. Projected canopy cover of the most cost-efficient scenario to achieve 40% cover by 2050.

Table E8. Details of the yearly planting effort and associated cost and total cumulative canopy cover achieved through this scenario.

Year	Annual Planting Effort (trees)	Annual Cost ($)	Total Canopy Cover
2024	1500	2,741,250.00	27.9%
2025	1875	3,426,562.50	27.7%
2026	2344	4,283,203.13	27.5%
2027	2930	5,354,003.91	27.3%
2028	3662	6,692,504.88	27.1%
2029	3662	6,692,504.88	27.0%
2030	3662	6,692,504.88	27.0%
2031	3662	6,692,504.88	27.0%
2032	3662	6,692,504.88	27.2%
2033	1831	3,346,252.44	27.5%
2034	916	1,673,126.22	28.0%
2035	458	836,563.11	28.7%

Year	Annual Planting Effort (trees)	Annual Cost ($)	Total Canopy Cover
2036	229	418,281.56	29.5%
2037	**229**	**418,281.56**	**30.4%**
2038	229	418,281.56	31.5%
2039	229	418,281.56	32.6%
2040	229	418,281.56	33.7%
2041	229	418,281.56	34.8%
2042	229	418,281.56	35.9%
2043	229	418,281.56	37.0%
2044	229	418,281.56	38.1%
2045	229	418,281.56	39.2%
2046	**229**	**418,281.56**	**40.1%**

Case Study 3: 30% canopy cover by 2039

Of the 27 scenarios that achieved a 30% target, this scenario was the most cost effective. It achieves the **30%** target **by 2039** (Figure E7), which is two years after the same target is achieved in Case Study 2. Like Case Study 2, this scenario also applies a 'more large trees' planting mix, and whilst the first year planting effort for this scenario is low at only 500 trees planted in 2024, it requires an intensive front-loading planting rate. This means that 51% of the required trees are planted in the first five years, with a **maximum planting effort of 4,877 trees** in 2029. By 2039, **a total of 16,046 trees** will have been planted.

Implementing this scenario will require an **investment of $29,324,065** over the next 16 years, which is approximately $20.9M more than the current BAU scenario over the same time period. This scenario does not achieve a 40% target

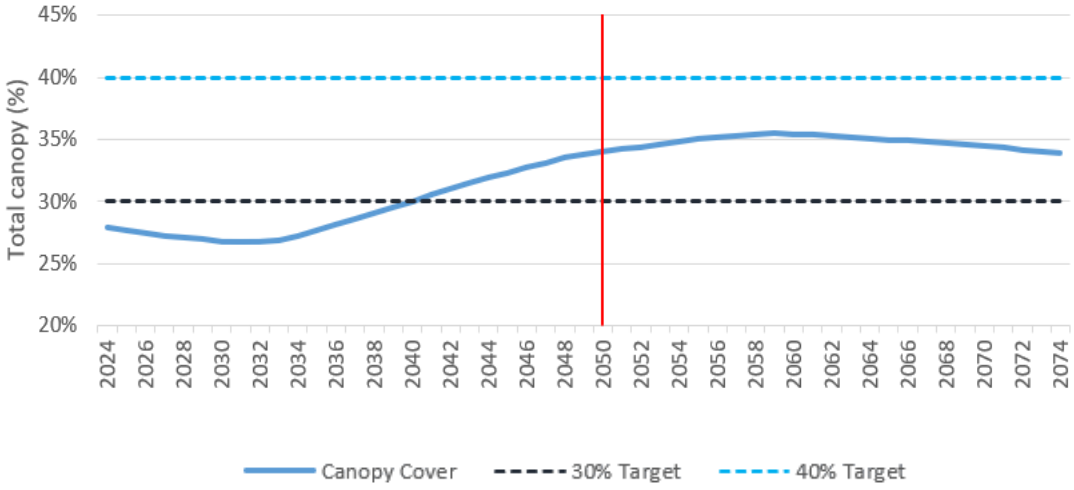


Figure E7. Projected canopy cover of the most cost-efficient scenario to achieve 30% cover by 2050.

Selected Scenario and Target: 30% canopy cover by 2050

Based on the modelling undertaken, we considered the realistic implementation and financial requirements together with the available plantable space and determined that a 40% canopy cover target by 2050 is unrealistic for our Council area. Rather we selected the scenario that most closely achieved the 30% canopy cover target by 2050 (i.e. Case Study 3) and further refined the scenario within the TPP to determine the number of trees needed to be planted to achieve our 30% target by 2050.

The result was a scenario that commenced with a year 1 planting effort of 550 trees (Figure E8). Under this scenario, increased plantings will commence in 2025 and we will plant a total of 13,410 trees by 2050, which is approximately 2.5 times more than what would be planted on public land in the same time period under our current 'business as usual' (BAU) planting rate (see Part 3, Table 4).

As well as altering the number of trees planted and the species mix, we also needed to front-load planting effort in the first 10 years of planting (from 2025) (see Part 3, Figure 15). This front-loaded effort means that 80% of the trees to be planted between 2025 and 2050, will be planted in the first 10 years. A peak planting effort of 1,343 trees per year will be required from 2029 to 2033. The front-loading effort allows for accelerated canopy cover growth to 2050, and also means that by 2036 annual planting efforts will return to nearly the same as current public BAU planting efforts of 200 trees per year.

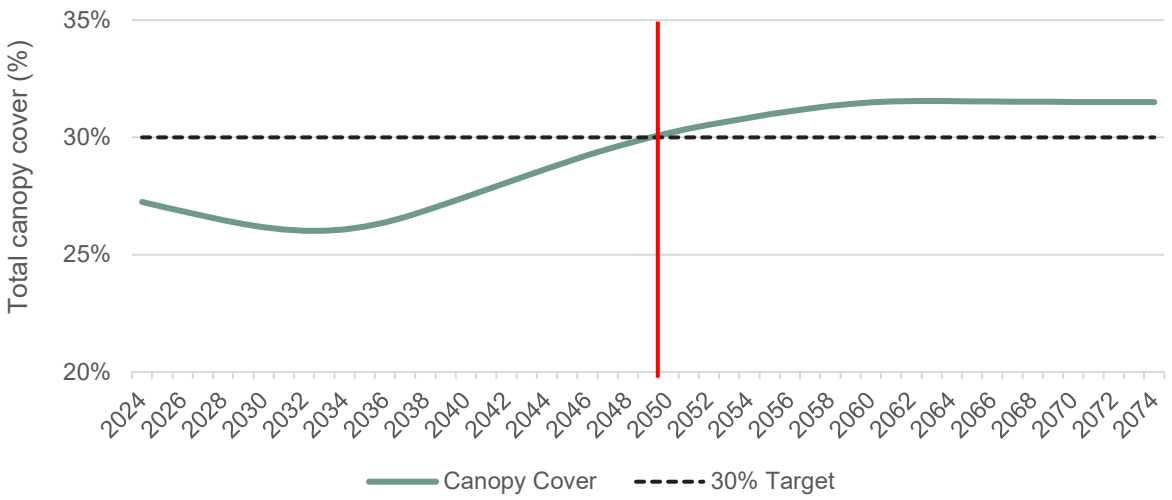


Figure E8. Projected canopy cover under the selected TPP scenario.

Annex F. Street Tree Prioritiser (STP) tool

Approach and Method

Edge's Street Tree Prioritiser (STP) tool was used to quantify and prioritised plantable locations. A plantable location was defined by using the following criteria:

1. Located within a public road reserves, parklands, and bushlands
2. Surfaces containing at least 1m^2 of plantable space, defined as any lawn grass or natural surface.
3. Places that are not currently covered by tree canopy and are more than 5m away from the nearest existing tree.

Data Sources

Nearmap is a subscription-based data service providing regular high resolution aerial imagery updates and a suite of AI-based add-on packs. The AI vegetation pack from Nearmap includes a canopy cover layer (>2m height) used to define canopy. The AI surfaces pack from Nearmap includes lawn grass, and natural ground covers which together were taken to represent plantable space.

Additional spatial data was provided by Council including road corridor, park, crown lands, land use zoning, and land ownership. All parkland areas were those designated zoning categories RE1, C1, C2, including bushland areas designated using Crown Lands datasets. All datasets were post-processed within ArcGIS and QGIS and results were tabulated to the Council, LGA, and road reserve/parkland/bushland areas. All data were projected using Geocentric Datum of Australia 2020 (GDA 2020) Map Grid of Australia Zone 56.

Landsat surface temperature data was acquired from the United States Geological Survey via EarthExporer.com and was post processed according to the Landsat 8 user handbook. Absolute surface temperature values were translated into relative surface temperature values above or below baseline values using the CSIRO methodology[28]. The Landsat thermal data used was collected on February 28, 2021, which corresponded to a hot, clear day in the area (maximum air temperature 28.9 °C as measured at BOM Sydney - Observatory Hill station).

Social vulnerability data was provided by the Australian Bureau of Statistics using the 2016 Socio-Economic Indexes for Areas (SEIFA) Index of Relative Socio-economic Disadvantage (IRSD), assigned using SA1 level data, except for Watsons Bay (SA1 1134629), which due to having no population, did not have a SIEFA score. Prioritisation calculations in these locations were conducted using the average SEIFA score of the council to prevent the over- or under-weighting of canopy and heat scores in these areas (excluding SEIFA scores all together would multiply the influence of areas with no canopy or high heat, artificially promoting those areas to highest priority).

Quantifying Plantable Opportunities

Plantable space was identified using NearMap Surfaces Datapack derived from imagery acquired on December 21, 2021. All lawn grass and natural surfaces within the surfaces datapack were deemed 'Plantable Space'. This plantable space layer was reviewed by Council to remove active sports field areas (i.e. playing areas of sporting ovals and golf fairways) as they are not considered

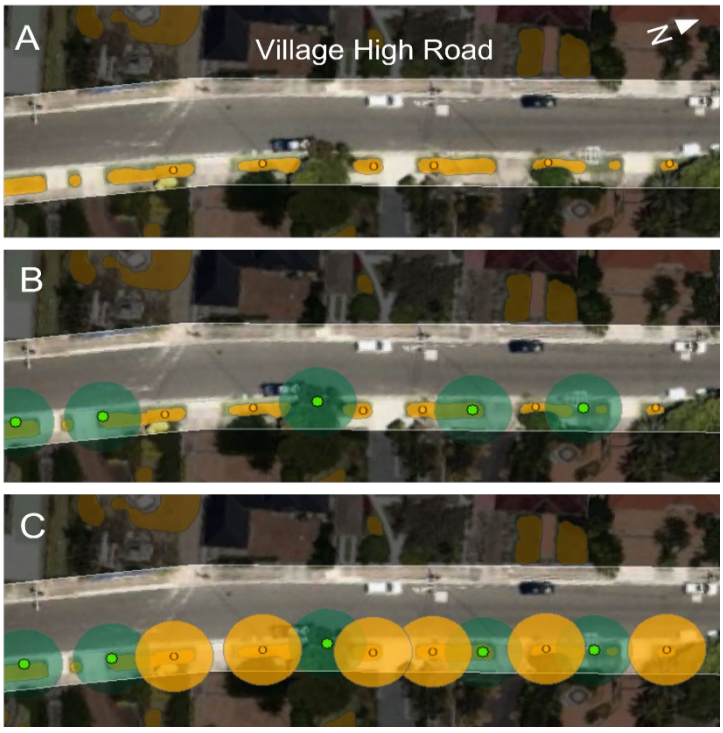
[28] Caccetta, Peter; Devereux, Drew; Amati, Marco; Boruff, Bryan; Kaspar, Joseph; Phelan, Kath; Saunders, Alex (2017): Land surface temperature and urban heat island estimates for Australian urban centres. v2. CSIRO. Data Collection. https://doi.org/10.4225/08/59bf0ce837385

viable planting locations. All plantable space that was large enough to support a tree (>1m^2) and far enough (>5m) from existing trees was identified as a 'Plantable Opportunity' (Figure F1). Plantable opportunities were tabulated for the whole of council to understand how many trees the council could theoretically support. However, not every plantable opportunity can be planted due to ownership, use, utilities, or one of many other restrictions.

As such, road corridors[29], parklands[30], and bushlands[31] were specifically evaluated to tabulate their plantable opportunities and to prioritise each of these landscapes to ensure tree planting achieves its greatest impact most urgently.

- Plantable Space: area of land covered by grass or other natural surfaces (excluding council-identified sports fields)
- Plantable Opportunity: Plantable space that is >1m^2 in area and at least 5m from current trees and nearest plantable opportunity.

Road reserves were also delineated using suburb boundaries, prioritising results in terms of an entire road corridor within a single suburb. Parklands were assessed according to their individual park boundary but also separated at the suburb boundary, thus some road reserves and parks may have two listings differentiated by the suburb designation. Plantable opportunities were calculated for each individual assessment area (individual road reserve, park, or bushland).



A. Plantable space (orange areas) is any surface that is grass or natural covering. Plantable opportunities (orange points) are any plantable space larger the 1m^2 and more than 5m from the nearest plantable opportunity.

B. Plantable opportunities are excluded if they fall within 5m of a current tree (green points) or under canopy (green areas).

C. Precise, data-informed calculations of the total number of plantable opportunities allows for modelling of canopy evolution over time using parameters to estimate crown size at maturity depending on species selection.

Figure F1. Example from a section of Village High Road, Vaucluse, of how the STP tool identifies plantable opportunities.

[29] Acquired from Woollahra Municipal Council Road Reserves Split Dataset.

[30] Identified as all Public Parklands (RE1), Private Recreation (RE2), National Parks and Reserves (C1), and Environmental Conservation (C2) zones from Council's Local Environmental Plans Zoning dataset.

[31] Bushland areas defined using the draft Crown Land plan of management and were removed and analysed separately from the Parklands dataset.

Prioritising Plantable Opportunities

To understand where planting will have its most immediate impacts, each individual road reserve, parkland, and bushland area was ranked based on its number of plantable opportunities, urban heat, and social vulnerability. Values for all three variables were obtained for each assessment area. To integrate these three data sources into a single comparable metric and to avoid undue influence from the long-tail distributions, each dataset was normalised to the 5th and 95th percentile, meaning the highest 5% of values were set equal to 1, and the lowest 5% of values were set equal to zero, to avoid over undue influence of outliers (i.e. small roads with no canopy). Remaining values were then normalised between 0 and 1. With all three metrics normalised from 0-1, the average of these three values was used to calculate the Integrated Priority Assessment (IPA) Score. This allowed for areas to be ranked according to their combined need for planting and ranging from 0 (low priority) to 1 (highest priority).

Prioritised Annual Planting Plan

The prioritisation outputs from the STP analysis will be combined with the outputs of the best planting scenario from the TPP analysis to develop an annual prioritised planting plan for the Council. This is done by taking the total number of trees to be planted in each year to achieve the canopy cover target and applying this to the prioritised planting locations to develop a year-by-year planting plan. For example, if 1,000 trees are to be planted each year, then the year 1 planting plan will comprise the top 1,000 highest ranked planting locations; year 2 will comprise the next 1,000 highest ranked planting locations, and so on until all trees are planted as required to reach the cover target by 2030, or all plantable opportunities are filled. This insight can be used to inform implementation frameworks and community engagement around annual planting programs.

Results – Plantable Opportunities

Assessing all plantable space across both private and public lands within the Council identified 20,264 plantable opportunities with Vaucluse having the highest number of 7,042 (Table F1). Vaucluse also had the highest number of plantable opportunities within Road Reserves (1,421) and Public Parks (2,165). Rose Bay had the second most plantable opportunities (4,672), however many of those were within the private recreation areas associated with the Royal Sydney Golf Club. Despite the large presence of the Royal Sydney Golf Club, Rose Bay still had the second highest number of plantable opportunities in public parklands (720). The second most plantable opportunities found within road reserves occurred in Bellevue Hill (803). Darling Point, Double Bay, and Woollahra all had between 100-200 plantable opportunities within the road reserves, while Watsons Bay, Paddington, Point Piper, and Edgecliff and had limited (<100) road reserve planting areas.

Table F1. Plantable opportunities within each suburb and across Woollahra Municipal Council (WMC)

Suburb	Total Plantable Opportunities (Public and Private)	Total Plantable Opportunities (Public)	Plantable Opportunities (Road Reserves)	Plantable Opportunities (Public Parks)	Plantable opportunities (Bushlands)
Vaucluse	7,042	3,588	1,421	2,165	2
Rose Bay	4,672	1,248	528	720	0
Bellevue Hill	3,313	1,081	803	278	0
Watsons Bay	1,292	770	90	569	111
Darling Point	1,273	661	104	557	0

Suburb	Total Plantable Opportunities (Public and Private)	Total Plantable Opportunities (Public)	Plantable Opportunities (Road Reserves)	Plantable Opportunities (Public Parks)	Plantable opportunities (Bushlands)
Woollahra	817	203	115	88	0
Double Bay	759	340	135	205	0
Point Piper	551	76	73	3	0
Paddington	347	83	16	67	0
Edgecliff	198	51	47	4	0
WMC	***20,264***	***8,101***	***3,332***	***4,656***	***113***

Of the 20,264 plantable opportunities across the Council area, just under 40% (8,101) occur on public land (road reserves, parklands, and bushland areas - Table F2, Figure F1). Of the public plantable opportunities, 57.5% occur in parklands, 41.1% in road reserves (i.e. street corridors), and just 1.4% in bushland areas (Table F2). The lack of plantable opportunities in bushland areas is a result of the already substantial vegetation cover within these areas.

Table F2. Plantable opportunities within public land use zones.

Land Use Zones	Tenure	Total Plantable Opportunities	Proportion (%) of Opportunities		
			Public	Private	Total
Road Reserves	Public	3,332	41.13	n/a	16.44
Parklands (RE1, C1, C2)	Public	4,656	57.47	n/a	22.98
Bushlands	Public	113	1.39	n/a	0.56

Most plantable opportunities fell within privately owned land distributed across the Council area with slight concentration of plantable opportunities in the eastern areas with fewer opportunities in the western areas such as Paddington (Figure F1). Across public lands, several large areas were dominant targets for plantable opportunities, namely golf courses. While golf course fairways were excluded from plantable space, adjacent areas provided many locations for potential tree plantings. Parklands also provide many plantable opportunities, though the distributed tree planting along road reserves presents the best opportunity for distributed planting covering the whole of the Council.

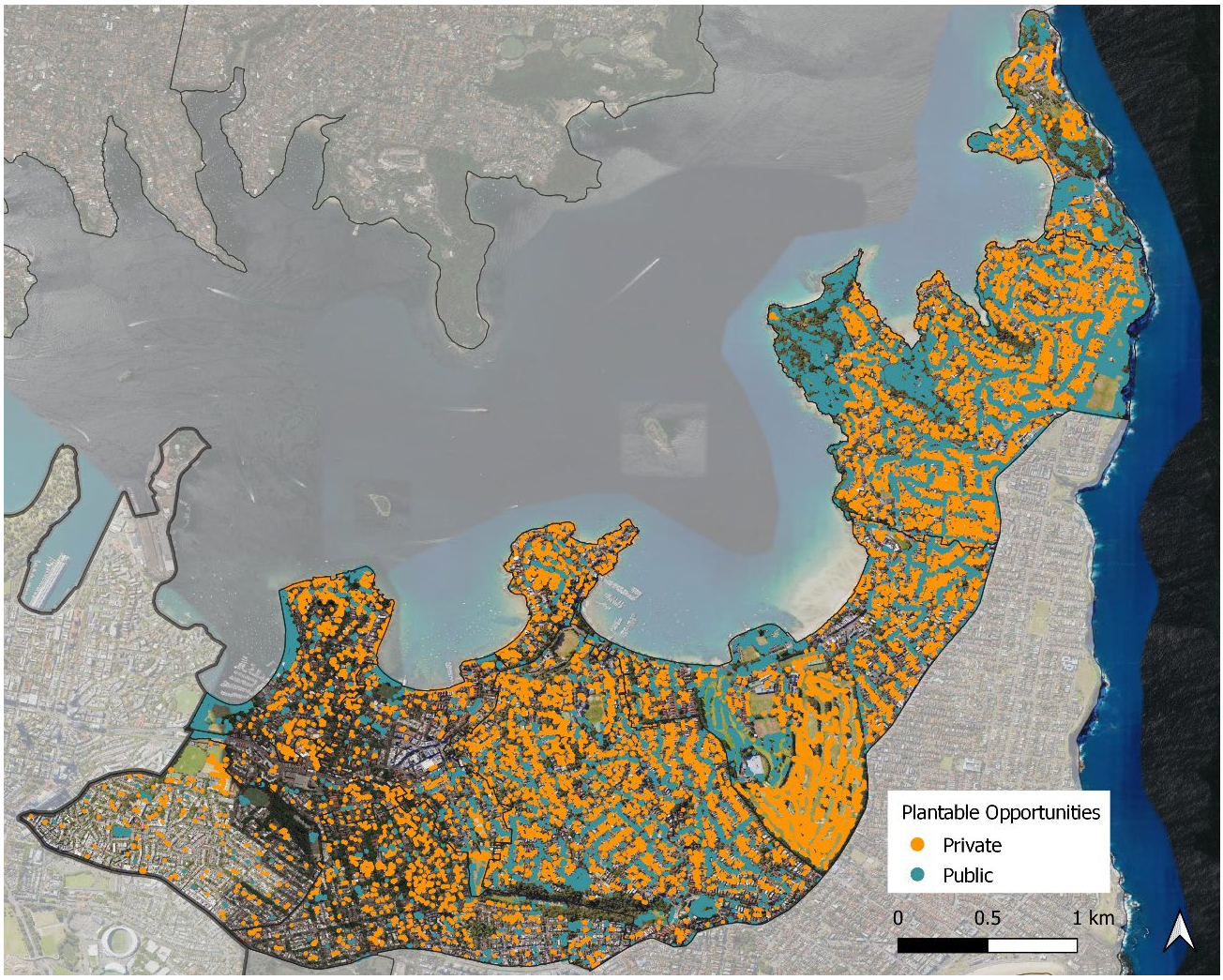


Figure F1. Plantable opportunities identified on both public and private lands.

Results – Prioritising Plantable Opportunities

Reviewing the public assessment areas (road reserves, parklands, and bushlands) for current canopy area reveals that, in general, parklands have better canopy cover than most road reserves (Figure F2). Additionally, road reserve canopy coverage generally reflects the broader canopy coverage of their suburb.

The distribution of urban heat within the assessment areas has several clear trends. First, proximity to water provides a significant cooling impact with areas with larger shorelines (e.g. Watsons Bay) having lower overall temperatures and areas without shoreline (e.g. Paddington) recording warmer temperatures (Figure F3). Additionally, the cooling influence of parks and open spaces is apparent with larger open spaces such as the Royal Sydney Golf Club being cooler than surround assessment areas.

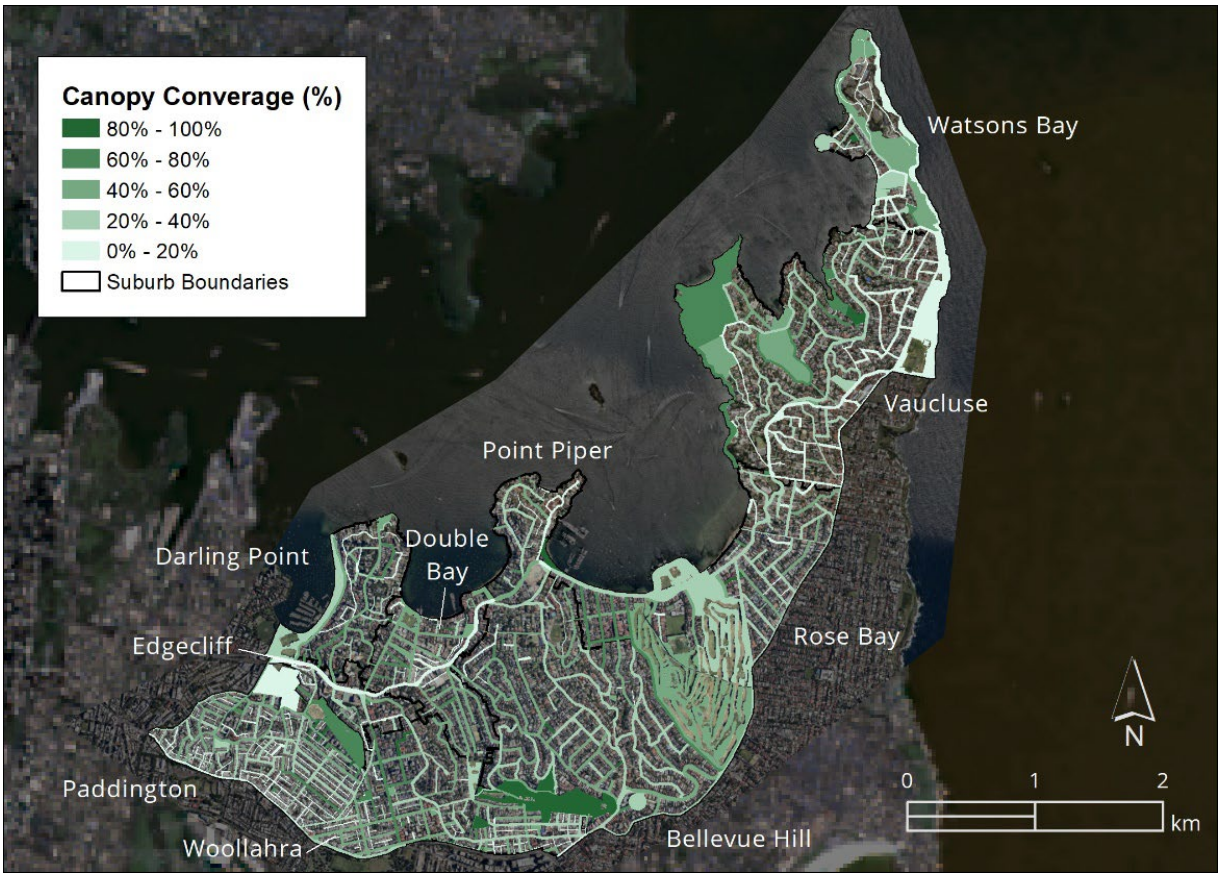


Figure F2. Proportion of canopy cover across assessment areas.

Figure F3. Urban heat relative surface temperatures for all assessment areas

Social vulnerability across the assessment areas was generally found to be relatively low compared to broader averages. Across the council, generally areas nearer the shoreline and closer to parklands were found to have lower social vulnerability (Figure F4). Within the WMC area, there were several areas without population and therefore without SEIFA scores.

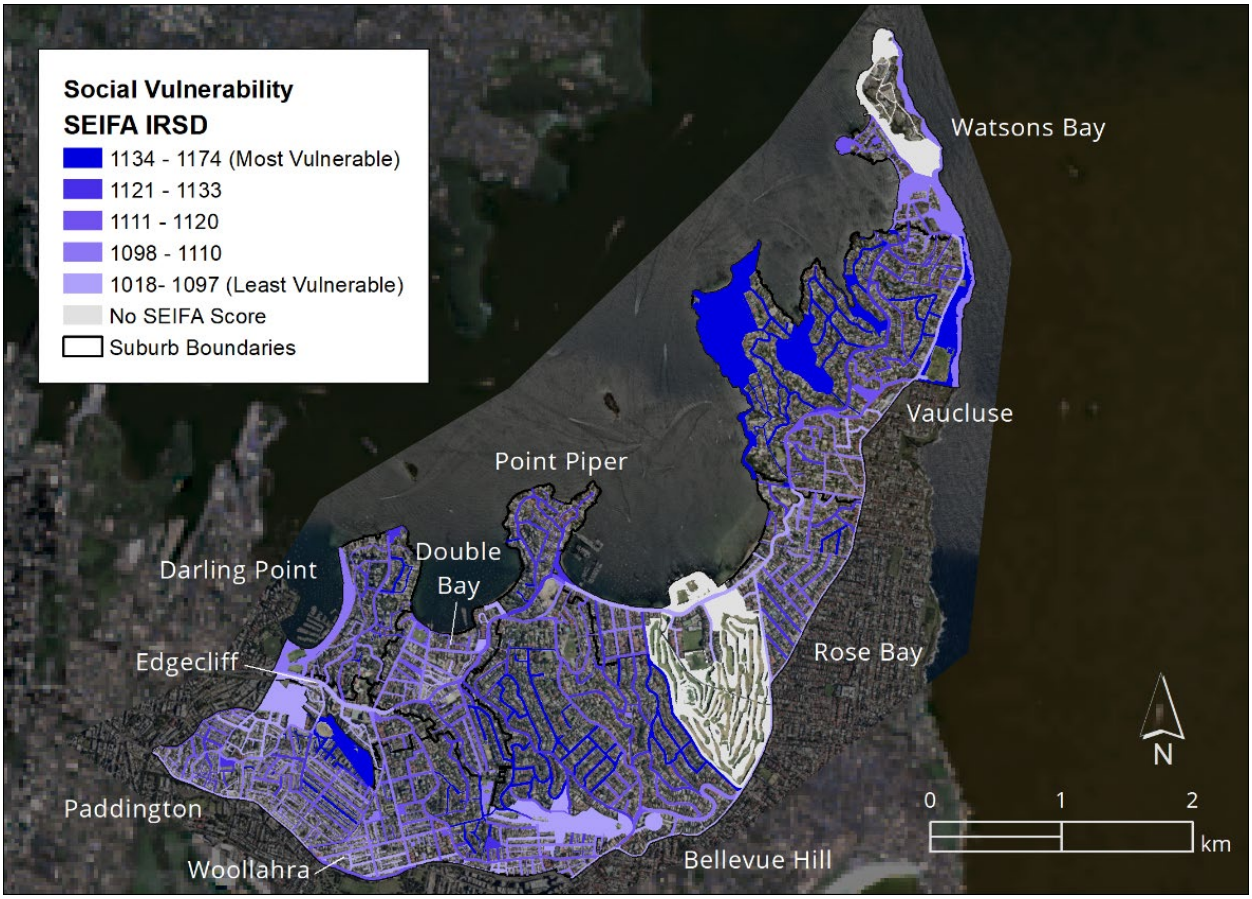


Figure F4. Social Vulnerability for each assessment area calculated as the SEIFA IRSD score.

Although all the above metrics - canopy coverage, urban heat, and social vulnerability - provide a suitable rationale for prioritising planting, this study also provided an integrated prioritisation assessment score to give a single comparative metric of combined prioritisation across the whole of Council. These individual variable maps allow for re-prioritisation based on individual and/or local considerations.

High priority planting areas are generally well spread across the council (Figure F5), with Bellevue Hill and Vaucluse having a moderately higher density of high priority spots. Coastal areas tend to be a lower priority on account of water-front cooling reducing their urban heat values. At the suburb scale, Watsons Bay, Point Piper, and Darling Point were the three coolest suburbs while Paddington, Woollahra, Bellevue, and Edgecliff were the hottest. As a result, Watsons Bay, Point Piper, and Darling Point have the fewest high priority areas (Figure F5). Of the top 100 highest priority plantable opportunities, Bellevue Hill and Vaucluse each have 21, Paddington has 18, Rose Bay has 16, Woollahra has 15, Double Bay and Edgecliff each have three, Darling Point has two, and Watsons Bay has one.

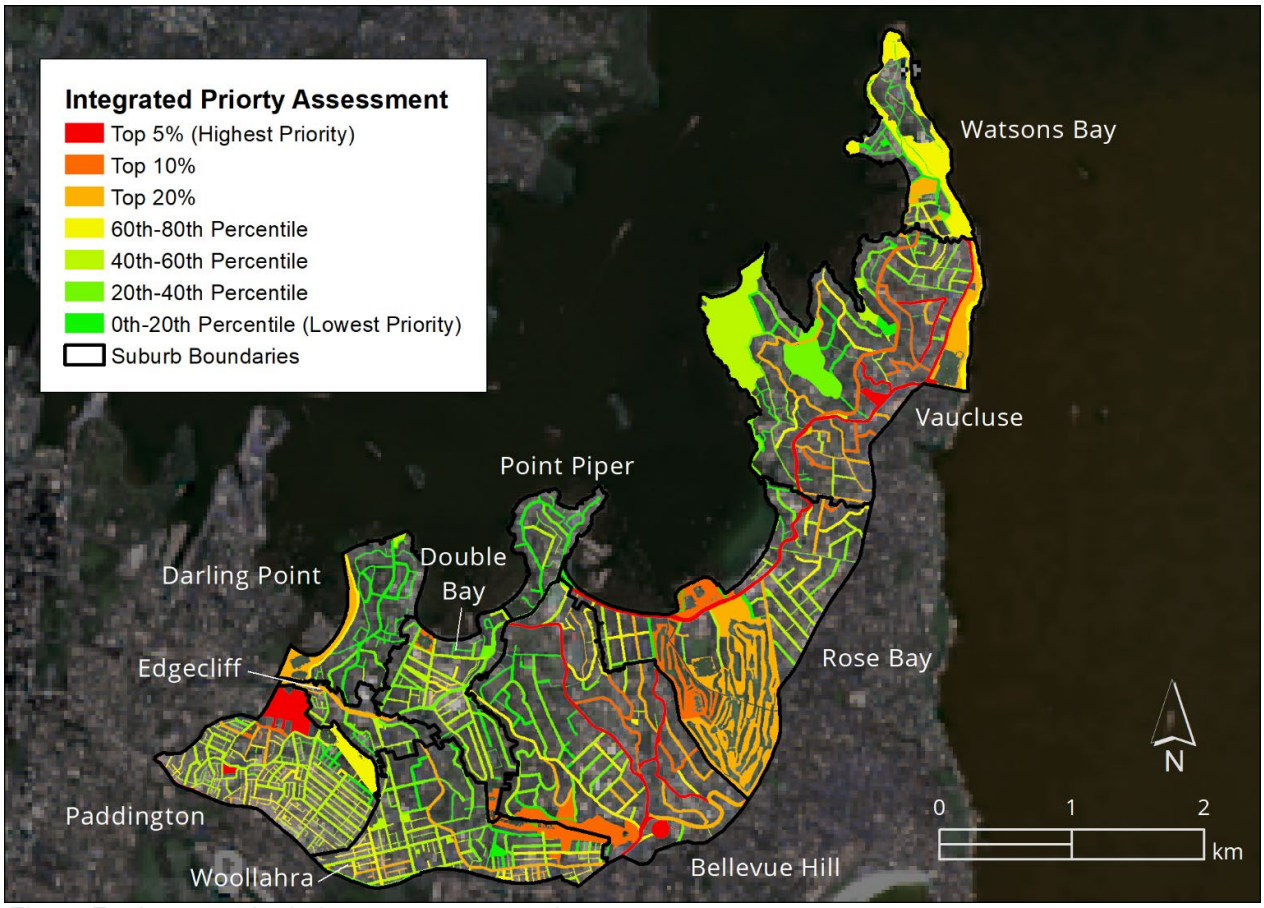


Figure F5. Integrated priority assessment results.

Across the whole of council, Bellevue Park and the Royal Hospital for Women Park were the highest priority planting areas. Both areas had a large number of plantable opportunities (both above 95th percentile), and both had high relative heat island scores, though the Bellevue Park received a higher social vulnerability score giving it top priority over Royal Hospital for Women Park (Table F3). Victoria Road in Belleview Hill was the highest priority road with a high number of plantable opportunities, a high heat score, and moderate social vulnerability. Bellevue Hill has five of the top 10 highest priority areas, although high priority areas are generally well distributed across the whole of Council.

Table F3. Integrated Priority Assessment results for the top 10 features (e.g. park, road), ordered by overall IPA rank. For each feature (type), the name and suburb are shown, together with the feature's overall IPA score, and the absolute values and normalised scores (in grey text) for each on the IPA component criteria (i.e. plantable opportunities, relative urban heat, SEIFA IRSD).

IPA Rank	Type	Name	Suburb	IPA Score	Plantable Opportunities (score)		Relative Urban Heat Value (score)		SEIFA IRSD Value (score)	
1	Park	Bellevue Park	Bellevue Hill	0.77	125	(1.00)	+5.43	(0.57)	1058	(0.74)
2	Park	Royal Hospital for Women Park	Paddington	0.73	37	(1.00)	+7.22	(0.87)	1125	(0.31)
3	Road	Victoria Rd	Bellevue Hill	0.72	52	(1.00)	+6.51	(0.75)	1112	(0.40)

IPA Rank	Type	Name	Suburb	IPA Score	Plantable Opportunities (score)		Relative Urban Heat Value (score)		SEIFA IRSD Value (score)	
4	Road	New South Head Rd	Rose Bay	0.71	96	(1.00)	+5.32	(0.55)	1083	(0.58)
5	Road	Bundarra Rd	Bellevue Hill	0.71	38	(1.00)	+6.87	(0.81)	1124	(0.32)
6	Road	Old South Head Rd	Rose Bay	0.70	21	(0.57)	+6.35	(0.72)	1046	(0.82)
7	Road	Old South Head Rd	Vaucluse	0.70	128	(1.00)	+5.67	(0.61)	1096	(0.50)
8	Road	Bunyula Rd	Bellevue Hill	0.70	37	(1.00)	+7.19	(0.87)	1140	(0.22)
9	Road	New South Head Rd	Vaucluse	0.68	100	(1.00)	+5.94	(0.66)	1113	(0.39)
10	Road	Latimer Rd	Bellevue Hill	0.77	47	(1.00)	+6.78	(0.80)	1137	(0.24)

Road Reserves

Road reserves offer one the most impactful locations for tree plantings as these are often the areas when citizens most frequently encounter trees and therefore plantings in these areas may make the biggest day-to-day impact on people's lives. Victoria Road in Bellevue Hill was identified as having the highest planting priority of all road reserves (Table F4). Planting trees at any of the 52 plantable opportunities along this road would likely increase the walkability on this area (Figure F6). Of the highest 100 priority areas, 80 are road reserves, offering a total of 1,819 plantable opportunities. While planting any of the 3,332 opportunities within road reserves would provide benefits to those areas, 55% of road reserves were found to have no plantable opportunities at all, including 22 of the top 80 priority roads. This is due either to being well saturated with existing trees or being over crowded with impermeable surfaces. Regardless of the reason, tree planting plans should assess the distribution of tree plantings and address any underlying reasons that may be excluded certain areas from planting consideration.

Figure F6. Example of plantable opportunities (orange points) along Victoria Road in Bellevue Hill.

Table F4. Integrated Priority Assessment results for the **top 10 roads**, ordered by overall IPA rank. For each road, the name and suburb are shown, together with the overall IPA score, and the absolute values and normalised scores (in grey text) for each on the IPA component criteria (i.e. plantable opportunities, relative urban heat, SEIFA IRSD).

IPA Rank	Type	Name	Suburb	IPA Score	Plantable Opportunities (score)		Relative Urban Heat Value (score)		SEIFA IRSD Value (score)	
3	Road	Victoria Rd	Bellevue Hill	0.72	52	(1.00)	+6.51	(0.75)	1112	(0.40)
4	Road	New South Head Rd	Rose Bay	0.71	96	(1.00)	+5.32	(0.55)	1083	(0.58)
5	Road	Bundarra Rd	Bellevue Hill	0.71	38	(1.00)	+6.87	(0.81)	1124	(0.32)
6	Road	Old South Head Rd	Rose Bay	0.70	21	(0.57)	+6.35	(0.72)	1046	(0.82)
7	Road	Old South Head Rd	Vaucluse	0.70	128	(1.00)	+5.67	(0.61)	1096	(0.50)
8	Road	Bunyula Rd	Bellevue Hill	0.70	37	(1.00)	+7.19	(0.87)	1140	(0.22)
9	Road	New South Head Rd	Vaucluse	0.68	100	(1.00)	+5.94	(0.66)	1113	(0.39)
10	Road	Latimer Rd	Bellevue Hill	0.77	47	(1.00)	+6.78	(0.80)	1137	(0.24)
11	Road	Old South Head Rd	Bellevue Hill	0.66	15	(0.41)	+6.97	(0.83)	1058	(0.74)
12	Road	Serpentine Pde	Vaucluse	0.65	55	(1.00)	+5.52	(0.59)	1117	(0.37)

Parklands

Parklands hold the majority of plantable opportunities on public lands (Table F5) containing 4,656 opportunities. Bellevue Park and its 125 plantable opportunities was identified as having the highest planting priority. The large open spaces of parklands often have considerable capacity for additional tree plantings. Given that the STP spaces plantable opportunities at 5m intervals (assuming 10 diameter crown at maturity), this tends to overfill parkland areas that may be more suited for larger crowned trees (for further discussion, see section on tree size influence on STP outputs).

Table F5. Integrated Priority Assessment results for the **top 10 parks**, ordered by overall IPA rank. For each park, the name and suburb are shown, together with the overall IPA score, and the absolute values and normalised scores (in grey text) for each on the IPA component criteria (i.e. plantable opportunities, relative urban heat, SEIFA IRSD).

IPA Rank	Type	Name	Suburb	IPA Score	Plantable Opportunities (score)		Relative Urban Heat Value (score)		SEIFA IRSD Value (score)	
1	Park	Bellevue Park	Bellevue Hill	0.77	125	(1.00)	5.43	(0.57)	1058	(0.74)

IPA Rank	Type	Name	Suburb	IPA Score	Plantable Opportunities (score)		Relative Urban Heat Value (score)		SEIFA IRSD Value (score)	
2	Park	Royal Hospital for Women Park	Paddington	0.73	37	(1.00)	7.22	(0.87)	1125	(0.31)
15	Park	Samuel Park	Vaucluse	0.65	58	(1.00)	5.44	(0.57)	1117	(0.37)
22	Park	Tingira Memorial Park	Rose Bay	0.63	213	(1.00)	5.05	(0.51)	0	(0.37)
29	Park	Gugara Park	Paddington	0.61	6	(0.16)	5.97	(0.66)	1018	(1.00)
30	Park	Plumb Reserve	Woollahra	0.61	18	(0.49)	6.66	(0.78)	1087	(0.56)
33	Park	Woollahra Golf Course	Rose Bay	0.60	355	(1.00)	+4.59	(0.43)	0	(0.37)
36	Park	Lough Playing Fields	Double Bay	0.60	87	(1.00)	+4.20	(0.36)	1108	(0.42)
42	Park	Cooper Park	Woollahra	0.57	45	(1.00)	+2.95	(0.15)	1087	(0.56)
43	Park	Steyne Park	Double Bay	0.57	59	(1.00)	+3.89	(0.31)	1116	(0.37)

Bushlands

Only three bushland areas were assessed, and all of them ranked as medium or low priority (Table F6). In total, only 113 plantable opportunities were identified in bushland areas.

Table F6. Integrated Priority Assessment **results for bushland areas**, ordered by overall IPA rank. For each bushland area, the name and suburb are shown, together with the overall IPA score, and the absolute values and normalised scores (in grey text) for each on the IPA component criteria (i.e. plantable opportunities, relative urban heat, SEIFA IRSD).

IPA Rank	Name	Type	Suburb	IPA Score	Plantable Opportunities (score)		Relative Urban Heat Value (score)		SEIFA IRSD Value (score)	
123	Gap Park	Bushland	Watsons Bay	0.49	90	(1.00)	1.40	(0.00)	1102	(0.46)
315	Gap Park	Bushland	Watsons Bay	0.41	21	(0.57)	3.29	(0.21)	1102	(0.46)
669	Parsley Bay Reserve	Bushland	Vaucluse	0.17	2	(0.05)	3.04	(0.17)	1135	(0.25)