# Urban Forest Strategy
2017-2027

Moreland City Council

VISION STATEMENT

To promote and encourage the transformation of Moreland into a municipality where healthy trees and vegetation are a core part of the urban environment

Moreland values the important contribution of trees and vegetation in making the municipality a vibrant place to live, work and visit; and is committed to protecting, enhancing and managing our urban forest into the future

MAYOR'S FOREWORD

Moreland's Urban Forest Strategy 2017 – 2027 will enable Council, for the first time, to provide a strategic approach to protecting and enhancing vegetation across the municipality while increasing tree canopy in our streets and parks.

The Urban Forest Strategy aims to realise this vision by nurturing a healthy, attractive and diverse urban forest to improve the health and wellbeing of current and future generations.

Improving tree canopy cover throughout the City of Moreland will increase community health and liveability in the area. Urban forest provides numerous physical and mental health benefits – reducing the impacts of heat and pollution, creating shaded streets and comfortable open spaces, and encouraging physical activity and a connection with nature.

While tree canopy cover in our streets and parks has increased over the past decade, private tree canopy has declined by a quarter.

Moreland's landscape is under pressure from a growing population, urban densification and climate change. This has resulted in a significant decline in vegetation and tree canopy on private land and therefore requires a strong response to protect existing trees and to enhance amenity and liveability through the planting of new canopy trees.

Council is well placed to respond to these challenges and has committed additional resources to improving tree protection across the municipality as well enhancing tree canopy cover.

Key actions in the Urban Forest Strategy 2017 – 2027 include:

- Doubling canopy cover across Moreland to 29 per cent by 2050 to mitigate the impacts of heatwaves
- Improving both the health and successful establishment of Council trees
- Protecting existing trees through improved planning and enforcement measures
- Working closely with community groups and residents to support greening initiatives while fostering positive community attitudes towards urban forest
- Continuing to plant canopy trees in Moreland's streets and parks to fill vacant sites and replace under-performing trees
- Improving tree health and cooling through the integration of water-sensitive urban design

Responsibility for implementing the Urban Forest Strategy goes beyond Moreland City Council's management of its parks, reserves and streetscapes but includes contributions from the whole community.

The development of this Strategy involved significant community engagement and received very strong community support.

I would like to thank those people involved in the development of the strategy: in particular representatives from the community, fellow councillors and council officers.

Cr John Kavanagh
Mayor (2017-2018)

EXECUTIVE SUMMARY

There is strong evidence that improving urban greening through the planting of trees contributes to liveability, community health and wellbeing, cooler neighbourhoods, higher property values, asset protection and amenity values. It also provides opportunities for connecting with nature, something that is often perceived to be missing in urban areas. This vegetation also provides critical ecosystem services such as air and water filtration, shelter, shade, habitat, oxygen, carbon sequestration, stormwater abatement and nutrient cycling.

Over the past two decades Moreland's urban forest has been affected by extended dry periods, urban consolidation, inadequate protection during construction, and constrained levels of maintenance. At the same time, the community are increasingly calling for more action to improve the amenity of streetscapes, increase vegetation cover, reduce the impact of the urban heat island effect and improve the protection, management of existing vegetation and support for community planting.

Council's Street Landscape Strategy (2012) and Urban Heat Island Effect Action Plan (2016) identified expanding canopy cover from trees as the most effective way to cool our streets.

In response, Council has developed this Urban Forest Strategy to deliver practical measures that guide the sustainable planning, planting, management, resourcing and protection of vegetation across Moreland. The term urban forest refers to all the trees and other vegetation in public and private spaces. It includes, for example, street and park trees, front and backyard vegetation, grasslands, shrubs, wetlands, nature strips, balcony plants, and green roofs and walls.

Background work undertaken in preparation of this Strategy has improved our understanding of the current urban forest, its challenges and identified opportunities for greening across the municipality.

Key findings include:

- Moreland has a relatively young urban forest providing 14% tree canopy cover comprised of 9% private trees and 5% public trees (park trees, 2.6%; street trees, 2.4%). This compares with 17.3% tree canopy cover in neighbouring Darebin and 18.5% in Yarra.

- Between 2005 and 2016, overall canopy cover has declined from 15.6% to 14.2%. Urban consolidation is the main cause of the decline in tree canopy on private land from 12% to 9%.

- During the same period, canopy cover from street trees and park trees has grown by 26% and 63% respectively, albeit from a low base.

- The process of urban consolidation has failed to deliver improved landscaping outcomes and vegetation cover through the planning scheme.

- Over the past three decades, community groups and Council have revegetated large areas of our waterways, such as the Merri Creek.

- Over a dozen community groups continue to invest significant volunteer resources in to regularly planting, weeding and maintaining vegetation in Moreland streets, parks and along our waterways.

- It is estimated that Moreland has over 130,000 trees in the public realm and a further 250,000 trees in the private realm.

Street Trees

- Despite the strong medical and scientific evidence base about the benefits of trees, approximately 85% of Moreland's streetscapes are without any natural shade.

- 95% of the current street tree population assessed to have good health.

- Between 2006 and 2017, Council has planted over 40,000 street trees.

- Moreland's 60,000 street trees are worth an estimated $271 million in amenity value and provide the community with $361,073 worth of environmental benefits annually.

- Climate change is likely to have a significant effect on many trees in Moreland. A climate analysis of Moreland's street trees found 15% are vulnerable to current climate conditions while this will increase to 53% under moderate climate scenarios by 2050 and 84% under an extreme climate scenario by 2090.

- Moreland's street trees store over 11,329 tonnes of carbon dioxide (CO_2) and remove a further 912 tonnes annually.

- An over reliance on small, short-lived trees limits the potential canopy and benefits of the urban forest.

- The optimised planting of larger canopy trees would increase the amenity values of street trees to over $1.2 billion by 2050 and deliver over $4.6 million in direct environmental benefits annually. In addition, these street trees could potentially store 40,000 tonnes of carbon dioxide and sequester a further 1,416 tonnes of CO_2 annually.

- There are 394 different species of street trees with a mix of exotics (26%), natives (69%) and indigenous (5%) vegetation.

- 66% of tree species are from Myrtaceae Family; 26% of the forest is dominated by the genus, Callistemon, and 21% by Eucalypts

- Council's tree maintenance and resourcing have struggled to keep up with the compounding effect of the 5,0000 annual planting targets resulting in 20% average annual fatality rates

An urban forest strategy for Moreland will need to address not only these challenges but additional considerations including: species selection and placement; better engagement of private households; the relationship between vegetation and air quality; soil health; water demand and supply options; partnerships with road and footpath works; working with utilities; risk management; asset renewal and management; growing maintenance requirements and resourcing implications; public-private tensions; managing community expectations and engagement; and skills development.

This Strategy recommends a significant shift in approach to managing and resourcing the urban forest to realise a vision to promote and encourage the transformation of Moreland into a municipality where healthy trees and vegetation are a core part of the urban environment. It aims to realise this vision by nurturing a healthy, attractive and diverse urban forest that uses traditional and innovative greening solutions to improve the health and wellbeing of current and future generations through the doubling of vegetation canopy by 2050.

In practice, this requires the planting and resourcing of larger canopy trees (including deciduous species) to improve shade, cooling, biodiversity, energy savings, air quality, health benefits and amenity.

This Strategy has identified a further 30% of Moreland's land area where vegetation canopy could potentially be planted, including 14% of private land plantable opportunities and 15.6% of public land plantable opportunities (see canopy cover figure). The practical saturation of our streets and parks could achieve 14% and 6.6% respective canopy cover.

Successfully achieving this vision should provide a balance to the highly urbanised environment of the municipality and will directly impact the daily lives of residents and visitors as well as improve the liveability of Moreland in the long term.

Responsibility for implementing this strategy goes beyond Moreland City Council's management of its parks, reserves and streetscapes but includes contributions from the whole community.

The Strategy recommends Moreland City Council and the community commit to the following objectives:

- Introduce strategies to protect and enhance the urban forest in both the public and private realm through the development of a Tree Protection Policy following a review of the Planning Scheme, Structure Plans and Local Law to ensure vegetation is accepted as a core element of the desired neighbourhood character;

- Implement 5 year planting and maintenance plans to deliver a consistent approach to improving amenity, liveability, biodiversity and sustainability;

- Sustainably resource Council's tree planting, establishment and maintenance programs to ensure quality outcomes that minimise and mitigate risks to the community and ensure a healthy urban forest;

- Adopt a more sustainable annual tree planting figure of 3,500 street trees and 750 park trees.

- Plant larger, longer lived canopy trees where appropriate;

- Adjust species selection and maintenance practices to ensure future climate resilience of the urban forest;

- Integrate greening opportunities with all relevant Council capital works projects and initiatives to ensure the strategy complements other aligned organisational plans and strategies supporting community, environmental and economic wellbeing;

- Better support community planting and greening activities;

- Increase awareness and engagement opportunities with the community, developers and Council staff around the benefits and value of Moreland's urban forest, including supporting community greening initiatives in the public and private realm; and,

- Complement other aligned organisational plans and strategies that support community, environment and economic wellbeing.

According to Victoria's Local Government Act (1989), the primary function of councils is "to endeavour to achieve the best outcomes for the local community having regard to the long-term and cumulative effects of decisions". Short-term action on these recommendations is critical for the implementation of the Urban Forest Strategy because most vegetation takes over a decade to start delivering the benefits identified above.

Moreland has shown that it has the capacity and resources to intervene and implement appropriate and positive measures to cool its streets and neighbourhoods through the provision of shade from healthy street trees. This Urban Forest Strategy requires Council and the community take the next important step of ensuring vegetation is no longer a peripheral concern but a core part of daily life in Moreland.
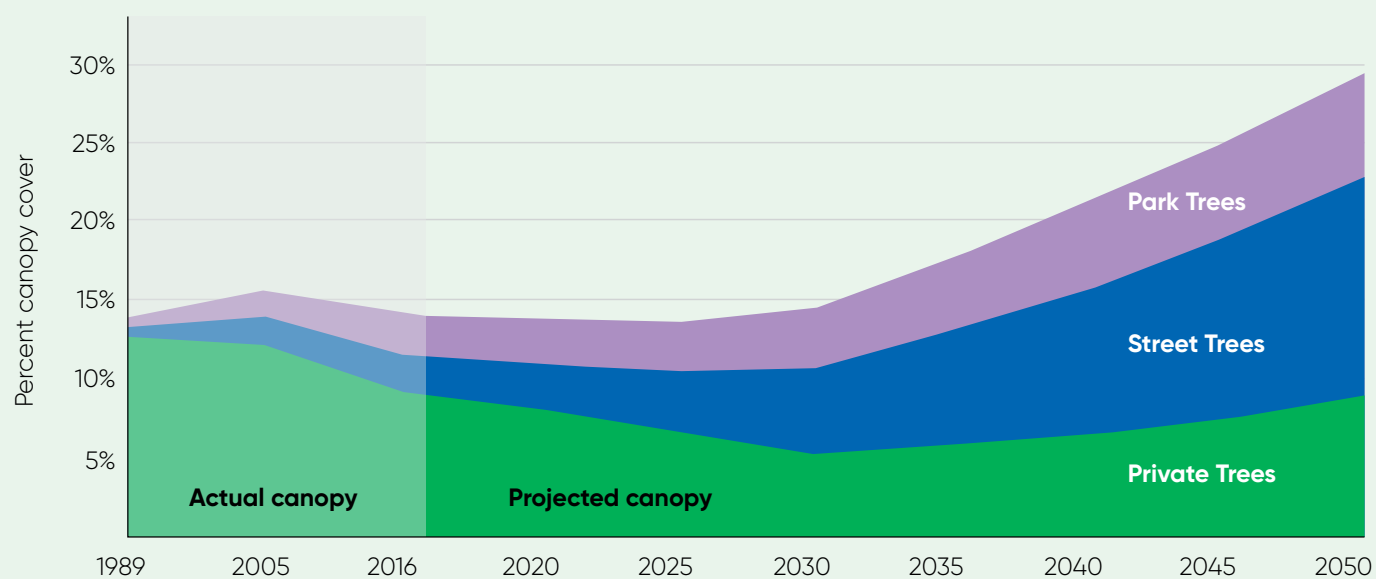
	1989	2005	2016	2020	2030	2040	2050
Street trees	0.7%	1.9%	2.4%	3.0%	5.5%	9.3%	14.7%
Park trees	0.6%	1.6%	2.6%	2.8%	3.8%	5.6%	6.6%
Private trees	12.7%	12.1%	9.2%	8.0%	5.2%	6.5%	9.0%
Moreland canopy cover	14.0%	15.6%	14.2%	13.8%	14.5%	21.4%	30.3%

Actual and Projected Tree Canopy Cover under the implementation of the Urban Forest Strategy

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Community consultation program

Our urban forest will thrive best if it is valued and supported by the local community. Community custodianship of vegetation, whether it is their own garden, nature strip, a street tree, a green roof, car park vegetation, or community plantings along our waterways or train lines benefit not only the vegetation but also the broader community. At the same time, Council needs to improve community understanding of the importance and benefits of urban greening whilst encouraging residents to fear less about large trees, garden shrubs, long grass, overhanging limbs and consider autumn leaves and seed pods less problematic. It also requires Council to sustain and maintain its urban forest as living assets.

Council undertook a range of targeted and more general engagement and consultation activities throughout the development of the Urban Forest Strategy. These have included holding information stalls at community events (such as the Coburg Night Market, Fawkner, Gowanbrae and Glenroy Festivals and the Sydney Road Street Party), public presentations at local Neighbourhood and Community Centres, internal presentations to Council stakeholders, meetings with key community groups and residents, and discussions with local school children. In May 2017, the draft Urban Forest Strategy was endorsed by Council for community consultation.

The community consultation report and the Urban Forest Strategy were then endorsed by Council in August 2017.

1 INTRODUCTION
A HEALTHY & RESILIENT
URBAN FOREST

It is not uncommon to hear visitors to Moreland exclaim that they know they have arrived in the municipality due to the lack of streetscape vegetation. Recent satellite and aerial images show that Moreland is not only hotter, has less vegetation and open spaces than many municipalities in Melbourne, but we know that our community is more vulnerable to climate change.[1] If we want to fulfil the vision for a sustainable Moreland that supports a resilient community living in an attractive, accessible and safe environment, then it is important that we take some important steps towards greening our municipality through shade trees and improving the provision of vegetation and nurturing our urban forest.

The term urban forest refers to all trees and other vegetation in public and private spaces. It includes, for example, street and park trees, front and backyard trees, grasslands, wetlands, nature strips, shrubs, balcony plants, and green roofs and walls.

Despite an extensive planting program over the past decade to increase vegetation in our parks and streets by Council and community groups, canopy cover across Moreland has declined. Urban consolidation has been the main cause of this decline through the removal of tree canopy in the private realm. Once this vegetation has been removed, it is very difficult to replace. The disappearance of the traditional backyard presents a challenge for providing canopy cover on private land.

Vegetation and urban consolidation are not mutually exclusive outcomes and both can produce positive health outcomes when designed well. However, if urban consolidation is not well planned and managed then the resulting development can place added pressure on Moreland's urban forest with detrimental health outcomes for the community.

The declining overall canopy cover highlights the divergent interest and responsibilities between the private and public realms for the protection and establishment of trees. Over the past two decades Moreland's urban forest has been constrained by not only urban

consolidation, but also extended dry periods, climate change, and inadequate protection during development.

Moreland's urban forest is a significant asset to the local community and environment because it provides many critical ecosystem services such as air and water filtration, shelter, shade, habitat, oxygen, carbon sequestration, stormwater abatement, nutrient cycling and mitigation of the urban heat island effect. Our urban forest also contributes to community health and wellbeing, amenity, asset protection, property values and provides opportunities for connecting with nature, something that is often perceived to be missing in urban areas.

Council has attempted to realise many of these benefits by making the municipality greener. However, Council's over reliance on small, short lived street trees with a high failure rate amongst new plantings combined with a steady urban consolidation and concomitant loss of vegetation has resulted in a decline in overall canopy cover. Between 2005 and 2016, overall canopy cover across Moreland has declined from 15.6% to 14.2% of the land area largely due to a 24% drop in private tree canopy. During the same period, canopy cover from street trees and park trees has grown by 26% and 63% respectively, albeit from a low base. As a result, the burden for managing the urban forest is shifting to the public realm to deliver these outcomes. However, because

future opportunities for vegetation in the private realm are increasingly limited due to the growing footprint of the built form, new planting opportunities will need to be realised largely in the public realm if Moreland is to grow its urban forest.

Council has recently adopted an Urban Heat Island Effect Action Plan which identified expanding canopy cover from trees as the most effective way to cool our streets.

In response to some of these challenges, Council has developed this Urban Forest Strategy to achieve a vision of a green, leafy Moreland that is attractive, sustainable, diverse and healthy, and which provides a pleasant environment for the community to live and work. This will be achieved through practical measures that guide the protection, planting, management and resourcing of vegetation across Moreland to ensure the urban forest delivers essential environmental, social and economic services to the community and environment.

This Urban Forest Strategy builds upon and complements Council plans and policies, notably the 2012 Street Landscape Strategy, the Health and Well Being Plan, WaterMap 2020, the Open Space Strategy, the Municipal Strategic Statement, Zero Carbon Evolution Strategy and the Urban Heat Island Effect Action Plan.

The Urban Forest Strategy is supported by several detailed reference documents that provide Council staff and the community with a range of practical documents to understand and ensure a clear and consistent approach to managing the urban forest, including:

- A Street Tree Planting Plan
- A Technical Tree Planting Manual
- A Tree Protection Guide
- A Decision Making Guide
- A Nature Strip Guide
- The Amenity Value Formula (City of Melbourne Method)
- The Habitat Streets and Buffer Zones Map

The implementation of the recommendations in Figure 39 and adoption of the guidelines included in this Strategy could potentially result in the doubling of Moreland's urban forest canopy from 14% in 2016 to 29% by 2050. This is equivalent to a quadrupling of public realm canopy from 5% to 20% respectively.

2 VISION

To promote and encourage the transformation of Moreland into a municipality where healthy trees and vegetation are a core part of the urban environment

Council will achieve this vision for greening Moreland by nurturing a healthy, attractive and diverse urban forest that uses traditional and innovative greening solutions to double public realm canopy by 2030 to improve the health and wellbeing of current and future generations.

Council will achieve this vision for greening Moreland through the following objectives:

- Protect and enhance the urban forest in both the public and private realm
- Value the urban forest as a core element of our urban space
- Create a diverse urban forest of trees and other vegetation that will enhance urban ecology
- Maintain the health of the urban forest
- Manage and mitigate urban forest risks
- Monitor and review progress to measure success and best practice
- Strengthen community custodianship and engagement of the urban forest

3 BENEFITS OF THE URBAN FOREST

Trees and vegetation in the urban landscapes provide many environmental, health and economic benefits. Urban trees and streetscapes are worth much more than they cost and they are the key to urban sustainability. In fact, the overall environmental and amenity benefits provided by trees within Moreland outweigh their maintenance costs by ten to one. Moreover, maintaining a healthy urban forest is a cost-effective strategy for Council to meet a range of economic, health, wellbeing and environmental targets.

Contact with attractive, accessible green space or nature encourages greater levels of physical activity; can improve mood, and lower levels of stress, anxiety and depression.

The Moreland Urban Forest Strategy (UFS) aims to improve the health and liveability of the Moreland community through a diverse, resilient and robust urban forest. It will achieve this aim by nurturing a large urban forest that will perform well under future climate conditions and therefore maximise the benefits provided to the environment and the community.

Moreland City Council recognises the important contribution of vegetation, especially trees, in making the municipality a vibrant place to live, work and visit; and is committed to protecting, enhancing and managing our urban forest into the future. Many Moreland community members acknowledge the value and role of trees, in particular, their contribution to Moreland's character and sense of place.[2]

Figure 1 illustrates some of the core services trees provide, including cooling the municipality on warm days, providing food and shelter for Moreland's wildlife, increasing property values, and easing stormwater flows into streets and waterways.

Combining sustainable water management with the urban forest amplifies the overall environmental, economic and social benefits. Water plays a crucial role in improving the quality of a space through greening, providing visually attractive blue space, and providing relief from high temperatures by cooling open space.

TREES:
- **Improve local economies**
- **Improve mental health**
- **Improve physical activity**
- **Increase property value**
- **Prolong the lifespan of roads**
- **Provide habitat**
- **Reduce medical care**

LEAVES:
- **Reduce sound**
- **Cool the air**
- **Provide shade**
- **Reduce electricity consumption**
- **Reduce wind speed**
- **Remove air pollution**
- **Slow rainfall**

TRUNKS:
- **Store carbon**

ROOTS:
- **Filter pollution from rainfall**
- **Improves soil health**
- **Prevent erosion**
- **Stabilise soil**

Figure 1: The benefits of trees

Investing in and maintaining the urban forest is a vital approach to urban management as it deals with the challenges of population growth, resource constraints and community wellbeing.

Social and health benefits

There is a growing evidence base linking vegetation with significant health benefits as well as the lack of vegetation with poor social and health outcomes, including:

- Vegetation is a key component in facilitating a sense of place, community, neighbourhood character and social interaction; and

- Tree lined streets and parks can encourage physical activity[3], reduced respiratory illness[4], improve mental health and expedite recovery from medical care[5]

Additional research findings pertaining to health and wellbeing include:

- Adding 10 more trees per average city block has the effect of making residents feel seven years younger or $10,000 richer annually[6];

- The same study found that having 11 more trees in a city block, on average, decreases cardio-metabolic conditions in ways comparable to an increase in annual personal income of $20,000 and moving to a neighbourhood with $20,000 higher median income or being 14 years younger;

- People living in areas with higher street tree density had a far better perception of their own health;

- Residents also reported fewer conditions of obesity and hypertension compared with residents living in areas with fewer trees; and

- The social and health benefits of more trees were observed for areas within a five-kilometre radius of the trees.

Trees are also related to positive safety outcomes. Built up areas with high levels of vegetation have been shown to experience approximately 50% lower crime levels than areas with low levels of vegetation and a 10% increase in the amount of tree cover has been associated with a 12% decrease in crime.[7]

A child's mental and physical development is significantly improved when they have access to treed parks and reserves[8], fostering a connection to nature and encouraging physical activity to combat the onset of health issues such as diabetes and obesity.[9]

Pleasant parks and streetscapes can increase physical activity and promote active forms of transport. Moreland encourages walking and cycling within the municipality as physical activity is linked to improved health.

The urban forest further helps Council meet sustainable transport objectives as vegetated streets are known to calm traffic and thus reducing the risk to walkers and cyclists. Street trees also give motorists a defining edge to help guide their movements and to help them assess their speed, thereby increasing community safety.[10]

Rates of skin cancer are high in Australia. According to the Department of Health 1 in 2 Australians will develop some form of skin cancer in their lifetime. Tree canopies provide sun protection during summer months, filtering and blocking sun light to reduce ultraviolet exposure[11] and assist in protection against skin cancer and heat stress. Heat stress is a growing concern under climate change with the 2009, 2014 and 2015 heatwaves resulting in 374, 90 and 174 respective deaths across Melbourne.

In 2014, Lucinda Coates and colleagues concluded that "the dangers from extreme heat within Australia remain neglected, and fundamental changes will not take place until extreme heat is given the priority it deserves as Australia's number one natural hazard killer."[12]

Community planting days not only benefit the environment, but provide valuable opportunities for the community to meet one other, build a sense of place, celebrate their neighbourhood and connect with nature. Local friends groups together with Council run dozens of annual planting events to encourage community planting, biodiversity conservation and social connectivity.

Neighbourhood character

Landscape values provide a sense of human scale and soften the built landscape. Trees and vegetation can also reinforce the character of a neighbourhood and streetscape and visually link areas. Consistent planting themes within parks and streets can enhance landscape character. For example many parks and residential streetscapes within Moreland contain an eclectic combination of tree species. This Urban Forest Strategy provides guidance on some of the landscape values to consider including an assessment of the condition of the trees, a description of the planting site and a recommended planting approach for each park and street.

The urban forest can play a conservation role in cities from a heritage perspective. For example, several of Moreland's parks and streets include avenues of mature trees including Planes, Elms and Brush Box that were planted at a similar time to the establishment of the park or the construction of adjoining housing. These avenues add to the heritage character of the place and should be preserved. Unfortunately, many of these older plantings are starting to reach the end of their useful life with tree health declining due to maturity, water restrictions and climate extremes. Evidence of heritage tree decline has been observed in Temple Park, Methven Park and Fleming Park.

Moreland needs to start planning for the eventual replacement of these trees together with the local community to identify how to renew these landscapes whilst protecting the heritage character of the landscape. In some circumstances alternative plantings may be suitably and in others improved conditions will be required, such as improved soil structure (mulching, water availability and soil decompaction) and reduced conflict with infrastructure and services (See Reference Document 2 Tree Management Guidelines Section 7 Soil Health Guidelines).

Environmental benefits

The urban forest is an essential part of providing ecosystem services in urban areas. Urban trees for example filter particulate matter and pollutants from the air and stormwater, they reduce the flow and amount of stormwater by intercepting and storing rainfall and they improve groundwater flows[13] (Figures 1 & 2). Urban vegetation provides shelter, habitat and food for wildlife, and encouraging biodiversity.[14]

Trees are well known to intercept rainfall and reduce stormwater pressures. Mature deciduous trees, such as Liquidambars, intercept between 1.89 and 2.65kL of water per year, while evergreen trees including pines can intercept more than 15.41kL per year (Seitz & Escobedo 2011). Studies have also shown that urban runoff is much higher from asphalt (62%) than from surfaces with tree pits (20%) or turf (<1%) highlighting the effect that trees can have on stormwater reduction.[15]

In a year, a large urban tree can:

Reduce summer temperatures like the equivalent of **10 air conditioners**.

Intercept and absorb **2500 litres of stormwater**.

Filter **30 kilograms of pollutants** from the air
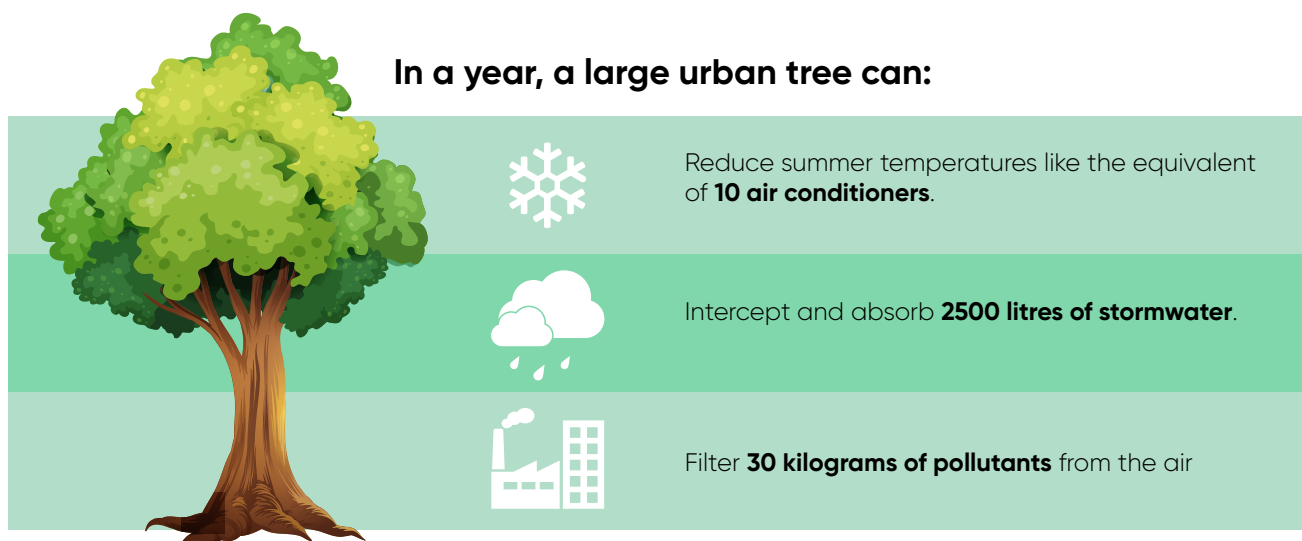
Figure 2: The environmental services provided by a large urban tree

Simple inexpensive interventions such as increasing soil and water volumes through the use of structural soils can amplify these benefits while improving tree health (See Reference Document 2 Tree Management Guidelines Section 7). Additional studies show that simple structural soils are valuable in extending a tree's rooting zone below the pavement with no impact on adjoining road and building assets.[16]

There is growing recognition of the important role that urban environments can play in the conservation of biodiversity.[17] Before this, cities were historically excluded as a worldwide ecosystem type.

There is also the intrinsic value of nature to consider. Trees can be incredibly magnificent in their own right and provide a critical connection to nature in our increasingly urban lives.

The urban heat island effect

When looking at the cumulative effects of the urban forest, it has the capacity to significantly reduce the urban heat island effect as well as providing relief during heatwaves[18] by shading people, buildings and infrastructure, and cooling the local environment, lowering the impacts of localised heat retention and re-radiation.

The urban heat island (UHI) effect is one of the most significant issues affecting urban environments in relation to current and future climates. UHI relates to significantly warmer temperatures experienced in metropolitan areas in comparison to surrounding rural areas.

The main cause of the urban heat island is the modification of the land surface with vegetation removal and through urban development, which uses materials that effectively retain heat. The UHI can also decrease air quality by increasing the production of pollutants such as ozone, and decrease water quality through the cycling of warmer water into catchments, which can affect vulnerable ecosystems.

Mitigation of the urban heat island effect can be accomplished by reducing urban albedo (i.e. reflective and absorbing hard surfaces), and the most efficient method to reduce urban albedo is by the placement of trees around structures to lower surface and air temperatures by providing shade and evapotranspiration.

Just a 10% increase in vegetation cover has been shown to reduce average air temperatures by 2.5° Celsius during a heatwave. This is a critical finding because heatwaves result in mortality and morbidity spikes in Melbourne. During the extreme heatwave and Black Saturday fires of 2009, 173 deaths were a direct result of the fires. However, what is less well known is that 374 people died from the heatwave. During the extreme heatwave of 2015, 174 people died in the Melbourne metropolitan area.

Evapotranspiration, alone or in combination with shading, can help reduce peak summer air temperatures by 1–5°C. Surfaces shaded by trees can commonly be 11–25°C cooler than the peak temperatures of unshaded materials; however on days of extreme heat the temperature difference under a tree canopy can be more than 30°C lower that unshaded areas. Reducing air and surface temperatures during heatwaves will be critical for reducing ambulance call outs and mortality and morbidity rates from heat stress amongst Moreland resident.

Vegetation and cooling

A strong evidence base supports the cooling benefits of increasing vegetation cover, including:

- Key factors influence the cooling effectiveness of Moreland's urban forest:
  » Location
  » Size and canopy coverage
  » Planting density
  » Irrigation management.[19]
- Maximise the cooling benefits of existing vegetation
  » Irrigation is critical for realising the cooling benefits of grass and trees during the day. Sustainable sources of irrigation from stormwater are to be prioritised.

» Passive irrigation can improve vegetation health, however increasing stormwater and wastewater capture and storage for irrigation use during extreme heat periods is a priority[20]

» In line with WaterMap 2020, Moreland should therefore continue to enhance the delivery of services from existing vegetation and open space by improving vegetation health through water sensitive urban design (WSUD). This will require an analysis of Moreland's stormwater systems data, blockage and flooding data, surface permeability data and surplus stormwater resources.

- More vegetation and trees are required

» Irrigation is an effective mechanism for cooling day time temperatures. [21] Council is reviewing current irrigation practices of open spaces and street trees as part of the Urban Heat Island Effect Action Plan.

» Gaps need to be identified within the existing coverage of vegetation and open spaces and related to temperature 'hot spots', social vulnerability and core activity centres.

- Some plant characteristics are more effective than others

» Broadleaf vegetation provides the best canopy shade and cooling benefits.

» Deciduous species can enhance winter solar access while providing summer shade and cooling.

» Canopy variation may improve night-time cooling through species diversity or formative pruning.

» We know little about the cooling performance of different tree species under different irrigation regimes.

- The location of trees is critical to maximise cooling benefits

» Appropriate selection and placement of tree species is important to maximise the delivery of their cooling benefits arising from both the provision of shade and evapotranspiration. An analysis of existing hot spots, social vulnerability and activity zones in Moreland is an essential first step (Figure 3).

City	Neighbourhood	Neighbourhood	Street	Microscale (site)

Step 1
Prioritise Neighbourhoods
- *Thermal imagery*
- *Social vulnerability*
- *Activity maps*

Step 2
Characterise Neighbourhoods
- *Identify existing UGI*
- *Identify built forms*
- *3D consideration*

Step 3
Maximise cooling of existing UGI
- *irrigation*

Step 4
Priritise streets based on exposure
- *canyon dimension*
- *street orientation*

Step 5
Identify specific UGI for locations within the street

**Prioritisation Framework for optimising UGI cooling benefit**

Figure 3: Priority steps for achieving cooling benefits from the implementation of an urban forestry (Urban Green Infrastructure, UGI) program[22]

Options for street trees, open spaces, green walls and green roofs will depend upon the characteristic of each site and are discussed below.

- **Street trees**
  - » Priority shading of building and paved surfaces in particular on footpaths, cycling paths and west facing buildings around activity centres, such as retail strips, schools, health centres, transport hubs (*Norton et al. 2015*).
  - » Street trees in urban canyons provide the largest cooling benefits. The term urban canyon is useful for describing Moreland's streets because most streets are characterised by a wide open street (floor) enclosed by buildings (walls) on either side.[23] Street orientation together with the width of the street and the height of adjoining buildings are important considerations for determining where and what type of vegetation to grow.

- **Open space**
  - » Prioritise the creation of open space in areas upwind of hot spots with high heat exposure, particularly in areas with vulnerable populations.[24]
  - » In dense urban areas such as Moreland, the creation of small pocket parks can still benefit neighbourhoods.[25]
  - » Irrigate grass and trees during extreme heat periods to maximise day time cooling benefits.

- **Green walls**
  - » In narrow streets (urban canyons) or where there is a high concentration of above ground utilities (ie powerlines) then irrigated street level vegetation and green walls (with air cavity) are an effective cooling option.[26]
  - » An alternative option is undergrounding or aerial bundling of cables (ABC) of powerlines to improve canopy cover and reduce maintenance costs.
  - » Consideration: in areas where vertical vegetation is not viable then building awnings and overhangs should be considered.

- **Green roofs**
  - » Irrigated green roofs provide some benefit particularly in reducing rooftop surface temperatures and minor microclimate benefits on low buildings. The cooling benefits of unirrigated green roofs are minimal.

The following images (Figure 4) clearly illustrate the critical role of vegetation in moderating the extreme temperatures observed in Moreland streets using ground based thermal imaging. The images clearly highlight the benefits of shade provided by tree canopy on cars, road surfaces and buildings. The thermal images were shot on a 41°C day and show that vegetation can moderate temperatures by up to 35°C.

Trees shade both people and hard infrastructure such as roads and buildings from direct sun and UV rays during summer. This has the significant positive impact of reducing energy use in buildings by lowering mechanical cooling requirements and therefore avoiding further carbon emissions.[27] This shading also protects and prolongs the life of asphalt paths and roads[28], reducing maintenance costs, and extending their longevity and need for replacement.

Figure 4. Ground based thermal images of Moreland streetscapes, Celsius

Weston Street Brunswick

Glenmorgan Street Brunswick East

Anderson Road Fawkner

Brunswick Road Brunswick

Economic benefits

Trees shade both people and hard infrastructure such as roads and buildings from direct sun and UV rays during summer. This has the significant positive impact of reducing energy use in buildings by lowering mechanical cooling requirements and therefore avoiding further carbon emissions. This shading also protects and prolongs the life of asphalt paths and roads. It has also been proven that trees enhance residential property values while reduce the time the property is on the market. Treed streetscapes have been shown to increase adjoining property values by an average of 20–30%.

Trees in retail streetscapes also improve retail and commercial area patronage by enticing people to stay longer and spend more.

Consumers will sometimes spend an additional 9% on an item in retail developments that include street trees compared with the same item in a non–treescaped retail outlet. Another study revealed that street trees can increase business income by 20%.

Through the use of an urban forest modelling tool called i–TreeEco, we can now attribute dollar values and weight measurements to most environmental benefits of trees. Air pollution amelioration, stormwater capture, carbon stored and sequestered can all be measured in quantities and dollars to allow much more accurate cost benefit analyses of trees.

These benefits clearly demonstrate the idea that urban trees are valuable contributors to civic infrastructure, or sometimes referred to as green or living infrastructure. It is also evident that larger trees provide greater social, environmental and economic benefits (Figure 5).

The utilisation of larger tree species will maximise the environmental, social and economic benefits provided by trees and facilitate sustained benefits for generations to come. Larger trees sequester more carbon, abate more pollution, provide greater reduction in urban heat and increase property values. Trees that live longer sequestered carbon for longer, remove more pollutants and avoid losses caused by cyclic tree removal. To facilitate optimised tree selection and planting, an improved tree planting program and design principles have been developed and should be implemented.

Figure 5. Relationship between a tree's leaf area, tree size and the social, economic and environmental benefits
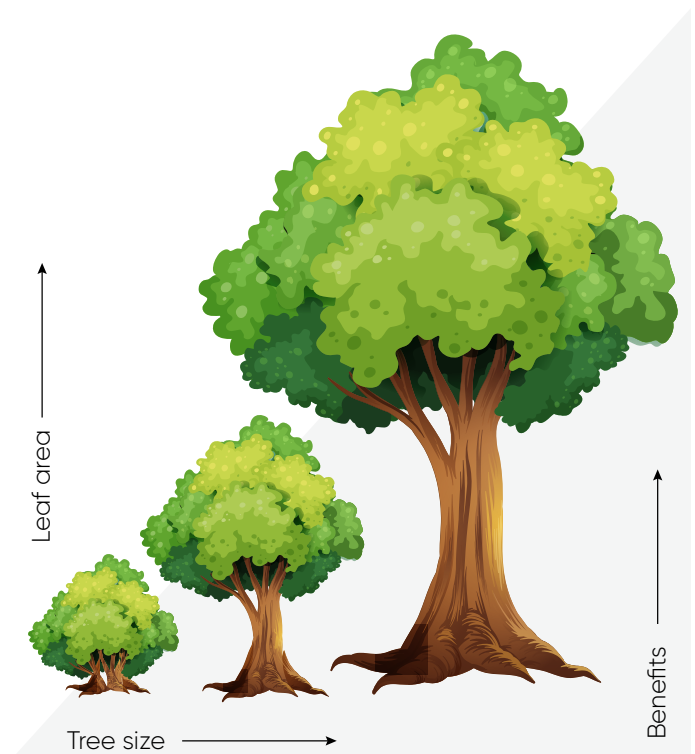
4 MORELAND'S URBAN FOREST

As of 2017, Moreland City Council currently manages over 130,000 trees in our parks and streets (2017). The health of the forest is good with a majority of trees yet to reach maturity, but there has been an over reliance on small trees and a high mortality rate of newly planted trees.

In 2016, Moreland City Council's Open Space units undertook the following urban forest works:

- Pruned over 30,000 trees
- Completed 4,000 tree inspections
- Planted 5,000 street trees
- Allocated $1 million to the annual planting and maintaining its urban forest
- Supported 16 community planting activities
- Managed weeds in over 1,500km of kerbside
- Responded to around 6,000 customer requests
- Maintained over 83 hectares of natural revegetation sites;
- Mowed over 7,500 Hectares of parkland
- Managed over 200 hectares of conservation land
- Undertook over 1,100 ground maintenance visits to childcare centres

During the past decade, Moreland City Council has planted over 40,000 trees through a range of programs including: the in-fill planting program, park renewals, streetscape improvements program, and annual capital works projects. In addition, Moreland City Council is responsible for protecting and restoring our sensitive creek environs. Through a range of programs and community events, the revegetation area has grown by 39,000m^2 over the past decade. As a result of this work, tree canopy cover from street trees and park trees has grown by 26% and 63% respectively from 2005 to 2016.

The single largest greening project for Council has been the annual street tree planting program which was developed based on the following criteria:

- Identified vacant tree sites (the in-fill program);
- Resident requests – where a street is either missing a number of trees or its trees are in poor health and need of replacement;
- Replacement trees for street and park tree removals; and
- Internal Council projects.

Moreland's annual street tree program has grown from planting 2,769 trees annually in 2006, to 3,548 in 2010, and 5,000 in 2016.

However, the combination of a 5% annual senescence for the overall forest and an average 20% failure rate for newly planted trees has meant that the net increase in trees from these programs since 2006 was only 12,054 trees. The reasons for the high failure rate are varied and complex, but clearly demonstrate that implementing the urban forest strategy requires a significant improvement in the average annual establishment rate of new plantings.

In short, once Council has filled the existing vacant sites, it could be planting half as many trees but focusing on larger canopy trees and improved tree health to ensure overall net gain. For this to occur, significant improvements in tree selection, planting and establishment practices are recommended combined with improved management and community engagement.

Details of these improvements are provided in the technical document section of the Appendices.

Street Tree Audit

A sample tree audit of 14,000 trees was undertaken to collect data on the various aspects of each tree: health, age, species and life expectancy.

Little is known about Moreland's private trees such as those on resident's properties. The difficulty of accessing private property to survey trees and limitations in aerial imagery makes it difficult to understand the diversity, overall health and number of private trees. However, their contribution to the urban forest is of equal important.

The technical analysis of Moreland's urban forest is presented in full in Part Two with some of the key observations of pertinence for the Urban Forest Strategy summarised below.

An overview of all street trees currently within Moreland City Council is provided in Figure 6 with an example of an area highlighted. This area around Anstey Railway Station in Brunswick highlights the significant lack of street tree canopy present in a busy retail, transport and residential activity centre and also priority hot spot location. Despite the high pedestrian needs in the area, the lack of building setbacks and narrow footpaths will make planting street trees challenging without a re-imagining of the streetscape. A design response as part of a capital works project is most likely required (see Street Tree Planting Plan).
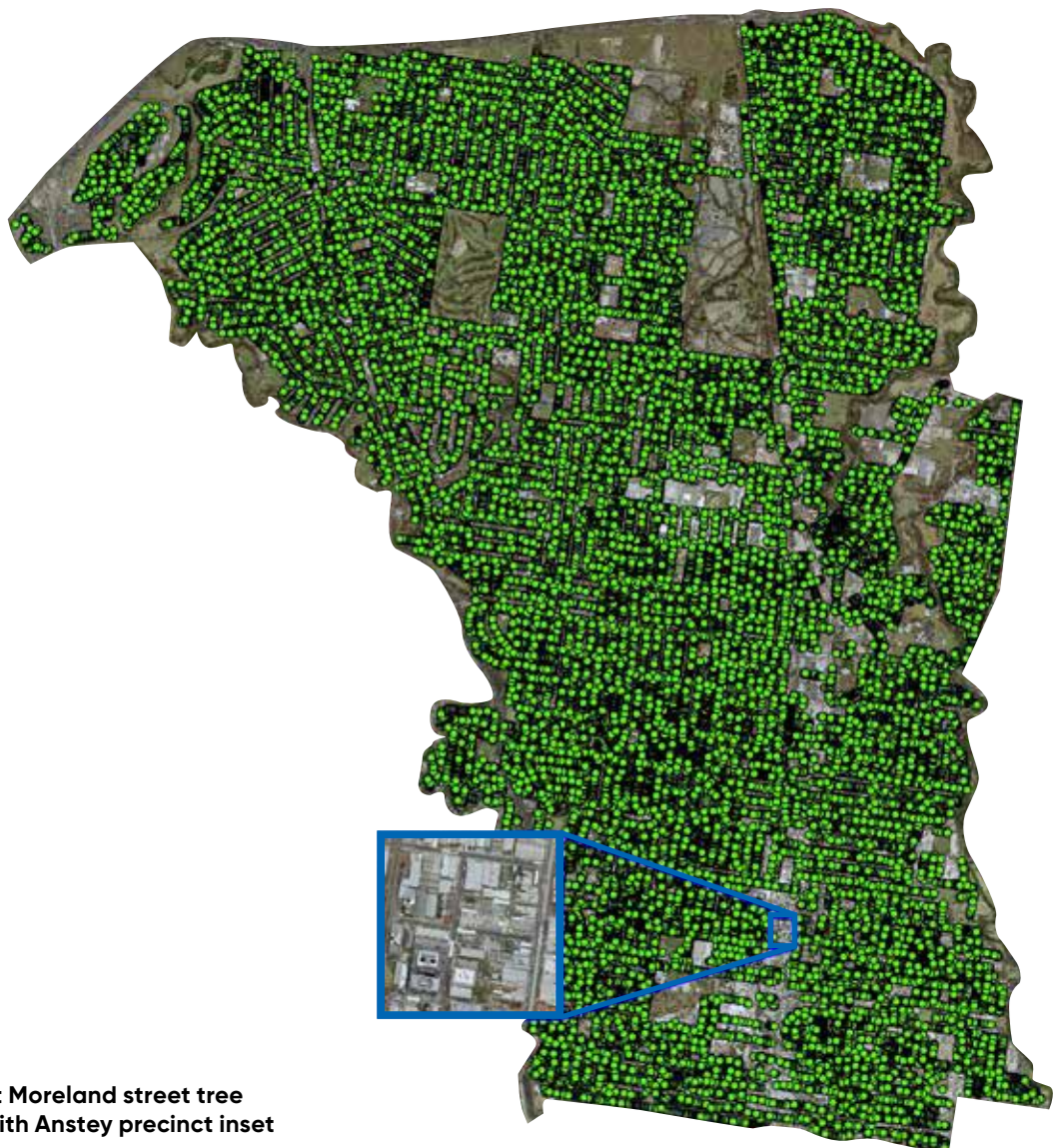
Figure 6. Current Moreland street tree locations map with Anstey precinct inset

Urban forest management

Key findings of a review of Moreland's urban forest produced the following findings:

- In 2017, Moreland has over 59,000 street trees and around 70,000 park trees

- A long term strategic approach to tree planting would better enable council to improve tree canopy, streetscape amenity and general tree health across the municipality.

- An improvement in the quality of planting and establishment practices are required to improve tree survival and health.

- Significant challenges remain in reversing the incremental and diffuse loss of vegetation and trees from Moreland's public and private landscapes. With the exception of several key parks and the waterways revegetation programs, most Council landscapes are serviced at basic levels. Maintenance activities are largely limited to mowing, pruning and herbicide application with little or no resourcing of renewal planting. If not remediated then the outcome will be a decline in the presentation of the municipality as well as a reduction in the delivery of economic, environmental and social ecosystem services from Moreland's urban forest.

- Challenges remain in ensuring greening is part of the transformation of Moreland's three activity centres (Brunswick, Coburg and Glenroy) to ensure that opportunities are made available for street trees and integrated into the rationalisation and improvement of existing roads, transport and services infrastructure. The integration of vegetation within Moreland's activity centres is critical for softening the dominant hard edged built form in line with best practice urban design principles to produce a high quality public realm.

- Some community and resident planting projects in nature strips, parks, car parks and along railway corridors are regularly sprayed out with herbicide or slashed. Such actions undermine community confidence in Council's commitment to encourage resident greening activities.

- Community and resident groups find it difficult to understand Council policy and decision making processes in regard to tree planting, tree removals, community gardens

- A limited understanding tree risks across Council and the community and needs to be managed appropriately in line with best practices and the evidence base.

- Overhead powerline clearances often require extensive pruning of trees that can be unsightly

Tree health

- 95% of the current tree population assessed to have good canopy health

- 57% of the current street tree population is comprised of trees less than 5 metres in height. The majority of these trees will not attain canopy dimensions that will significantly contribute to the amenity and environmental benefits in their streetscapes.

- 71% of street trees are expected to live for more than 30 years

- 3% of street trees estimated to have life expectancy less than 10 years

Benefits

- All of Moreland's street trees have a combined amenity value of over $270 million

- Moreland's street trees store over 11,329 tonnes of carbon dioxide (CO2) and remove a further 912 tonnes annually.

- The current environmental and amenity value/risk of an over reliance on the Family Myrtaceae: $179,441,036

- An over reliance on small, short-lived trees limits the potential canopy and benefits of the urban forest.

Species diversity

- 66% of tree species are from Myrtaceae Family

- Callistemons make up 26% of street trees

- Callistemon and Eucalyptus represent 46% of the current street tree population

- 86% of tree species are from 20 Genera

- 94% of trees are less than 10 metres in height

- The low species diversity of Moreland's urban forest makes it susceptibility to the widespread effects of current and introduced pests and disease, and the risk of large scale loss of these environmental assets from climatic extremes.

This Strategy details improved management approaches to transform Moreland's urban forest from its current state to become more coordinated, sustainable and attractive. This requires a dramatic shift away from the current approach to tree planting and the adoption of a high level of interdependence between management planning for existing trees, the application of life cycle planning principles to the management of the tree population and adequate resourcing.

Over the next decade, Moreland's residents are likely to demand greater amenity improvements to our parks and streetscapes. At the same time, Council has an obligation to improve the health and wellbeing outcomes for the whole community. It is therefore important that Council acknowledge and endorse the following as a priority:

- Implement, and resource, the recommendations and action plan of this Strategy;

- Protect and maintain existing trees;

- Continue to invest in improving the quality and coverage of trees in the public realm; and

- Explore new opportunities for the provision of trees and vegetation across Moreland.

5 DIVERSITY

Moreland's streets are currently populated with an estimated 58,113 trees, which consist of a diverse mix of exotics (26%), natives (69%) and indigenous native (5%) vegetation.

The following list of tree species includes those identified to be indigenous to Moreland and that are suitable as street trees.
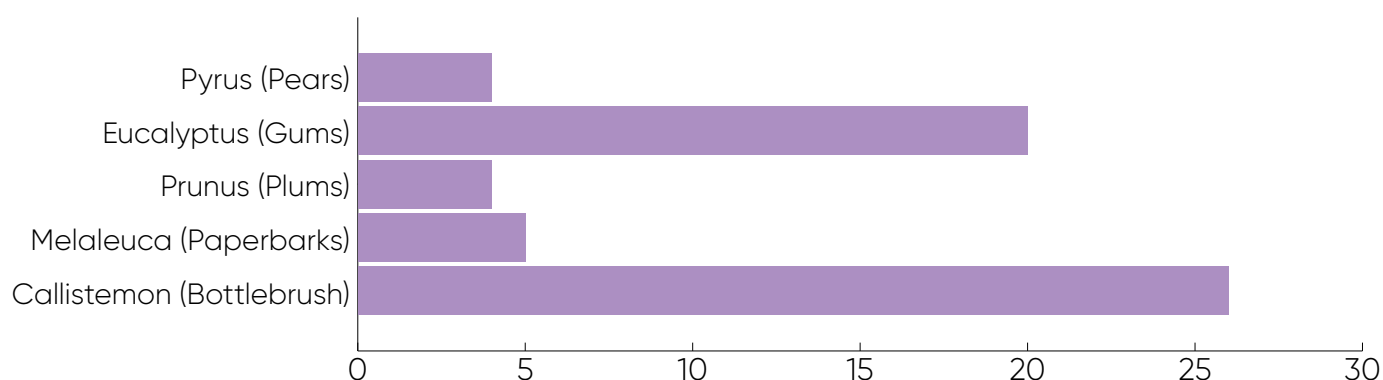
Acacia implexa Lightwood	*Acacia melanoxylon* Blackwood	*Allocasuarina littoralis* Black She-oak
Allocasuarina verticillata Drooping Sheoak	*Eucalyptus camaldulensis* River Red Gum	*Eucalyptus melliodora* Yellow Box
Eucalyptus polyanthemos Red Box	*Eucalyptus tricarpa* Red Ironbark	*Eucalyptus viminalis* Manna Gum

There are more than forty (40) different plant families represented within the current street tree population, but currently twenty genera represent 86% of all street trees. Approximately 394 different tree species are identified within the Moreland City Council Street Tree Inventory data, with no species representing more than 10% of the total population.

Figure 7 highlights that Moreland City Council has had a strong priority of enhancing the native component of its streets, which is reflected by its most common street trees, *Callistemon* (25%) and *Eucalyptus* (20%). Such an emphasis has been focused on a small number of Genus and Species and requires a broader diversity of species to manage the potential significance of pest and disease considerations.

The most common species is *Callistemon viminalis* at just under 10% of the population ...
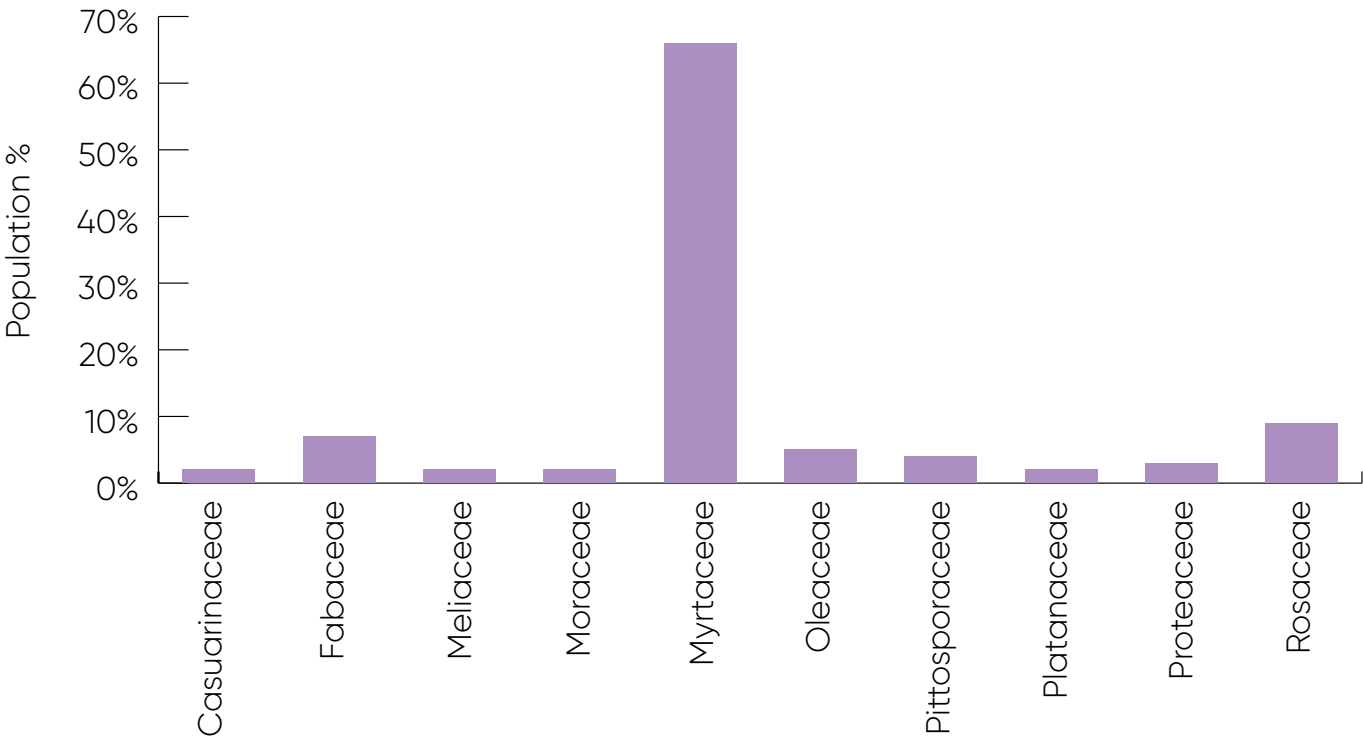
Figure 7. Tree diversity: most common street tree genera in Moreland

There are more than forty (40) different plant families represented within the current street tree population; however Figure 8 highlights that there is a preference for native species with 66% of all species from the family Myrtaceae. The dominance of Myrtaceae poses a risk for Council in terms of diversity and is to be addressed as part of future plantings.
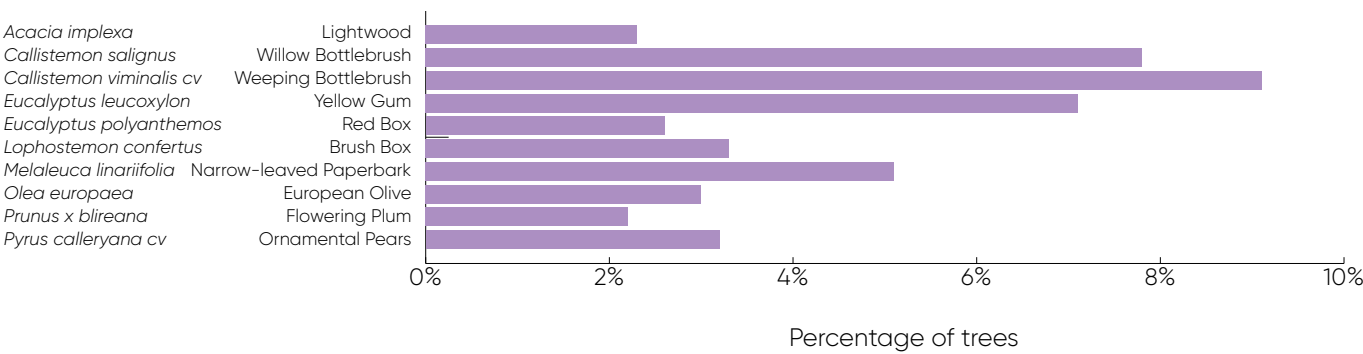
Figure 8. Tree diversity: Most common street tree families in Moreland

The Myrtaceae family includes species from genera: *Agonis*, *Angophora*, *Callistemon*, *Corymbia*, *Eucalyptus*, *Lophostemon*, *Syzygium* and *Tristaniopsis*. Most of these species are native to Australia, and have likely been selected for their hardiness and adaptability, as well as their aesthetic character.

Figure 9 shows the ten most common species within Moreland City Council streets and highlights the dominance of the *Callistemon salignus, C. viminalis, Eucalyptus leucoxylon* and *Melaleuca linarifolia.*

Figure 9. Tree diversity: Most common street tree species in Moreland

Percentage of trees

Diversification is a basic rule for reducing risk when managing financial assets. A similar approach is helpful in managing our urban trees because a greater diversity of species and ages ensures greater resilience and stability of the urban forest.

To minimise the potential for tree loss through issues of pest, disease, drought, heat, flood etc. diversity within the urban forest is paramount to its survival, longevity and succession. It is generally accepted that the greater the diversity, the lower the risk. Street tree and biological diversity can be achieved through species selection, stock provenance, maturity, and rates of growth.

Commonly used diversity benchmarks, introduced by Santamour[29], are:

• Plant no more than 30% of a family

• Plant no more than 20% of a genus

• Plant no more than 10% of a species

These benchmarks are not scientifically validated within urban environments, but they provide a conservative guide to ensure diversification within a forest setting so as to minimise the potential for widespread loss in the event of environmental extremes and plant pathogen incursion.

Moreland City Council will use these benchmarks as a general guide to modify species selection for the future street tree population to promote greater diversity and resilience. As such, the street tree population should be guided by the following:

• No more than 40% of one family

• No more than 15% of one genus

• No more than 5% of one species

The principle of these figures is the promotion of biodiversity and resilience. These guides do not apply to park, habitat or revegetation planting along Moreland's creek and waterways.

Native street tree plantings were predominantly comprised of Myrtaceae tree species; and approximately 5% of current street trees are indigenous to the area.

Species within the Family Myrtaceae are generally acknowledged to have high environmental adaptability, low pest and disease susceptibility and are particularly adapted to local climatic variance. While Council should acknowledge that greater Family diversity should be encouraged in a gradual shift away from Myrtaceae. However, a rapid move away from Myrtaceae species will likely have greater impacts on the economic, amenity, and environmental benefits of the urban forest and its resilience to current and future environmental and climatic conditions.

Useful Life Expectancy

Approximately 3% of the street tree population have an estimated life expectancy of less than 10 years. Life expectancy was assessed based upon the species, maturity (i.e. stage in life cycle) and current health of each sampled street tree. These assessments were then extrapolated for the entire population. The low abundance of dying trees (<10 years life expectancy) reflects an active management program that is removing dead and severely declining trees, and the greater abundance of tees with a life expectancy of over 30 years indicates an active program of tree replacement, and infill of vacant plantings.

Figure 10 provides a summary of the estimated life expectancies of Moreland City Council street trees.

Tree Height and Canopy
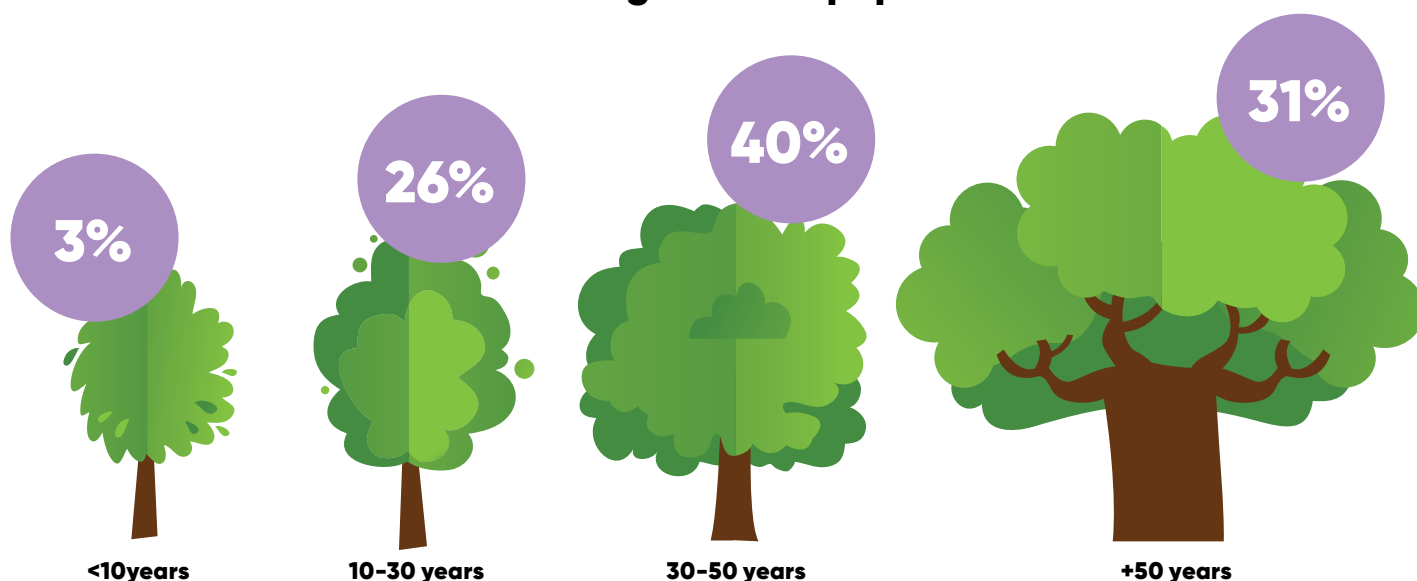
Currently 57% of all trees are less than 5m in height due to two factors. Primarily, an over reliance on small tree species, such as Callistemon, Prunus and Malus trees even on sites without powerlines. This shift to small trees was a strategic decision of the Open Space Unit in order to assist in maintaining trees and reducing complaints arising from conflict with other assets (powerlines, signage, vehicles etc.), tree root damage to buildings and fences, overhanging limbs and storm damage. A secondary cause of the small tree size is a result of poor tree establishment and maintenance practices that result in underperforming trees.

The dominance of smaller trees constrains potential canopy cover across the municipality as most of these trees have a canopy width of less than four metres.

There will always remain a need for small and narrow canopy trees in Moreland due to space constraints particularly in Activity Centres with narrow streets and no building setbacks. In addition, overhead powerlines provide a significant constraint on achieving effective canopy cover in streets. It is important to select suitable species for all sites to avoid inappropriate planting. For example, the pruning of street trees under powerlines requires significant resourcing from Council.

Percentage of total population

| 3% | 26% | 40% | 31% |
| <10years | 10–30 years | 30–50 years | +50 years |
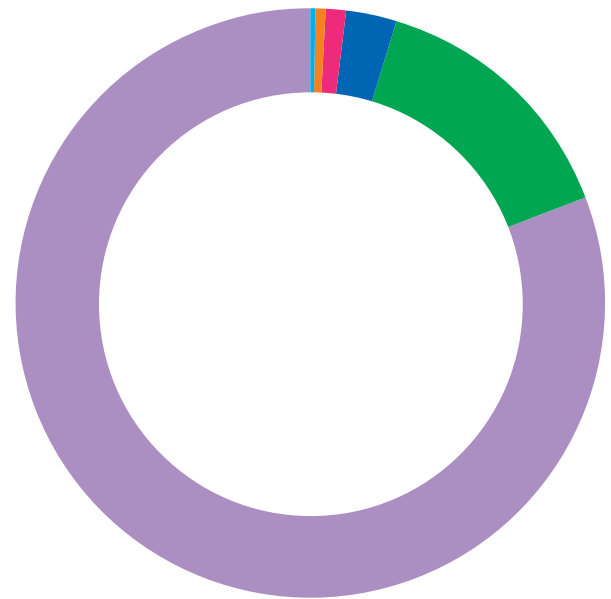
Estimated Life Expectancy

Figure 10. The estimated life expectancy of Moreland's urban forest

Health

A healthy urban forest is central to the health and wellbeing of Moreland's community. Key ingredients for a healthy urban forest include soil health, water availability, free of pest and diseases, clean air, a healthy form and canopy, and an even age distribution of the forest.

A 2016 assessment of Moreland's street trees found that 95% were in either excellent or good health. Figure 11 provides a summary of the estimated health of the urban forest. This summary shows that more than 95% of the current street tree population display leaf size, colour, density and internodal (seasonal) growth typical for their species. These are generally regarded as key indicators of good health. The low population of "Critical" and "Dying" trees reflects an active tree management program that removes these specimens so as to mitigate risk and maintain streetscape amenity.

Figure 11. Summary of the estimated health of Moreland's urban forest

- Excellent (80.82%)
- Good (14.25%)
- Fair (2.96%)
- Poor (1.01%)
- Dying (0.56%)
- Critical (0.40%)

Moreland has several significant treed avenue streetscapes that transform neighbourhood character

6 CANOPY COVER

Canopy cover is an important part of the urban forest strategy. It can be used as a proxy for measuring the extent of the urban forest. Canopy cover is a measure of the physical coverage of the combined tree canopy cover over the land area. Moreland's 14% canopy cover means that 14% of the 50.9km² land area of Moreland has tree canopy. Measuring the change over time and location and composition of this canopy help Council and the community understand where we are performing well and areas that may need interventions.

Council have undertaken a successful street tree planting program that has increased canopy cover from park and street trees three fold since 1989. However, the private realm is the largest contributor to tree canopy across Moreland (Figure 12). Urban consolidation over the past decade has resulted in a steady decline in vegetation within the private realm. As a result, the burden for providing future tree canopy in Moreland is increasingly shifting to the public realm and Council. There is an increasing reliance on council parks and road reserves for canopy cover and green space as dwelling construction removes existing trees and limits future tree planting opportunities.

- A 2016 detailed canopy cover analysis (Figure 12) found:

- Tree canopy cover across Moreland was 14%

- Overall tree canopy cover initially grew from 1989 through to 2005 but has since declined due to urban consolidation.

- Street tree canopy and park tree canopy contribute just 2.4% and 2.6% of Moreland's land cover respectively.

- Despite the strong medical and scientific evidence base about the benefits of trees, in 2017 approximately 85% of Moreland's streets are without any natural shade

  » Between 1989 and 2016:

    » Park tree canopy has grown 257%

    » Street tree canopy has increased 300%

    » Private tree canopy has declined 28% from 12.7% to 9.2%

- The footprint of buildings has grown 15% from 26% to 30%

- Urban consolidation is the main cause of declining canopy cover in the private realm since 2010. A reduction in canopy cover in streetscapes has been caused by: the Tulla Freeway widening; new development crossovers; and, powerline pruning and clearance programs.

- Canopy cover from street trees varies across Moreland's suburbs from 4.5% in Gowanbrae to less than 1% in Hadfield and Oak Park.

CANOPY ANALYSIS
2016 canopy by land area

Private land 31.4km²

Canopy 15%
No canopy 85%

Public space 9.6km²

Canopy 14%
No canopy 86%

Streetscapes 9.6km²

Canopy 15%
No canopy 85%

Moreland tree canopy

- Private trees
- Public realm trees
- Street trees
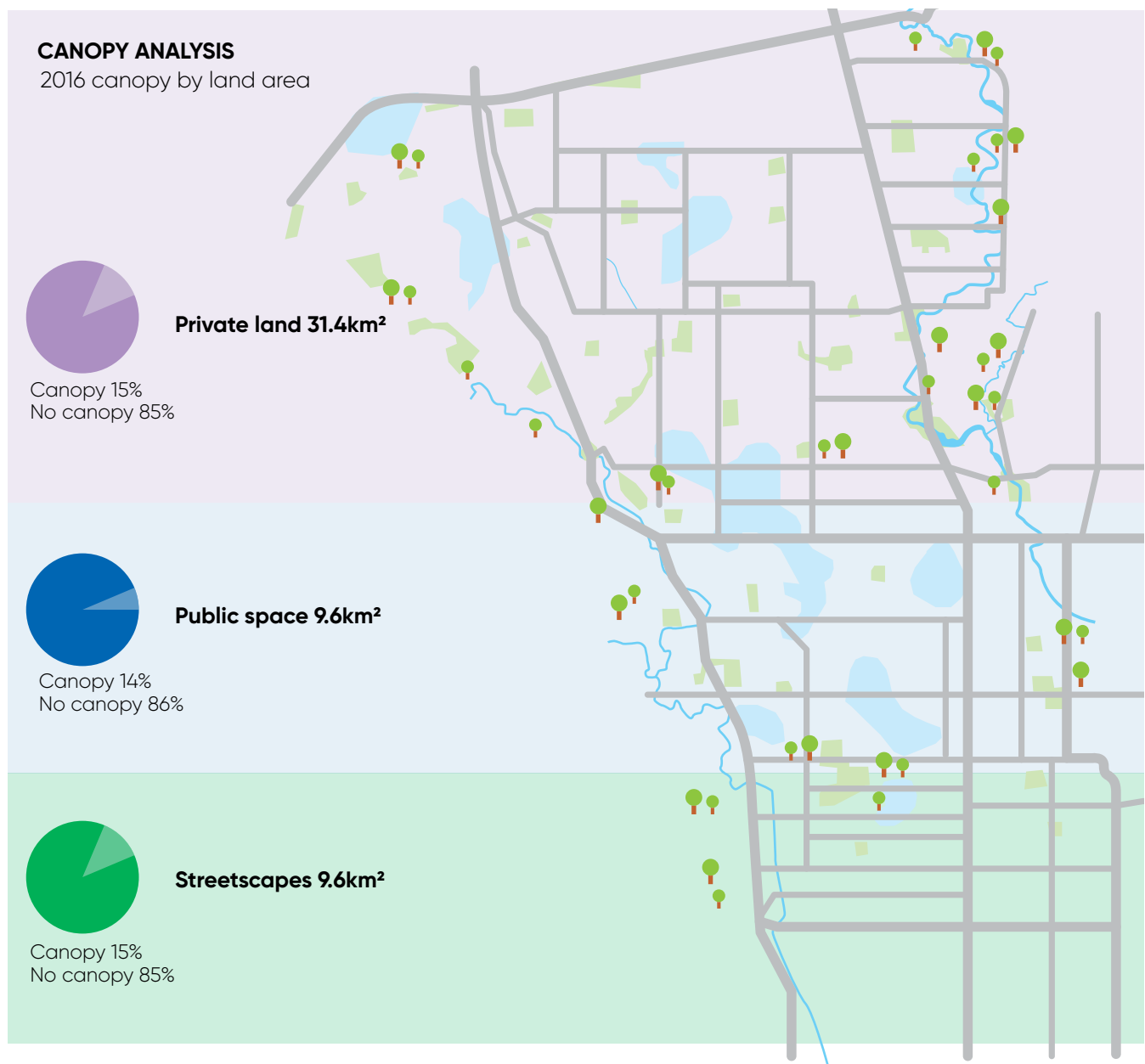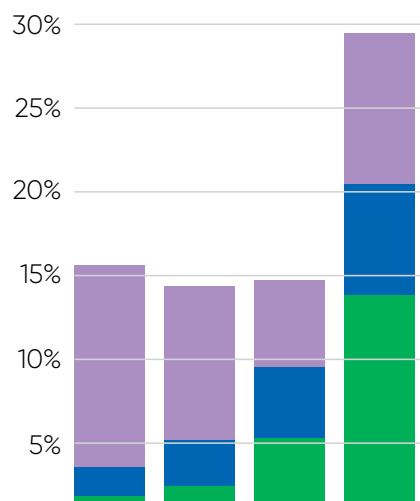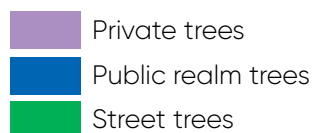
Figure 12. Moreland tree canopy by land area, 2005–2050

Over the coming decades, population growth and urban consolidation are likely to continue delivering larger building footprints and reduced opportunities for the planting of trees in shrinking private backyards. However, the public realm is likely to be equally constrained with increased demand for pedestrian movement, parking and traffic combined with reduced light availability and physical space for tree canopy due to higher density, taller buildings.

As such, Council will consider columnar tree forms for narrow, confined streets, lanes and areas where a spreading canopy would be inappropriate.

Moreland's 14% canopy cover compares with 17.3% tree canopy cover in Darebin and 18.5% in Yarra. In contrast, Wyndham in Melbourne's west has 3.1% cover but 80% grass cover while Manningham in Melbourne east has 40% canopy cover (Figure 13). Critically, the canopy analysis has identified significant scope for increasing canopy cover across Moreland's public and private realm.

The evidence base on canopy cover and change over time reveals a need for a strategic response by Council and the community if we are to realise the vision of transforming Moreland into a municipality where healthy trees and vegetation are a core part of the urban environment.
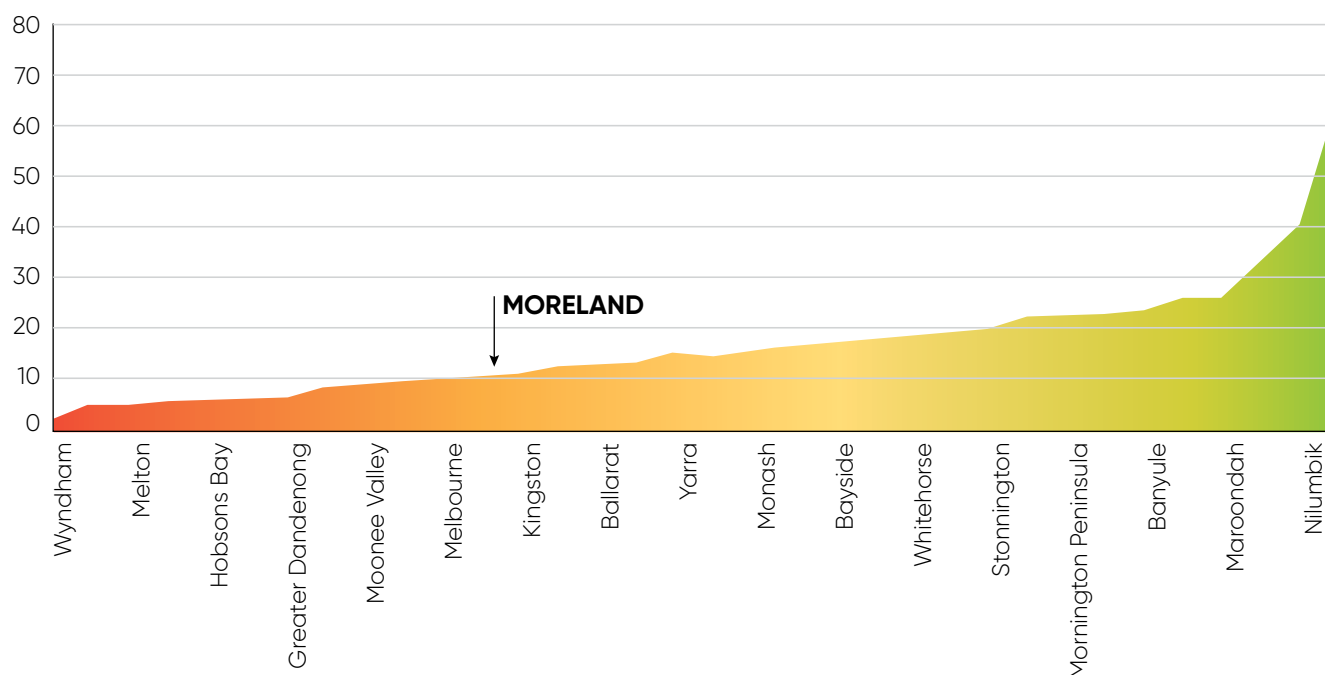
Figure 13. Canopy cover (%) for selected Victorian Local Government Areas[30]

The distribution of tree canopy cover

Moreland's 130,000 trees are fairly evenly distributed across the municipality. However, the age and size of these trees varies significantly and as a result the canopy cover provided by these trees also varies accordingly. Canopy cover is often used as a proxy for measuring the contribution of trees and vegetation to urban greening. In this report, canopy cover measures the physical coverage of tree canopy over the land.

Currently within Moreland City Council, trees provide 14% canopy cover. These statistics roughly align with the study conducted by the Institute of Sustainable Futures[31], which benchmarked Moreland City Council with 13.3% tree canopy cover in 2014 (Figure 13). During the past decade, overall canopy cover has declined from 15.6% to 14.2%. Urban consolidation is the main cause of the decline in private realm canopy from 12% to 9%. During the same period, canopy cover from street trees and park trees has grown by 26% and 63% respectively. Despite the strong medical and scientific evidence base about the benefits of trees, approximately 85% of Moreland's streets are without any natural shade.

Canopy cover was measured over two different years to understand change over time in the public and private realm.

The canopy cover figures for Moreland's streets were based upon three different methods: a land use assessment of 8 suburbs, a land cover assessment of all Moreland and a canopy analysis using iTree Canopy. iTree Canopy is a web-based software tool designed to easily and accurately estimate tree and other land cover classes (e.g., grass, building, roads, etc.) within a city or area. Details of the iTree Canopy assessment are provided in Reference Document 1 Street Tree Planting Plan.

In addition, the iTree Eco stratified sample provided canopy cover estimates for each tree assessed. This analysis was then used to extrapolate the estimated canopy cover within each suburb, and for the entire street tree population. This data was then compared with the results from the iTree Canopy tool and more comprehensive canopy mapping analysis undertaken by Greenspace Consultant.

Table 1 provides a summary of the street tree canopy cover estimates for each suburb. The suburbs of Gowanbrae, Glenroy, Hadfield, Oak Park and Coburg all have a higher number of street trees per area of the suburb and yet this does not necessary equate to canopy cover. There are numerous constraints which limit the location and size of street trees, and therefore tree canopy, including for example, the availability of nature strips, the width of footpaths (where most trees have traditionally been planted), the setback of buildings, overhead powerlines and street lights.

Table 1. Current street tree population and contribution to canopy cover by suburb

Suburbs	Area of suburb km2	2016 street trees (prior to 2016 planting season)	Street tree canopy as % of suburb
Brunswick	5.2	6,034	1.7%
Brunswick East, Fitzroy North	2.3	2,930	2.1%
Brunswick West	3.2	4,260	1.6%
Coburg	7	9,525	2.5%
Coburg North	4.9	3,823	1.6%
Fawkner	5.1	5,910	1.4%
Glenroy	9.1	7,203	4.1%
Gowanbrae & Tullamarine	1.4	643	4.5%
Hadfield	3	2,594	0.7%
Oak Park	1.9	1,629	0.8%
Pascoe Vale	4.9	5,618	3.8%
Pascoe Vale South	3	4,044	2.3%
Moreland Council Total	**50.9**	**54,313**	**2.4%**
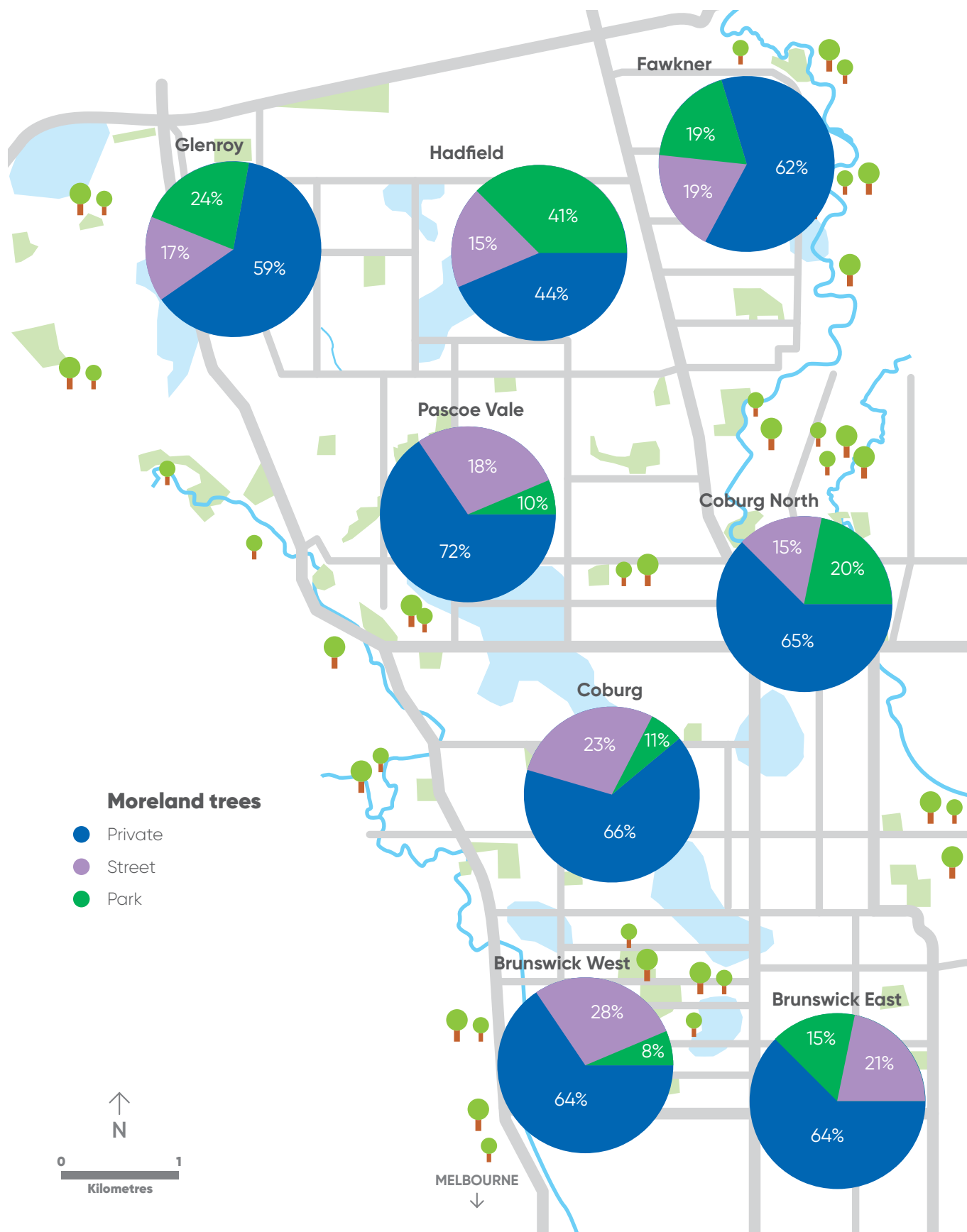
Figure 14. 2016 Suburb tree canopy cover proportions by street, park and private land, percentage

MORELAND CITY COUNCIL

Figure 14 provides a breakdown of the tree canopy variation between different Moreland suburbs in regard to the contribution of park trees, street trees and private trees. The proportion of street trees is generally consistent across the municipality at around 20% and is representative of the presence of roads. Private trees dominate the canopy of all suburbs except for Hadfield due to the large area of the cemetery. The contribution of park trees to canopy generally represents the area of open space in each area. For example, the large green space areas taken up by Glenroy's golf course and Hadfield's cemetery raise the contribution of park trees. In contrast, Brunswick West, Coburg and Pascoe Vale have fewer parks and therefore park trees only contribute around 10% of total canopy

A comparative analysis was conducted on three sets of aerial photography: 1989, 2005 and 2016 (Figures 15). Over time there has been an increase in hardscapes and a reduction in trees on private property. The land use change assessment also identified opportunities for planting trees in both the public and private realm.
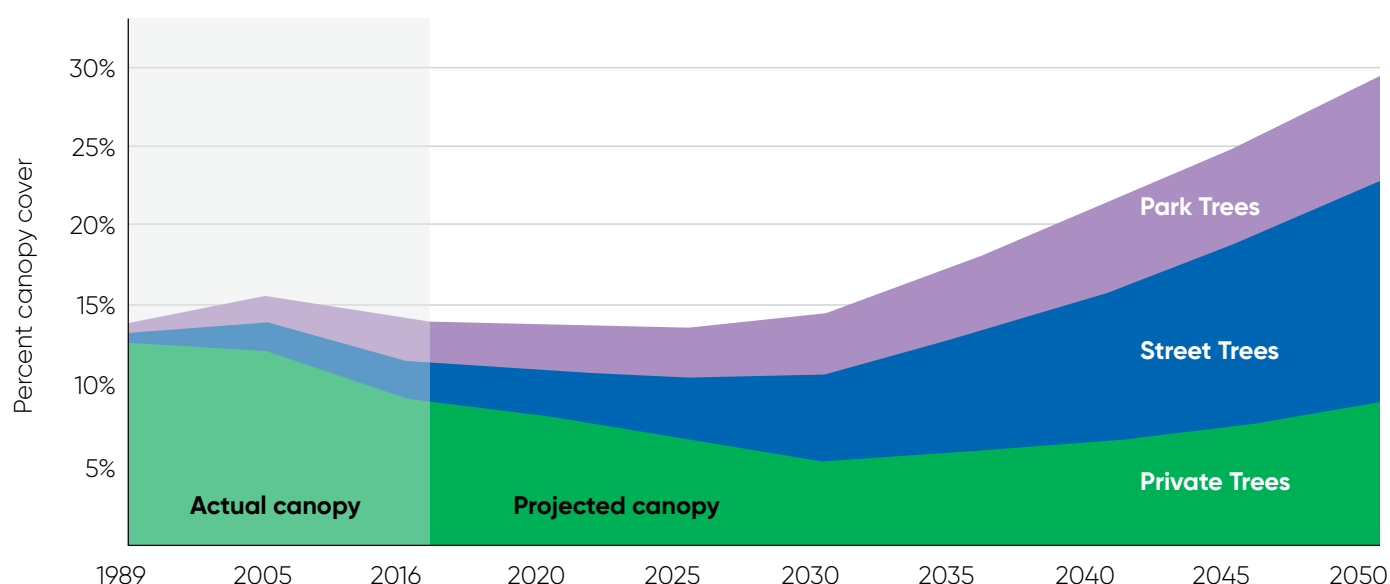
	1989	2005	2016	2020	2030	2040	2050
Street trees	0.7%	1.9%	2.4%	3.0%	5.5%	9.3%	14.7%
Park trees	0.6%	1.6%	2.6%	2.8%	3.8%	5.6%	6.6%
Private trees	12.7%	12.1%	9.2%	8.0%	5.2%	6.5%	9.0%
Moreland canopy cover	14.0%	15.6%	14.2%	13.8%	14.5%	21.4%	30.3%

Figure 15. Urban forest canopy cover change in Moreland including projected canopy cover under the Urban Forest Strategy, 2017–2050

The trees managed by Moreland City Council contribute to the character and identity of our neighbourhoods. The combined total of canopy trees on Council land has grown from a low base of 1.3% in 1989 to 5% in 2016 (Figure 15). This growth reflects Moreland City Council's increased and ongoing program of tree infill and replacement planting. Figure 15 clearly illustrates why Moreland's overall tree canopy cover has declined during the past decade despite the significant growth in public realm tree canopy (albeit from a low base). Between 1989 and 2016, canopy cover from trees on private land declined by 28%. It is expected that this steady decline in overall private realm canopy from 12.1% in 2005 down to 9.2% in 2016 will continue through to 2030 due to ongoing urban consolidation and the resultant vegetation removal. A more detailed suburb by suburb analysis will help explain how this decline is uneven across the municipality.

Kaspar examined the issue of Moreland's tree canopy cover in more detail by assessing canopy cover, change over time and the reason for this change by suburb.[32] Kaspar found that tree canopy cover in Pascoe Vale had declined from 18% to 15.6% between 2010 and 2015. The cause for this change was largely due to a 19% decline in private realm tree canopy or 160,625m^2 of tree loss. Urban consolidation was the main driver of this decline. This decline was equivalent to the loss of 345 netball courts of tree canopy in Pascoe Vale. The decline in private canopy was exacerbated by a 10% decline in street tree canopy. The removal of street trees to facilitate vehicle crossovers was the main driver for this loss together with dead tree removal and pruning works. This is discussed in the Street Tree Planting Plan and Figure 69.

On a more positive note, between 2010 and 2015 total tree canopy increased in Brunswick East by nearly 16%. This was largely due to tree canopy growth in the private realm (12.5%) and also from street trees (23.6%) and park trees (15.8%). Private realm trees make up the largest proportion of canopy in Brunswick East (Figure 15). Street tree canopy made up around 20.7% of streetscapes in Brunswick East, 17% in Coburg and 15.4% in Pascoe Vale.

Rather than assess tree canopy as a proportion of the total land area, Kaspar examined tree canopy within different land use types. For example, street tree canopy as a percentage of the area of Moreland's streetscapes or road reserve (road, footpath and nature strip). This is a similar measure to how the City of Melbourne assesses tree canopy figures. When the City of Melbourne note they currently have 20% tree canopy, this figure relates to the proportion of tree canopy relative to the area of public realm.

Figure 16 provides a detailed overview of the percentage change in canopy cover between 2011 and 2016, which was a period of significant urban consolidation across various parts of Moreland.

The data shows that canopy cover has generally increased across all land cover types, but is much more significant for street trees and park trees. Private realm tree canopy loss is of concern, especially given it makes up the largest land cover type. Declines are most pronounced in Pascoe Vale, Glenroy and Hadfield with urban consolidation the main cause for this decline. Interestingly private tree canopy has bucked the declining trend in Brunswick East and Coburg North where it has increased. The other interesting findings from this canopy analysis are the declines in street trees in Pascoe Vale and especially Brunswick West. The mapping exercise revealed that crossovers were a major contributor in Pascoe Vale whereas power line clearance and the recent Tulla Widening project explained the declines in Brunswick West.

It is important to view the percent change figures relative to the total contribution of tree canopy for each category. Both street tree and park tree canopies are coming off very low bases, so even with positive percent change in these two categories in Fawkner and Glenroy, the total canopy in these two suburbs has continued to decline.
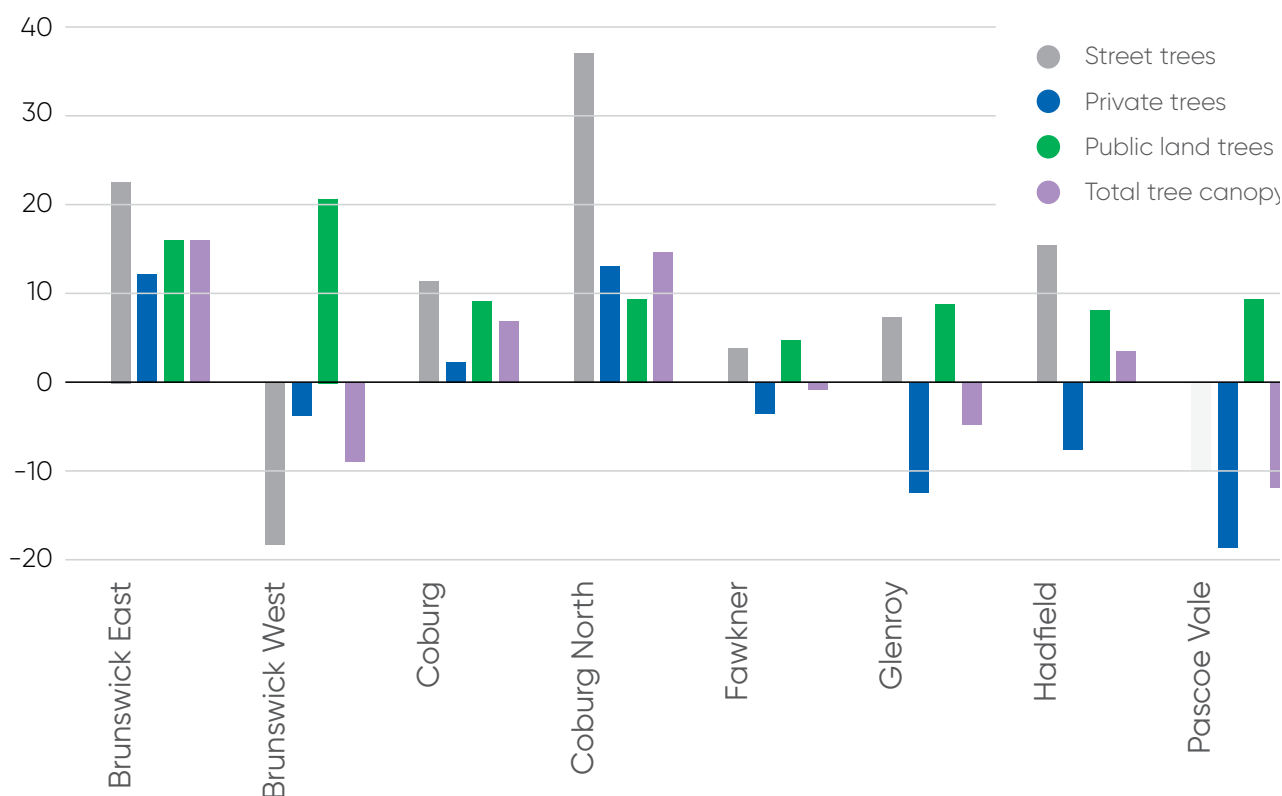
Figure 16. Canopy cover change for Moreland suburbs (SA2) between 2011 and 2016 by land-use category (% change)

Under a tree canopy saturation scenario, Moreland's street trees alone could potentially provide at least 14% canopy cover of the municipality or 75% streetscape canopy. This could be achieved by utilising larger tree species selection for vacant planting sites and when replacing underperforming or senescing trees. Because urban trees often take up to 30 years to reach a mature canopy, a more realistic 2050 goal is around 13–15% from street trees with a further 5–7% from park trees. This would be equivalent to a City of Melbourne tree canopy figure of around 50% and could be achievable by 2050 with the maturity of the urban forest.

Practical tree canopy saturation of our streets and parks could achieve 14% and 6.6% respective canopy cover.

The optimised planting of larger canopy trees would increase the amenity values of street trees from $270 million currently to over $1.2 billion by 2050 and deliver over $4.6 million in direct environmental benefits annually.

It is important to acknowledge the importance of other vegetation types beyond tree canopy. Grasslands, shrubs and under and mid storey vegetation are all critical aspects of the structural diversity of Moreland's urban forest that require greater support.

In addition, there are some areas where trees may be inappropriate to the design, use and landscape in which they are planted. Council cannot plant trees in the middle of recreation reserves, nor should all parks be saturated with tree canopy where open spaces with alternative landscaping and uses may need to prevail. At the same time, this Strategy has identified significant opportunities for increasing canopy cover across Moreland.

7 MEASURING THE VALUE OF THE URBAN FOREST

The tree assessment in 2016 provided tree attributes which help determine the dollar value of Moreland's street trees. iTree Eco provides a dollar value for the environmental benefits of trees including current environmental functions, longevity and overall performance of the forest. It is important to note that there are many other benefits of the urban forest that are not measured such as their contribution to habitat and biodiversity.

All amenity valuations were calculated using the 2015 City of Melbourne method (Further details about these methods are available in Reference Document 4 Amenity Value Formula – City of Melbourne Method).

The analysis of the current urban forest sets a benchmark against which future projections and performance will be measured.

Table 2 provides a summary of the environmental and amenity values of the current street tree population. It shows that Moreland's 60,000 street trees are worth an estimated $271 million in amenity value and provide the community with $361,073 worth of environmental benefits annually. The amenity value recognises that trees are a significant asset. The monetary amenity value has been based upon an internationally accepted value that relates to the trunk diameter and weighted according to a number of relevant considerations including species, aesthetics, location and condition. Revenue from amenity values supplements the tree maintenance program to maintain the overall asset value of Moreland's Urban Forest. See Reference Document 4 Amenity Value Formula (City of Melbourne Method) for more details.

Table 2 provides a summary of some of the current values of street trees in Moreland City Council. Figures 17 and 18 quantifies the significant air pollution benefits of Moreland's street trees. For example, every year more than 2.5 tonnes of ozone and 2.3 tonnes of air particulates are removed by our street trees. These are the same pollutants that cause serious respiratory problems for our residents. Our urban forest also plays an important role in removing carbon dioxide from our atmosphere.

Our street trees store over 11,329 tonnes of CO_2 and removing a further 912 tonnes annually. This is equivalent to removing the pollution produced from 4,066 cars from the streets of Moreland every year.

Table 2. Environmental and amenity values of current street trees prior to 2016 planting season

Estimated 2016 Street Tree Population	54,313
Total Canopy Cover (m²)	813,843
Carbon Storage (kg)	11,328,569
Annual Carbon Seq. (kg/yr)	912,080
Amenity Value	$271,179,839
Annual Heating (kWh)	187,193
Annual Heating (A$)	$65,646
Annual Cooling (kWh)	784,378
Annual Cooling (A$)	$273,800
Annual Heating & Cooling (kWh)	971,571
Annual Heating & Cooling (A$)	$339,446
Annual Pollution (kg)	5,839.7
Annual Pollution (A$)	$2,504
Annual Avoided Runoff (m³/yr)	8,412
Annual Avoided Runoff Value (A$)	$19,124
Most Common Tree	Callistemon (22%)
Average Trunk Diameter (cm)	21.2
Average Height (m)	4.7
Average Canopy Width (m)	3.0

Annual totals Moreland City Council

- Carbon Monoxide **90 kg per year**
- Particulate Matter (10um) **2324 kg per year**
- Particulate Matter (2.5um) **46 kg per year**

- Nitrous oxides **730 kg per year**
- Ozone **2603 kg per year**
- Sulphur dioxide **232 kg per year**
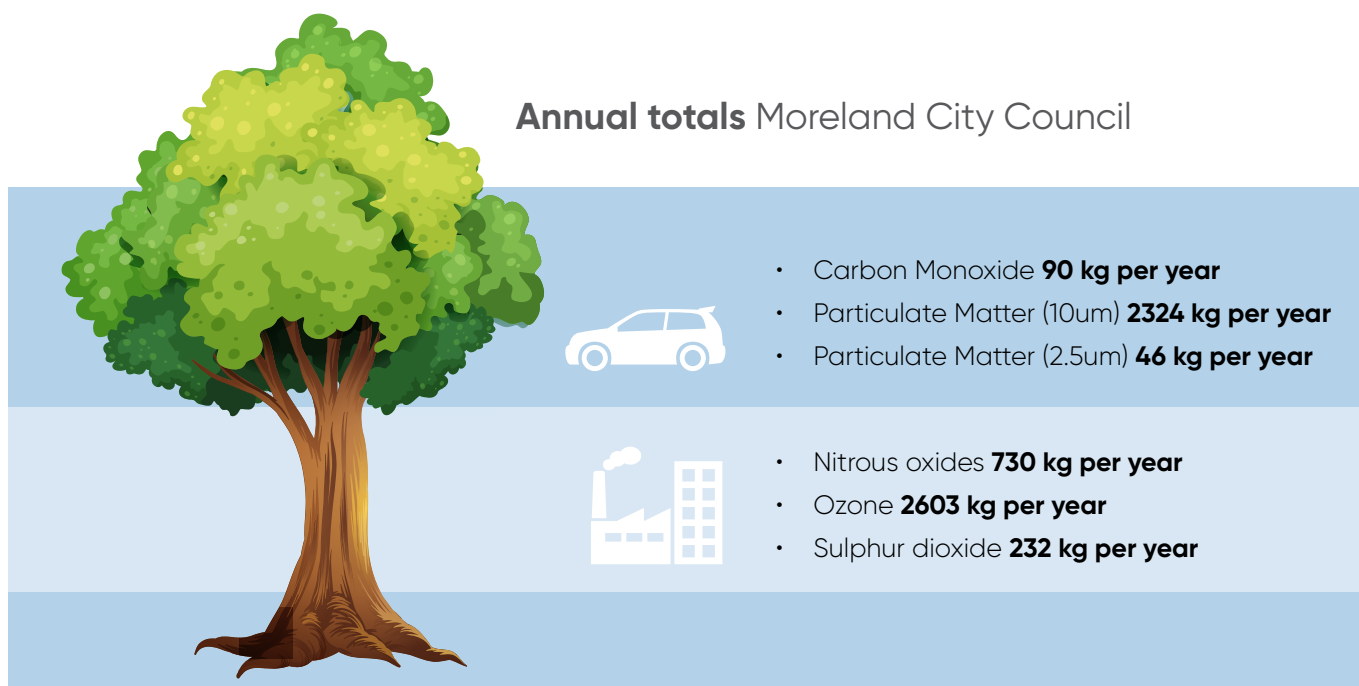
Figure 17. Air pollution removed by Moreland's street trees every year, kg


Equivalent number of cars
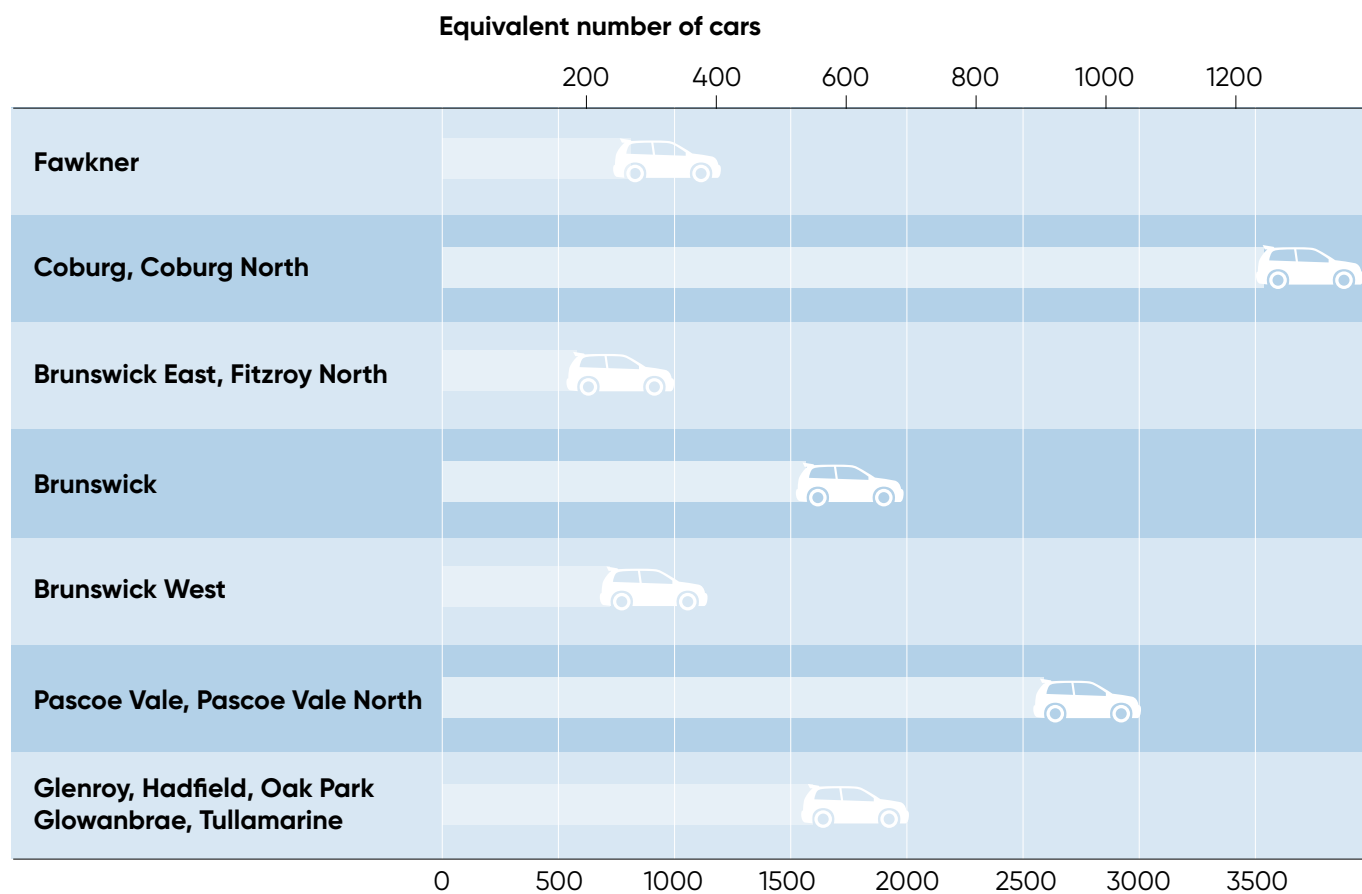
Figure 18. Carbon dioxide (CO2) removed and stored by Moreland's street trees every year, cars and tonnes

8 CHALLENGES

URBAN CONSOLIDATION

The process of urban consolidation across Moreland, and the rest of Melbourne, has resulted in the steady decline of vegetation in the private realm with a reduction in the size of front and back yards as well as a lack of setbacks to cater for vegetation and canopy trees.

While the canopy work has revealed a decline in private tree canopy especially in Glenroy and Pascoe Vale, there are some positives with a growth in Brunswick East and Coburg North. At the same time, many of the new developments in the Activity Centres are creating communal open space as well as roof gardens (see the Green Roofs section of Reference Document 1 Street Tree Planting Plan). While most of these spaces are constrained by the built form and competing services that limit soil volumes and tree canopy, there are also opportunities that can be realised through greening improvements in former industrial areas which were often completely impermeable and devoid of vegetation.

The results in Figure 12 highlight the increased and ongoing pressures that urban development is exerting on private green spaces and private trees; and the increased reliance on council parks and road reserves to provide canopy cover and community access to green infrastructure. Council needs to understand these shifts in canopy cover from a strategic planning perspective in terms of the protection of existing canopy trees and also the provision of new canopy trees in approved planning applications.

This is particularly critical in and around activity centres where footpaths and road reserves are often narrow and already congested with competing services.

A review of the 2009 Moreland Residential Landscape Guidelines and the Moreland Tree Planting Manual for Residential Zones 2014 is recommended as part of the scope of the Working Group. A review of these reference documents should improve both retention possibilities as well realise new opportunities for the planting of appropriate canopy trees on private land.

The location of electric lines within the municipality has an adverse effect on existing and the creation of avenues of significant street trees. Some of the electric lines in significant avenues have been converted to Aerial Bundled Cable (ABC). Insulated open span low voltage construction (tree cable) has also been installed in some areas. There is also high voltage aerial bundled cable (HVABC) in small amounts in various locations.

The undergrounding or bundling of powerlines with all new developments can ensure that these services do not further limit the provision of tree canopy on adjoining streetscapes.

This Strategy recommends the establishment of a working group to review a range of mechanisms and actions such as the planning scheme, local law, educational, incentives and other programs to provide stronger protection of existing private vegetation and introduce new programs to encourage planting on private land.

Climate change is predicted to increase the intensity and frequency of storm events which will have implications for Council. In October 2016, Melbourne experienced 12 storm events which is well above the long-term average of three events.

CLIMATE CHANGE

Moreland's urban forests, like all ecosystems, are impacted by climate change that includes increasing global air temperatures, increasing atmospheric carbon dioxide concentrations, changes in the patterns and amounts of annual precipitation, more frequent and intense storms, longer and more intensive droughts and heat waves, and changes in the frequency and severity of wildfires (IPCC, 2016). The impacts of severe storms and altered fire frequencies, particularly in peri-urban areas, will be profound (Moore, 2011).

The impacts of climate change on urban forests will not be uniform on either a national or global scale, which will make decisions related to planning and managing urban forests difficult as there will be few, if any, approaches that will apply globally, across a continent or across a nation. We continue to improve our understanding of the impact that these changes are having on trees growing in cities.

Moreland has already experienced increased temperatures, changes to rainfall patterns, greater storm intensities and droughts. In recent years, summer senescence has noticeably increased across a range of species due to prolonged drought and extreme heat. Tree mortality due to the 1999–2009 drought resulted in a significant increase in annual tree removals across Moreland.
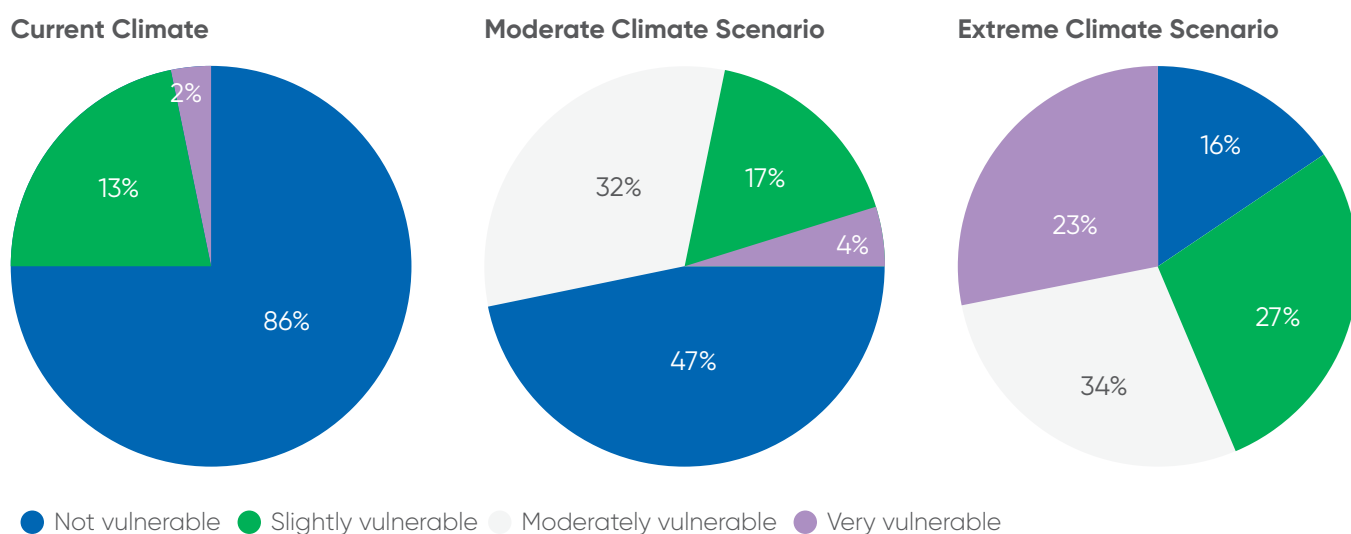
Kendal and Baumann (2016) found that two groups of popular urban trees are likely to struggle under climate change:

- Species from colder climates, such as northern Europe and the north-eastern United States.
- Species with narrow climate envelopes, such as many locally indigenous and other native trees[33]

Kendal (2016) recommends the selection of a diverse range of trees that are likely to: perform well to increasing temperatures; maintain or improve ecosystem services and ecological functioning; and strengthens the municipality's adaptation and resilience to climate change.

A climate analysis of Moreland's street trees found 15% are vulnerable to current climate conditions (Figure 19). This will increase to 53% vulnerability under moderate climate scenarios by 2050 and 84% under an extreme climate scenario by 2090. The climate analysis compared climate envelopes for species against both mean annual temperature and extreme minimum/maximum temperatures.

There are important caveats to the findings in Figure 19 such as species variability, the need to consider physiological characteristics and site conditions.

Current Climate

86% — Not vulnerable
13% — Slightly vulnerable
2% — Very vulnerable

Moderate Climate Scenario

47% — Not vulnerable
17% — Slightly vulnerable
32% — Moderately vulnerable
4% — Very vulnerable

Extreme Climate Scenario

16% — Not vulnerable
27% — Slightly vulnerable
34% — Moderately vulnerable
23% — Very vulnerable

● Not vulnerable ● Slightly vulnerable ● Moderately vulnerable ● Very vulnerable

Figure 19. Moreland street tree species vulnerability to current (moderate and extreme climate scenarios) and future temperature projections of mean annual temperature in degrees Celsius, Clean Air and Urban Landscapes 2017

A key to reading the species risk in Figure 19 is referring to the temperature risk colour coding scheme. Green coding notes that Moreland has a similar temperature to other places where the species is found (climate envelope) and the species is not considered vulnerable in this temperature scenario while red coding notes that Melbourne is 95% hotter than where this species is found and the species is considered very vulnerable in this temperature scenario.

Existing temperatures occurring in Moreland have already increased by 1.5 °C since the 1950s due to increased urbanisation and climate change. Under a moderate climate change scenario, where mean annual temperatures increase a further 0.8 °C by 2040 (a 25 year timeframe), 21% of currently planted trees were found to be moderately or extremely vulnerable. Under an extreme climate change scenario of a further 3 °C increase in mean annual temperature by 2090, 57% of currently planted trees were found to be moderately or extremely vulnerable. Table 3 lists some implications on the management of the urban forest during climate change which should be relevant to Moreland. Management responses to reduce the risk of failure can include improving:

- tree establishment and formative care
- water availability through passive irrigation
- deep soil volumes, and
- tree species selection

While there is good reason for concern over the impacts that climate change might have on urban forest tree species, there are also reasons for optimism. Many species that are widely planted in cities are renowned for their wide tolerance ranges and they should cope with the level of changes in temperatures and rainfall that are projected for many cities.

Other common urban trees come from populations that have wide and extensive natural distributions. Careful provenance selection and breeding, which source specimens growing on appropriate soils but from lower rainfall or warmer regions should ensure that there are suitable intraspecific selections to meet urban planting demands. Even if species' ranges are limited, there may be the option of selecting different species from within a genus. This is the case with the genera, Eucalyptus and Acacia within Australia, where there are large numbers of related species occupying a broad range of habitats.

For many species higher average temperatures will allow more rapid establishment and growth if water is available. Rapid tree establishment would be an advantage in many cities, provided efficient irrigation was available during establishment.

Frost sensitive species may be grown more widely and easily. For species with temperature dependent fruit or seed set, higher temperatures may result in trees that flower but which do not produce fruits and seeds which might be a nuisance.

Table 3. Simplified decision matrix for managing trees in the urban forest during climate change

Species characteristics	Tolerance of higher temperature	Tolerance of drought or lower rainfall	Likely impact of climate change	Management implications	Species example
Widely dispersed over a broad range	High	-----	Low	Select propagation material from appropriate provenance	*Kurrajong* species
Restricted range	Low	Low	High	Monitor performance and consider related species with tolerance of warmer, drier conditions	*Eucalyptus leucoxylon*
Drought prone	High	Low	High	May only survive if irrigated. Not recommended.	*Ficus macrophylla*
Drought resistance	Low	High	Moderate	Grow in shaded, cooler parts of cities	*Waterhousea floribunda*
Seed set	Low	Moderate	Moderate	May be an advantage when fruits or seeds are problematic in cities	*Prunus* species
Photosynthetic rate	Moderate	Moderate	Low	May be an advantage with higher establishment and growth rates. Could be enhanced with irrigation	*Tristaniopsis laurina*
Respiratory rate	High	Moderate	Moderate	Enhanced tree establishment and growth through efficient irrigation	*Ulmus parvifolia*
Transpiration rate	High	Low	High	May only survive if irrigated	*Ulmus procera*
Frost sensitive when young	Moderate–High	Moderate	Low	Small, young trees may be grown without protection from frost	*Buckinghamia celsissima*
Pests and diseases	Moderate	Moderate	Moderate	Need for species diversity and ongoing monitoring.	*Callistemon spp.*

There will be winners and losers among commonly planted urban trees species. In the fourteen year period of below average rainfall and above average temperatures experienced in south eastern Australia (1997–2010), many older conifers such as *Pinus radiata* and *Cupressus macrocarpa* died and urban populations of *Platanus* x *acerifolia* were deleteriously affected. Both Australian native and exotic species will be affected by climate change.

VEGETATION, URBAN SOILS AND WATER

Urban Soils

Moreland City Council predominantly has one of three surface geologies, with the soil profile in each closely related to the underlying geological material on which they have formed. Typical soils in Moreland comprise of dark grey sand over clay (Tertiary), light grey loams over clay (Silurian), and heavy clay (Volcanics). There are also smaller areas associated with alluvial flats and Tertiary volcanics are found in the slopes and bottoms of creek lines.

Soil disturbance, and extensive exporting and importing of soil material have commonly occurred throughout the municipality, resulting in highly modified , and often unpredictable, soil profiles. These Anthroposols or human modified soils are the predominant soil profiles that trees are planted into within the streetscapes of Moreland. These soil types can have degraded soil chemistry, nutrition, and structure, which can negatively affect tree health.

Unfortunately, soil contamination is a legacy of certain historic land uses and vehicle pollution in many urban soils or anthroposols across Moreland. Depending on the nature and extent of the contamination, and how the site is to be used, contaminated sites may pose risks to human health and the environment. Key considerations regarding managing risks pertaining to the management of contaminated soil include knowing where these sites are, whether they are contaminated, the extent and type of contamination and the potential impact on human health, the environment or amenity. Testing, managing and remediating contaminated soil can be very expensive.

To compound matters, urban areas are dominated by concrete, roads, buildings and other sealed surfaces that prevent the permeability of water and oxygen.

To facilitate improved soil environments around existing trees, soil health guidelines have been prepared to facilitate improved soil conditions and promote better tree health (See Reference Document 2 Tree Management Guidelines).

Urban Water

Water is essential in keeping our urban forest and green spaces healthy and cooling the city. The sustainable use of water is directly linked to liveability.

Water availability in urban Melbourne is a mix of climate variability and an abundance of stormwater.

Over the past 50 years we have seen a reduction in rainfall in southern and eastern Australia, more frequent heatwaves, fewer frosts, warmer temperatures, an intensification of drought conditions, and rising sea levels (CSIRO & BOM 2016).

The impact of increased water evaporation from plants and soil and the decrease in rainfall is also likely to diminish soil moisture. Combined with more extreme rainfall events it is also likely that this will lead to high levels of water runoff, limited infiltration of water through soil and an increased possibility of flooding events.

To manage these issues Council need to carefully consider how and when to use water. It is not a case of ceasing the use of water, but about considering alternative sources of water (such as stormwater) and how efficiently and effectively it is used to achieve the desired outcome.

LAND USE: OPPORTUNITIES AND CHALLENGES

Figure 20 shows the current land use for 8 Moreland suburbs (SA2) and shows that the majority of Moreland is comprised of private land, ranging from 43% in Hadfield to 73% in Pascoe Vale. The Hadfield figures are significantly different due to the large area of the Fawkner and Northern Memorial Park.

Public land (including parks and public buildings) occupied the smallest proportion of each suburb, ranging from 41% in Hadfield to as little as 8% in Brunswick West. Public streetscapes covered between 28% in Brunswick West and 15% in Coburg North (Figure 20).

A more detailed breakdown of the land cover types is shown in Figure 21 shows that buildings and hardscapes (i.e. roads, footpaths and car parks) cover 54% of the municipality.

The canopy assessment also identified a further 23% of Moreland where trees could

potentially be planted, which includes a further 14% plantable opportunities in the private realm and 9% in the public realm. The public realm plantable opportunities figure of an additional 9% cover needs to consider the place and value of open space areas with grass and vegetation rather than just trees.

It is important to understand that trees can play a greater role in shading hardscapes and that it is not a zero-sum outcome where tree canopy results in the loss of roads space. In addition, there is significant scope for improving tree canopy cover over hardscapes in a complementary manner. While there are always constraints that need to be considered, the aim of the street tree plan is to provide greater canopy shade for Moreland's streetscapes.

These land use figures presented in Figure 21 are important to consider when understanding change over time in canopy cover but also the scope for increasing tree canopy in the public realm, namely street and park trees.
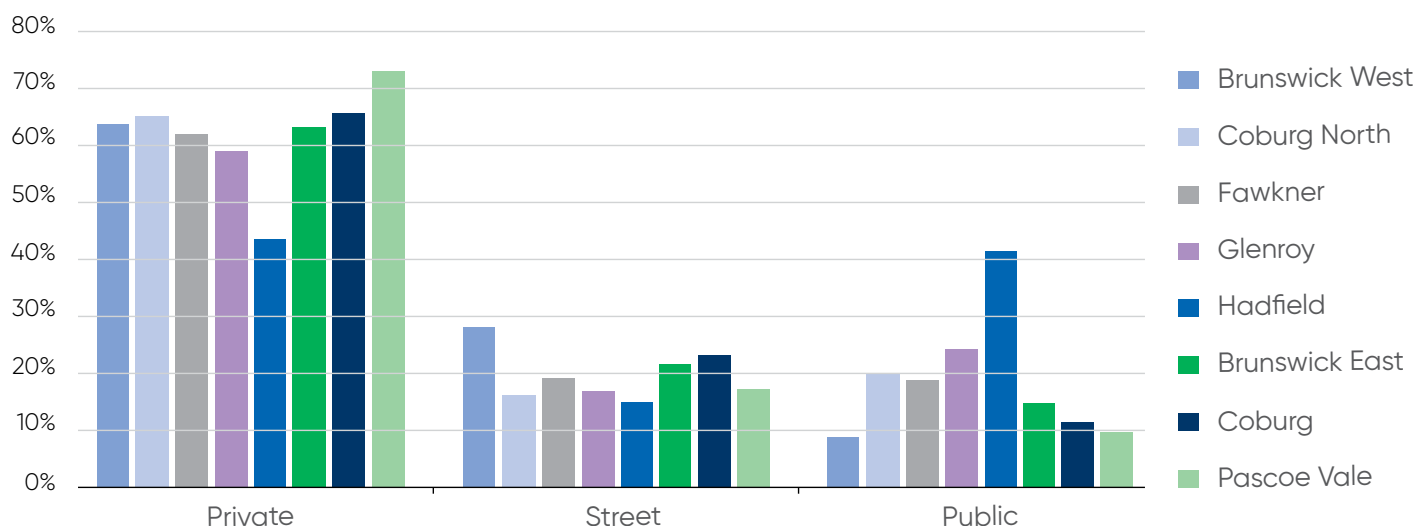
Figure 20. Distribution of land-use areas for 8 Moreland suburbs (SA2), 2016

BIODIVERSITY

Climate change is likely to amplify existing threats such as habitat loss and invasive species, making their impacts considerably worse. For example, there is already evidence of a shift in the timing of flowering or seed production and insect emergence, bird arrival and breeding to optimise reproduction and success.

Loss of biodiversity is a real threat in a changing climate. The effects of climate change on the biodiversity of Moreland's urban forest will occur at many different levels – from individuals to ecosystems. Species may alter distribution, abundance, behaviour and the timing of events such as migration or breeding. The most susceptible species will be those with restricted or specialised habitat requirements, poor dispersal abilities or small populations.

Urban consolidation, loss of backyards (which often provide good habitat linkages for fauna in particular) and incremental loss of vegetation to infrastructure make it difficult to maintain biodiversity. As Moreland's population continues to grow and the climate warms, it will become increasing important to provide refuge and connectivity of habitat for biodiversity.

While this Strategy emphases canopy species for street trees, the establishment of native under storey and mid storey vegetation is critical in our private gardens, parks and waterways for strengthening biodiversity. Council encourages the planting of indigenous vegetation to promote biodiversity but also acknowledges the role of exotic vegetation in providing habitat, nectar, seeds for example.[34]

Moreland City Council focuses on the preservation of habitat vegetation and a number of sites are registered in the 2011 Moreland Indigenous Vegetation Assessment Final Report.

Indigenous planting is promoted through the Strategy with a doubling of the extent of habitat corridors, a revised nature strip guide, a new parks vegetation program and recommended changes to open space maintenance practices which will strengthen biodiversity and habitat.

Council also recognises the importance of appropriate training for its staff. For example, in 2017 Council organised an ecological training program for its Arborist staff to recognise habitat sites and incorporate best practice in mitigating the effects of line clearance and pruning on native fauna and habitat.

There is scope for improving the planting of habitat vegetation as street trees but it is also important to acknowledge the important role of private gardens, nature strips, railway corridors and road plantations.

Climate change will also have indirect impacts on urban forest biodiversity. There may be increased pressure from competitors, predators, parasites, diseases and disturbances (such as bushfire or drought). It is likely to influence the composition of ecosystems and their distribution by altering water flows in rivers and wetlands and the occurrence of bushfires and floods.

RISK MANAGEMENT

A key issue confronting the community is how to manage the urban forest from a landscape, ecological and public safety perspective ensuring that reasonable care is taken to manage the risks associated with the urban forest.

Risk can be defined as the future 'possibility that things can go wrong or not turn out as expected' (Power 2004, p.61). It is a complex term that can refer to harm, security, safety, an uncertain future and a desire to control current and future outcomes. Risks within the urban forest may relate to the likelihood of a street tree limb drop impacting upon persons or property, the loss of trees due to pest and disease, higher mortality and morbidity rates from the lack of vegetative shade and cooling, greater obesity rates from lower activity levels due to poor streetscapes and open spaces, and fires in open space for example. An emerging weakness of risk management is that it is increasingly focused on mitigating reputational damage of organisations and management who perceive that delaying or not making a decision reduces their risks. As

such this response often diverts energy and resources away from the management of societal risks.

For Council, managing risk is about improving decision making, governance, resourcing and productivity. The important questions we need to answer in responding to risk are: the risk 'of what', 'how likely' and 'how serious'? In regard to an urban forest, risk management requires a shift in values away from trees as a liability to an asset, and for Council to move from reactively managing trees individually to strategically managing it as a whole or urban forest.

Moreland City Council manages over 130,000 trees including 59,000 street trees within a range of landscapes. In the majority of cases, the large numbers of trees prohibits an individual tree assessment approach. The time involved in the inspection procedure and the works generated from such inspections would be extensive and prohibitively expensive for the community. A broader, systematic and proactive approach to tree assessment is required that prioritises works on hazardous trees based on the establishment of tree risk.

Trees die from a range of causes including disease, insect attack, disease, drought, uprooting, poisoning and catastrophic stem failure in high winds, or more often a combination of factors working together. Limb failure can sometimes be an early sign of poor health.

Traditional grey infrastructure like roads, drains and buildings have often been monitored and assessed for acceptable levels of risks. Common risk management frameworks include Risk Management Standards and Guidelines (AS/NZS ISO 31000 Standards Australia 2009) and the International Risk Governance Council's Risk Governance Framework (IRGC 2005). In recent decades, specific techniques have also emerged in regard to identifying, assessing, analysing and managing risk in regard to the urban forest. Specific risk management frameworks relating to the Urban Forest include, for example, a Visual Tree Assessment.

Council uses a range of advanced procedures, techniques and equipment to manage risk in regard to our trees, including for example programmed tree pruning, decay-detection equipment, tree surveys and inventories, training, amenity tree valuations, hazard assessment, tree inspection, tree and landscape management plans, tree maintenance and monitoring schedules, contractor supervision, review protection plans for trees on development sites, root mapping; and arboricultural engineering.

Two terms that are often used when referring to trees and risk are hazard trees and tree defects. A hazard tree refers to a tree that has structural defects in its stem, branches or roots that may cause the tree or tree part to fail, and where such failure may cause personal injury or property damage. There are two kinds of tree defects: (i) injury or disease that seriously weakens the stems, branches or roots of trees, predisposing them to fail or (ii) structural problems arising from shallow rooting habits, inherently brittle wood, or poor tree architecture, including V-shaped crotches in stems and branches that lead to weak unions, etc.

The perception of safety or acceptable levels of risk is equally or sometimes more powerful than the reality of the condition of a tree and the situation that it is growing in. People without Arboricultural training are often involved in making decisions in regard to the urban forest that are based on local politics, emotions, and perceptions of safety. In order to make objective, science-based decisions on the safety of trees and the urban forest, individual trees and site conditions need to be assessed for the level of risk that they do or do not present by qualified Arborists.

A tree risk management program provides a systematic process for scheduling and inspecting trees, enables the prioritisation of works based on perceived risk, and allows judicial use of community resources. The fundamentals of tree risk management involve:

- Regular assessment and documentation with prioritisation of works;

- Appropriate tree selection and allocation of suitable space; and

- Properly maintained trees.

The need for crisis management can be alleviated by having in place a tree risk management process that aims to avoid, rectify or remove tree defects before they become hazardous.

An emerging challenge for Council is managing the implications of increasing the size and canopy of the trees it is planting on Moreland streets. Not only does Council need to meet landscaping and ecological considerations, but it needs to maintenance programs are adequately resourced and reasonable care is taken to manage the risks associated with hazardous trees and the impact of trees to community safety and on other assets.

Council assesses the level of risk ranging from low to high. For example, Council risk trees are under power lines, around schools or major roads, in playgrounds and sports fields, shopping precincts and near council facilities. These trees are audited annually.

Since 2014, the threshold for removing trees has been adjusted with a higher priority on tree retention. Previously, simple limb failure may have resulted in removal whereas there is a now a more technical response. The shift in attitude has occurred due to the professionalization of tree crews to employ skilled Arborists and a greater understanding of the overall integrity of the urban forest.

Quality tree management is probably the most important risk management program undertaken by Council's Open Space Unit. It starts before we even plant a tree (discussed in more detail in Reference Documents 1 Street Tree Planting Plan and 2 Tree Management Guidelines) and covers tree species and site selection, tree planting, tree pruning and maintenance, and our emergency response programs. The benefits of choosing to manage the risks of an Urban Forest through such an approach include the following:

- Lower frequency and severity of accidents, damage, and injury;

- Fewer expenditures for claims, and legal expenses;

- Healthier, longer-lived trees; and

- Overtime, fewer tree removals annually.

Despite this Council has adopted a systematic and proactive approach to tree assessment that prioritises works on hazardous trees based on the establishment of tree risk process. Moreland's tree risk management program provides a systematic process for scheduling and inspecting trees, enables the prioritisation of works based on perceived risk, and allows judicial use of community resources.

The key aspects of Moreland's tree risk management process include:

- Regular assessment and documentation with prioritisation of works,

- Appropriate tree selection and allocation of suitable space, and

- Properly maintained trees.

The tree risk management process aims to avoid, rectify or remove tree defects before they become hazardous.

PEST & DISEASE MANAGEMENT

The monitoring, containment and treatment of pest and disease attacks on the urban forest is important. Maintaining a diverse street tree population and improving tree selection, planting and maintenance programs will help to minimise the impact of any new pest or diseases. Elm Leaf Beetle management programs are already in place. Myrtle Rust, a serious exotic fungal disease was first detected in 2011 in Melbourne could have a significant impact on many species within the Myrtaceae family which dominate Moreland's urban forest. Ongoing monitoring is critical for all pest and disease issues. Further details are discussed in Reference Document 1 Street Tree Planting Plan.

RISK ASSESSMENT MATRIX OF TREES

Trees are living, dynamic organisms that pose some risk of harm to people and property. There are many factors that affect the level of risk associated with trees including the time of the year, extreme weather and previous maintenance works.

Overall risk from trees is extremely low. Norris (2010) compiled statistics from a 53 month period and calculated the fatality rate from accidental tree failure in an urban area at 1:17.7 million annually during that period.

Management of unreasonable risk is an appropriate response; however, the elimination of all risk from trees in our community is not practical or environmentally sound, as this would require the removal of many trees in the community. This is not desirable as the very small risk that the population of trees represent is outweighed by the benefits that the trees provide.

Risk versus Hazard

There is often confusion between risks and hazards when assessing risk. Risk and hazard are not the same. A hazard is the presence of, or ability of, something to cause harm. With all mature trees, there may be a hazard present, just as there may be with any man-made structure. For example, the ceiling of a building could fall into a room. This is a hazard. It is a hazard that, if it falls on a person, will most likely cause some level of injury. This injury is classified as a consequence. The likelihood of the ceiling failing is extremely remote. The likelihood of the ceiling failing when it could cause an injury is even more remote, as the room will not be occupied at all times over a 24 hour period.

The combination of the consequence and the likelihood is the risk. In the example above the risk is so small that a reasonable person would take no particular action to avoid the risk. A risk assessment aims to categorise risks to identify risks that are unacceptably high. A decision then can be made on the most appropriate way to manage the risk down to an acceptable level.

Risk assessment

A tree risk assessment is undertaken to identify trees that pose a risk of harm to people or property that is greater than the risk threshold that is acceptable based on normal community standards of risk and any specific factors for the particular tree or location.

There are a number of approaches to urban forest risk assessment. A standardised and systematic process for assessing tree risk is the International Society of Aboriculture's Tree Risk Assessment Qualification (TRAQ).

Such processes ensure the results of a tree risk assessment provide the community and assessors with sufficient information to make informed decisions to enhance tree benefits, health, and longevity.

The risk assessment takes into account the hazard from the tree, and in particular, any factors that increase the hazard of that particular tree from the general population of trees. These factors will include tree health, tree structure and the presence of observable dead or broken branches, cavities or structural issues. The risk assessment also takes into account the magnitude of harm that may occur from the most likely hazard posed by the tree and the likelihood of that harm occurring based on the type of target (e.g. person, building) and how often that target is likely to occupy the target area.

Mitigation measures are recommended for trees that have been identified as an unacceptable risk in order to reduce the risk to an acceptable level. Sometimes this may require tree removal or pruning. Where appropriate, habitat creation may be considered as part of the risk reduction works.

While inspecting and assessing each tree a risk assessment is completed. The risk rating is allocated to help assess the risk the tree or group of trees pose to the target. For details of the risk assessment criteria see Reference Document 1 Street Tree Planting Plan.

The formula is (Likelihood of Failure * Likelihood of Impact)/2*Consequences.

When conducting the assessment the part of the tree that is most likely to fail within the inspection period is assessed and rated. The inspection period for this assessment has been deemed at 36 months.

TREES AND OTHER ASSETS

The urban forest is subject to a variety of pressures, conflicts, changes to land-use and public requirements. These pressures lead to damaged trees, which may affect their function and viability in the landscape. The conflict between tree roots or canopy and infrastructure is pervasive in urban areas. The increase in urban development linked to the need and desire to have trees in our landscapes will invariably lead to conflicts.

Understanding the various causes of infrastructure damage will allow the most appropriate actions to be developed to minimise the risk of damage occurring. A range of strategies need to be considered such as appropriate species selection and site assessment, root pruning and barrier placement to avoid or manage tree root conflicts with infrastructure.

Most of Moreland's streets include above ground power and communication cables. Council has legislative clearance requirements for trees around powerlines. Electricity Safety (Electric Line Clearance) Regulations 2015 (Energy Safe Victoria). This requires regular clearance pruning to attain required clearance distances. As the population increases and urban consolidation occurs there is also pressure to increase the size and number of vehicle crossovers, which can add pressure to existing trees. Co-ordination with service providers and other council departments is required to ensure the sustainable management of street trees.

Planting Guidelines in Reference Document 2 Tree Management Guidelines provide recommended setbacks and clearance requirements for a range of infrastructure.

ROAD SAFETY

Roadside trees do not appear to comprise a significant risk to drivers. Instead, they encourage lower speeds and are now accepted and used as effective traffic calming devices. Traffic authorities have tended to severely restrict roadside tree planting by enforcing 'clear zones' to be kept free of rigid objects such as trees above a specified trunk diameter. As a consequence clear zones are seen as the largest impediment to roadside tree establishment on arterial roads. In 2007 in NSW tree crashes comprised only 4.4% of all crashes with a fatality rate of 3.1%. Alcohol, speeding and driver fatigue were the biggest contributing factor to fatal crashes. The tree tends to be unfairly blamed as the cause of the accident, when in fact the tree collision is only the outcome of a run-off-the-roadway incident.

Street trees, if properly selected, adequately spaced and pruned to branch high, do not create major visibility problems for drivers entering intersections. In fact parked cars, especially large vehicles such as 4WDs and SUVs, create substantially more visibility problems than trees for pedestrians and vehicles.

In fact, the presence of trees encourages people to walk for both exercise and transport and is associated with reduced incidence of heart attack and type 2 diabetes.

Moreover, trees planted along the kerb, especially if closely spaced; define a pedestrian zone separated from traffic, creating a sense of safety both physically and psychologically. The perception of safety is an important component of walkability, and there are safety aspects of tree planting in the verge between the footpath and roadway. This includes an increased perception of safety, by separating pedestrians and moving vehicles, and by creating a protective barrier which reduces the risk of being hit by a 'run-off-the-road' vehicle.

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ROAD STABILITY, FOOTPATHS AND ROOT INCURSION

Pavement damage due to tree roots has budgetary implications for local government. Costs include pavement repair, tree removal and replacement, legal expenses, and injury claims (Foster, Lowe & Winkelman 2011).

At the same time, research challenges the common assumption that pavement cracks near roots are always caused by trees. Footpath damage can result from soil conditions and age of pavement as well as from tree roots. D'Amato and others (2002) found that older footpaths fail more often; and footpaths did not fail at higher rates where trees were present. With no roots present, 61% of all pavement expansion joints were also cracked.

Council receives a number of claims every year for alleged damage caused to buildings by trees. Such claims and damages put financial pressure on Council but also cause resident angst and frustration.

There is a need for strategic response. Moreland's soils are dominated by high reactive clay which can experience significant shrinkage and expansion due to changing soil moisture.

9 PLANTING OPPORTUNITIES

After the 2016 planting season, it is estimated that 58,702 trees are currently growing within Moreland's streets with a further 7,258 potential planting locations available. If all of these vacant sites are planted, then Moreland's streetscape should be basically saturated with 65,960 street trees, including 941 potential planting sites that could be developed in non-conventional nature strip sites (e.g. in road plantings). These vacant sites represent missing environmental and amenity value to Moreland City Council, and if strategically planted could provide more than $657,000 of annual environmental benefit to the community.

- There are currently 6 trees for every vacant site across the municipality

- There is a disproportionate distribution of vacant plantings between suburbs with Gowanbrae, Tullamarine, Glenroy, Hadfield, and Oak Park having a tree to vacant planting ratio of 3:1

It is likely that additional vacant sites could be identified, most of which will require design and capital works, particularly in the three activity centres.

Table 4 provides a summary of the estimated status of street trees and potential planting sites within Moreland City Council, based upon existing inventory data and a 2016 stratified sample survey of 4,769 street trees and an earlier sample of nearly 10,000 trees. Details of data sets and sampling methodology are provided in Reference Document 1 Street Tree Planting Plan.

A complete field audit of every street in the municipality was conducted in 2016 to identify all current planting opportunities in conventional planting sites such as nature strips and medians, as well as areas with the potential for alternative planting treatments such as in-road planting and borrowed streetscapes such as park frontages. These will require design outcomes and are discussed in Street Tree Planting Plan.

Table 4 identifies a total of 9,140 currently vacant planting sites and 941 potential planting sites that were identified in early 2016 within Moreland streets.

Selecting tree species based upon the location of the planting site, its restrictions and tree functions will enable the most environmentally functional tree to be established to maximise carbon sequestration, pollution removal, passive energy benefits, canopy cover and rainfall interception; and facilitate targeted tree species selection to fulfil specific environmental needs e.g. high pollution removal along major roadways.

Further analysis is required to understand the full scope and priority for scheduling these potential planting sites against capital budget and local site constraints.

Tree Status	Description	Total	Percentage
Current	Street trees	58,702	89%
Proposed	Potential future planting sites requiring design	941	1.4%
Vacant	Currently vacant planting sites	6,317	9.6%
Total	**Future street tree population**	**65,960**	**100%**

Table 4. Street Trees and Vacant Planting Sites

Trees (14%)

Buildings (30%)

Hardscape (24%)

Non-plantable (8%)

Plantable (23%)
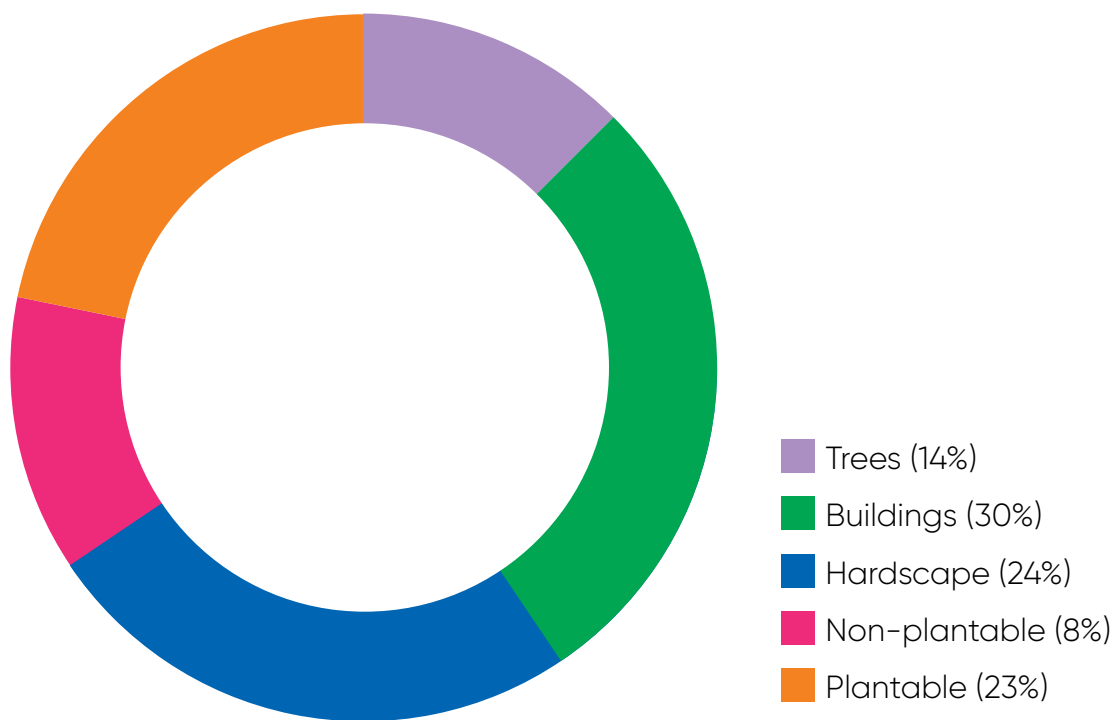
Figure 21. Moreland land cover types including opportunities for tree planting

The tree canopy results for 2011 and 2016 for 8 Moreland suburbs revealed a very distinct pattern where total tree canopy remained largely stable (–1.1% change) while streetscapes (+5.6% change) and public areas (+4.6% change) increased canopy cover and private areas lost canopy cover (–6.6% change). The loss in private realm vegetation was largely due to tree removal relating to construction activities. The steady pace of urban infill development is resulting in losses of tree canopy under private tenure, at a time when Moreland is trying to set ambitious targets to increase overall canopy. Despite Council's efforts to increase canopy cover in the public realm (streets and parks), the loss in the private realm is negating the overall impact.

The 'dynamic equilibrium' in tree canopy cover change whereby canopy losses are approximately offset by concurrent canopy growth, means that arguments around the setting of ambitious targets to increase the urban forest's canopy may be difficult to achieve without changes in tree protection and infill development policy and planning on private land.

In 2016, Council introduced planning scheme amendments to all Residential Zones (RGZ, NRZ and GRZ) to provide for an increase in vegetation through a preferred "green"

landscape character across the municipality. The amendment also recognised the function of landscaping, such as canopy trees by requiring the planting of a minimum of one semi mature canopy tree.

Moreland's street and park trees provide around 5% cover of all land areas. Based upon land data provided by Council, Moreland City Council nature strips occupy 6.2% of the total land area of the municipality, from which street trees are currently providing 2.4% canopy cover.

Glenroy and Coburg have the largest number of current vacant sites at 2,263 and 1,291 respectively. Over 23% of the vacant sites are located in Glenroy with a further 14.3% in Coburg with only 10% in Brunswick. The difference in vacant site numbers is largely due to the wider nature strips and footpaths that are located in Glenroy and Coburg. In contrast, Brunswick dominates in terms of potential vacant sites that will require a design outcome due to the often narrow streets and footpaths.

These vacant planting locations represent currently available and potential opportunities to increase the structural and functional value of Moreland streetscapes. These vacant sites are conservatively estimated and factor in many of the identified safe clearance and setback areas from existing intersections, services and other assets.

The current street tree to vacant planting site numbers shown in Table 5 represent a ratio of 5:1 (i.e. for every five trees planted, there is 1 vacant planting site). This ratio is acknowledged to be better than many municipalities around Australia, with a ratio of approximately 3:1 commonly identified.

Table 5 highlights the disparity of planting site vacancies between suburbs of Moreland City Council. Gowanbrae, Tullamarine, Glenroy, and Oak Park have the greatest rate of vacancy, with a 2:1 or 3:1 ratio identified (i.e. for every two trees planted, there is 1 vacant planting site).

While the high vacancy rate and low ratios can reflect more prevalent site restrictions for tree planting and the relative age of residential communities, they also highlight suburbs where significant improvement for tree density can occur.

All vacant planting sites and potential planting sites are identified on a map of Moreland in Figure 22, which provides a useful overview of vacant planting sites, and an example of vacant planting density in a sample area which has low canopy cover. The 9,140 sites highlighted yellow represent currently available sites that are vacant and the 941 purple sites represent potential planting locations in streetscapes that will require strategic design to facilitate tree planting are discussed in the Street Tree Planting Plan.

Table 5. Current Street Trees with Vacant Sites by Suburb and Ratio, 2016

| Suburb	2016 Street trees (Prior to 2016 planting season)	Vacant tree sites			Streets trees (Vacant sites ratio)
		Current	Potential	Total vacant	
Brunswick	6,034	425	550	975	6:1
Brunswick East & Fitzroy North	2,930	326	56	382	8:1
Brunswick West	4,260	456	97	553	8:1
Coburg	9,525	1,291	154	1,445	7:1
Coburg North	3,823	784	0	784	5:1
Fawkner	5,910	778	0	778	8:1
Glenroy	7,203	2,263	72	2,335	3:1
Gowanbrae & Tullamarine	643	326	0	326	2:1
Hadfield	2,594	432	0	432	6:1
Oak Park	1,629	581	0	581	3:1
Pascoe Vale	5,618	887	0	887	6:1
Pascoe Vale South	4,044	591	12	603	7:1
Moreland Council Total	**54,313**	**9,140**	**941**	**10,081**	**5:1**

Figure 22. Current vacant plantings locations map across Moreland

Legend:
- 🟡 Current vacant street tree site
- 🔴 Potential street tree site (designed)

10 NEIGHBOURHOOD CHARACTER AND THE URBAN FOREST
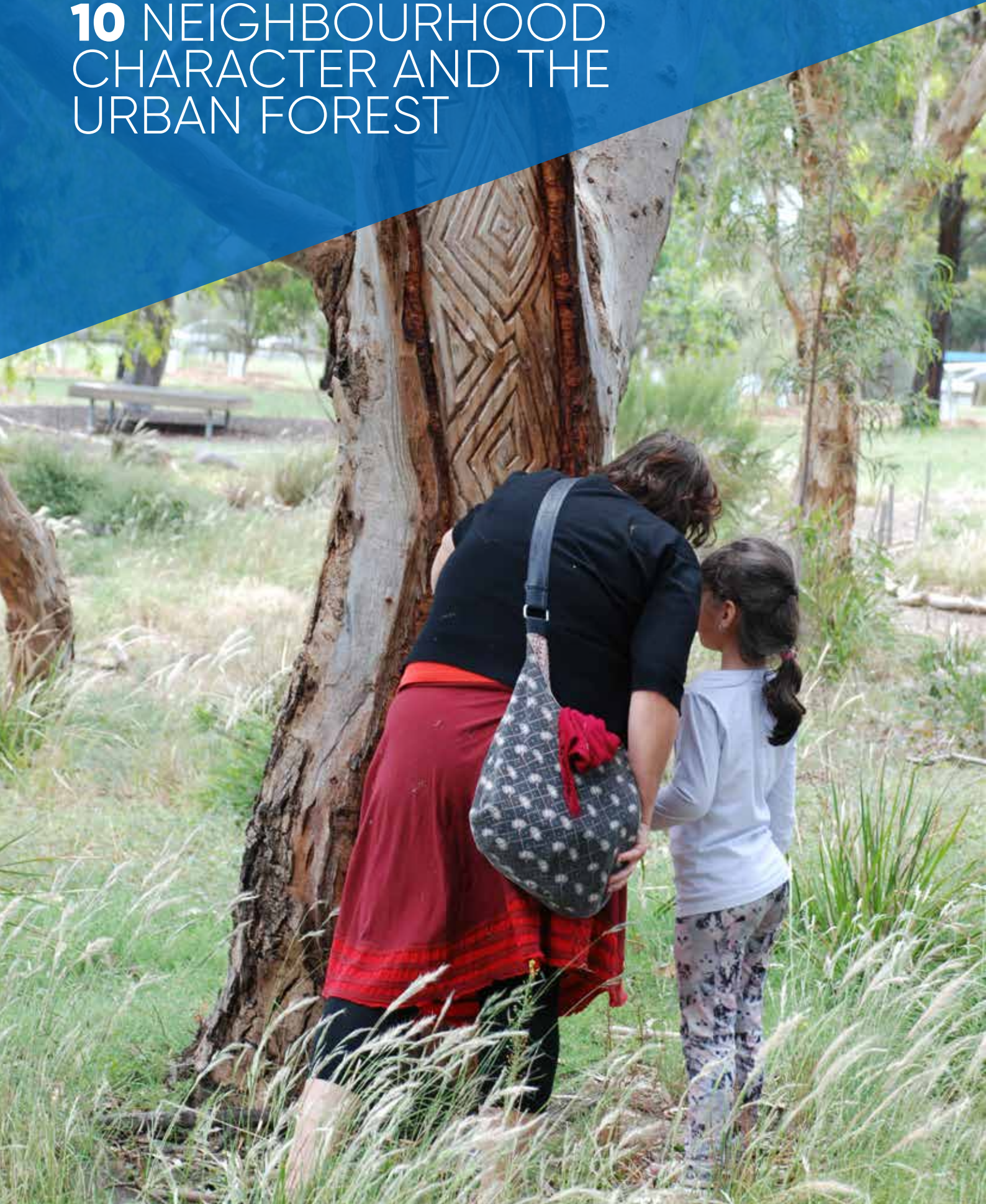
WURUNDJERI HERITAGE

Moreland's urban forest strategy acknowledges the Wurundjeri as the traditional owners of the land. We acknowledge their elders past, present and future. It is important that Moreland goes beyond the basic protection provided to Indigenous sites of significance through the Planning Scheme and Aboriginal Heritage Regulations and instead provide opportunities to identify historical and current connections to the land in partnerships with the Wurundjeri Council.

This Urban Forest Strategy acknowledges that we have much to learn and plenty of work to do if we are to repair the poor state of land that was occupied by and forcibly taken away from the Wurundjeri who had cared for the land for over 40,000 years. For this acknowledgement to be meaningful, Moreland will need to not only improve its protection of important cultural and environment sites but improve our engagement with the Wurundjeri people through a process of reconciliation, engagement, improved access to land, the adoption of traditional land management practices, place naming and the celebration of indigenous place and traditions. It is also important that Moreland provides appropriate protection of this living heritage (see Boxed Text: Murnong Harvest Festival).

COMMUNITY VALUES

Moreland's community is incredibly rich and diverse as is their relationship to vegetation. On the one hand, the community are increasingly calling for more action to improve the amenity of streetscapes, increase vegetation cover, reduce the impact of the urban heat island effect and improve the protection and management of existing vegetation. On the other hand, there remains a strong aversion to tree risk with increasing demands from residents who are more litigious and demand the removal of large trees, complain about trip hazards and nuisance factors such as leaf litter, and flower drop. At the same time, the community is increasingly sedentary with low maintenance balconies and courtyards more common than backyards. Every year, Council's arborists receive around 6,000 customer complaints that predominantly emphasise the negative concerns of the community. Such divergent attitudes and shifts present challenges for managing the urban forest.

In 2017, Council commenced a three year research program led by the University of Melbourne to better understand community perceptions of vegetation across the municipality. This will be the first comprehensive assessment of community values of the urban forest and will be very useful in assisting Council in improving communication and the delivery of its tree maintenance and planting programs.

Murnong Festival Harvest Festival

The traditional staple food of Aboriginal people of South East Australia, the Murnong (or Yam-Daisy) is now close to extinction on much of the grassy plains that spread across the northern and western district.

The annual Murnong Harvest Festival is a good example of celebrating place, cultural traditions and traditional plants which also acknowledges the strength and significance of ongoing access to, and celebration of, land and country.

Murnong and other plants that are important to the Wurundjeri people, are part of a cultural land restoration project on the

Merri Creek on Connolly Avenue, Coburg by the Merri and Edgars Creek Confluence Area Restoration Group (MECCARG) in collaboration with the Wurundjeri Council.

Every year in November, the community celebrates the Murnong harvest festival and learns about and engages in Wurundjeri culture. Activities typically include: a tanderum ceremony; traditional dance performance and dreamtime stories; boomerang painting and throwing; spear throwing demonstrations; didgeridoo lessons; craft stalls; and of course the Murnong harvest and bake.

PARKS, HABITAT VALUES AND HABITAT CORRIDORS

Moreland is a highly urbanised municipality with few native vegetation remnant patches or scattered trees in comparison to peri-urban and rural councils that harbour similar Ecological Vegetation Communities. Nevertheless, Moreland contains environmentally significant areas, in particular local creeks and their surrounding environs.

The majority of the municipality resides in the Victorian Volcanic Plain Bioregion which was predominantly covered by the Ecological Vegetation Classification Plains Grassy Woodland (55) which has an Endangered Bioregional Conservation Status. The protection of remnant vegetation and habitat enhancement to encourage insect, bird and animal populations is important. The Environmental Significance Overlay (ESO) applies to both the Merri Creek and environs (includes Edgars, Merlynston, and Campbellfield Creeks) and the Moonee Ponds Creek and environs (includes Westbreen and Melville Creeks). Vegetation maintenance and future plantings along the creeks and within the bounds of these overlays should focus on strengthening and protecting the environmental significance through selecting indigenous species of local provenance within parks and streetscapes. Decisions also need to be informed by endorsed policies and strategies, such as the Development Guidelines for the Merri Creek (2004) and Merri Creek and Environs Strategy (2009) for example.

Buffer zones have been created adjacent to these important natural areas to guide the selection of species and planting types within the parks and streetscapes of these areas (Reference Document 5 Habitat Streets and Buffer Zones Map).

Coordinating waterway, park, street tree and nature strip plantings can encourage nature and provide links and expand areas of natural habitat for insects, birds and small mammals. While canopy trees are an important part of encouraging nature, it is also critical to ensure there is structural diversity in plantings with mid-storey and under-storey plantings too.

The Urban Forest Strategy identifies habitat corridors and nominates appropriate street tree species to provide such links (Reference Document 5 Habitat Streets and Buffer Zones Map). Our waterways and parks offer the best opportunity to grow a range of indigenous plant species, and these plantings and the juxtaposition of natural formations with the regular plantings of the streets will contribute to the richness of Moreland's urban design.

Caution must be exercised if planting non local species in these areas to prevent hybridisation with indigenous populations. It is acknowledged that these streets may have existing planting of exotic tree species and some contain significant avenues which perform a habitat function. It is not recommended that these species be removed as part of this strategy. Species with weed potential or a tendency to sucker should not be planted in the buffer zones. A list of species that this applies to is provided in Reference Document 1 (Street Tree Planting Plan Section 5).

PLANNING SCHEME

Moreland's future urban forest will be partly shaped by Council's decisions today, just as current decisions are shaped by those previously made. As climate, population density and public health pressures increase, strategic decisions will need to be made that meet a range of needs for the future population ensuring that our public and private trees provide the greatest possible environmental, social and economic benefits to the community.

Council has in place some important policies and planning scheme controls to protect certain elements of Moreland's urban forest. To ensure that Council can maintain and improve its urban forest, a strategic vision is required to provide the framework from which the existing overlays, policies and planning scheme controls can operate. It will also provide a foundation for Council to consider alternative mechanisms and approaches to ensure that planning today contributes to the longevity and health of Moreland's future urban forest.

Optimal municipal wide management and planning for the urban forest must cover both public and private property – urban trees make no distinction between land tenure, yet tenure has significant effect upon individual trees and the canopy as a whole.

Moreland has been experiencing a sustained increase in housing density that has been shown to negatively impact on the amount of green space in neighbourhoods, particularly in private gardens. The subdivision process and design of new dwellings has resulted in a steady decline in private realm vegetation and canopy cover across Moreland during the past decade. Much of this vegetation will be lost forever because building footprints are very difficult to reverse. Moreover, developers and private owners are also replacing mature trees with trees or other vegetation that will not provide the same canopy cover and size of the removed vegetation (Brunner and Cozens 2013; DSE 2011).

Plan Melbourne 2017–2050 revises the 2014 version of Plan Melbourne to reflect current State Government policies and priorities. Linked to the release of Plan Melbourne 2017 was a review of the Residential Zones. The residential zones review found that the residential zones released in 2014 had been implemented in an inconsistent manner across Melbourne. The Minister for Planning has advised that newly reformed residential zones will be released in 2017 that will include requirements that will result in a mandatory percentage of garden space (rather than the current cap on the number of dwellings).

It is anticipated that the newly reformed residential zones will include requirements that blocks between 400–500 square metres require a 25% minimum garden area, blocks between 501–650 metres need 30%, and blocks larger than 650 square metres must have a 35% garden area. As the zone provisions are yet to be released however, it cannot be confirmed how these requirements will operate, where they would apply or whether there is ability for Council to vary these provisions. Changes to the residential zones are likely to have significant implications on the Urban Forest Strategy as it effects the private realm. These implications should be reviewed by the Working Group and factored into any future planning for the urban forest.

Moreland's Municipal Strategic Statement includes strategies to retain existing vegetation and large trees, provision of sufficient space and conditions for planting of new canopy and screening trees, landscape design which contributes to reduction of UHIE, summer shading and winter sun, for example:

- Application of the Moreland Landscape Guidelines 2009 to the assessment of landscape plans (Clause 21.03–4, Objective 12 and associated strategies);

- Neighbourhood Character Policy requirements include the planting of trees in front setbacks, maximise opportunities for tree planting in side and rear setbacks and if in the Neighbourhood Residential Zone,

New apartment developments are increasingly incorporating vegetation as a core part of design.

the planting of trees in the secluded private open space of each dwelling (clause 22.01) with reference to the Moreland Tree Planting Incorporated Plan for species selection (see schedules to clauses 32.07–32.09);

- Vehicle crossing provisions that limit new subdivisions to one crossover per site and therefore limit the removal of street trees and encroachment into landscaped front setbacks (see clause 22.03); and,

- Incorporated Plan Overlays, Development Plan Overlays, Design and Development Overlays that include requirements for landscaping and tree planting.

There are additional controls that provide protection for trees under Council's Planning Scheme for their botanical, habitat, ecological or environmental values. As such permit requirements exist under the following planning scheme provisions to remove, destroy or lop vegetation:

- Environmental Significance Overlays (ESO) for the Merri, Moonee Ponds, Edgars, Melville and Merlynston Creek corridors, and the suburb of Gowanbrae;

- Heritage Overlay (HO) Appendix 3

- Erosion Management Overlay (EMO) Appendix 4

- Public Acquisition Overlay (PAO) Appendix 5

- Clause 52.17 Native Vegetation.

Unfortunately, existing significant vegetation outside these areas remains largely unprotected through the planning and development process.

In 2015, new requirements for landscaping and canopy trees were introduced for Neighbourhood Residential Zone. It is hoped that these provision will slow the decline of private realm canopy, but their effectiveness will need to be closely monitored through ongoing canopy analysis. It is likely that existing planning provisions for the protection of trees and encouraging tree planting will only slow the decline of private tree canopy in Moreland. It is therefore recommended that a cross Council Working Group is established to explore a range of options to strengthen greening outcomes in a strategic and coordinated manner.

A range of additional mechanisms are available to Council to mitigate the declining canopy cover in the private realm and could be considered by the Working Group, including:

- Local Law;

- Maintain, improve and enforce planning protections with relevant ESO;

- A Significant Landscape Overlay;

- Additional tree controls under the HO;

- A Significant Tree Register; and

- Targeted incentive programs, and education campaigns to encourage planting in the private realm. Success in slowing the decline in private realm.

PRIVATE REALM VEGETATION OPPORTUNITIES

The urban consolidation process has resulted in the loss of vegetation from the private realm. While it is very difficult to reverse this process, there are still significant opportunities in the private realm for tree canopy and vegetation.

Beyond Council street tree plantings, park plantings and waterway revegetation, there are many other ways the community can contribute to meeting the urban forest objectives, including:

- Protecting existing trees and their canopy;

- Planting canopy trees in front and backyards;

- Planting shrubs and groundcovers that support biodiversity;

- Participating in community planting days;

- Provide helpful guidance on the planting of small, medium and large trees to residents;

- Tighten the protection of existing significant trees;

- Installing WSUDs such as raingardens;

- Establishing green roofs and walls;

- Growing plants on balconies;

- Monitor the provision of canopy trees in line with development planning conditions;

- Providing space for canopy trees and permeable surfaces; and

- Continue to educate residents and businesses about the benefits of tree canopies.

In order to support this target, Moreland will review a range of opportunities for encouraging the protection of existing trees as well as mechanism for encouraging the planting of canopy trees in the private realm.

In addition to private residence, there are many state and private schools, hospitals and other large landholders across the municipality. Council will work with these landholders to encourage them to plant canopy trees and support the principles of Moreland's Urban Forest Strategy.

Significant Tree and Vegetation Register

The aim of a significant tree and vegetation register is to recognise, celebrate and protect exceptional or significant trees that exist in the municipality in the public and private realm, which contribute to the urban forest and city character as a whole

The City of Melbourne found that tree protection in the private realm is most effective through the creation of a significant tree register. Conditions in Moreland differ somewhat from Melbourne, but a 2012 survey identified 4,500 significant trees across the municipality. Moreland will establish a Working Group to consider the development of a significant tree and vegetation register that identifies eligible trees and vegetation for protection. There may need to be changes to the Local Law or an amendment to the Moreland Planning Scheme to complement these changes. The protection of significant trees in the private realm may be a permit trigger if any significant pruning, lopping or removal of a significant tree is proposed.

Neighbourwoods Program

In addition to tree protection measures within the local law and the planning scheme, Moreland will need to consider a range of alternative mechanisms to encourage residents to protect existing vegetation and promote the planting of canopy trees in the private realm. A Neighbourwoods programs is recommended to be trialled in Moreland to encourage greater community interest in planting appropriate canopy trees and vegetation on private land. The Neighbourwoods Program could include Council support for residential and community greening initiatives, rate rebates for greening, improved education campaigns, and the provision of free or subsidised trees. Similar programs have been running successfully in Sydney and North America for over a decade.

GREEN ROOFS

A green roof is a roof that is covered in plants, typically grown in a shallow substrate (less than 300mm). Green roofs can provide a range of environmental and social benefits, such as urban cooling, stormwater management, increased plant biodiversity, habitat for native fauna, increased amenity. The design intent should clearly state the specific outcomes or benefits that the green roof is targeting, so that the components of design can be assessed accordingly.

The 'Growing Green Guide for Melbourne' is a very useful document for designing green roofs in Melbourne and is a great place to get started. The information provided here is general in nature and technical green roof information should be obtained from design and engineering professionals to suit specific conditions.

Engineering considerations

The structural capability (weight loading) of the roof is a critical aspect of green roof design. It determines what depth of substrate the roof can hold and therefore the planting design. In Melbourne, the minimum depth of a green roof substrate should be around 100mm to aid plant survival during dry periods.

Waterproofing is important to ensure the green roof does not compromise the building. The waterproof layer should be flooded to test that there are no leaks before the green roof is installed.

Another important requirement of the design is to provide for safe access. The expected number of visitors and frequency of maintenance may affect the safety system that is installed for access and working at heights.

Plant selection

Plant selection for green roofs should consider:

- Design and functional intent of the green roof
- Substrate depth, water holding capacity and composition
- Site conditions including light levels, wind, temperature, soil moisture (both very dry and waterlogged).
- Low maintenance requirements
  » dense ground cover to outcompete weeds
  » suited to the site conditions and long lived plants or able regenerate (self seed or root suckers) so that replanting is minimised.
  » Low foliage biomass grasses are preferred to high biomass grasses as the later require considerable maintenance if the foliage browns off during dry periods.
- Ease of access to maintain the roof and the maintenance budget allocated
- Decision to apply any supplementary water after establishment

Some examples of species which may be suitable for green roofs are provided in Table 6. Species selection will be limited in shallow green roof systems (e.g 100–150mm) constructed in Melbourne and provided with no supplementary watering. To maximise survival on such green roofs, species that have high drought tolerance and yet have the capacity to be high water users should be chosen (Farrell et al. 2013; 2015). A greater range of species will be suited to green roofs with a higher water holding capacity (generally deeper substrates, for example 200–300mm). A growing number of buildings across Melbourne have green roofs that have been planted with a diversity of plants and systems.

Substrate selection

Green roof substrates should be light weight, well drained and stable over time. The University of Melbourne are evaluating a range of materials such as scoria, crushed brick, biochar and bottom ash products with organic matter added as green roof substrates.

The depth of substrate is often limited by weight loading restrictions on buildings, frequently less than 200mm when green roofs are retrofitted onto existing buildings. Light-weight materials allow the depth of substrate to be maximised within the weight loading restrictions.

It is important to consider how the substrate will be transported onto the roof. Possible methods include blowing or craning the substrate up in bags.

Maintenance

The green roof planting should be designed for low maintenance. Weeding, replanting and pruning will be required.

Fertiliser use should be minimised and only applied if the plants are showing signs of nutrient deficiency. Green roof substrates tend to have a low capacity to hold nutrients and therefore there is a risk of nutrient leaching following fertilisation. Care should be taken when applying fertiliser, particularly if the green roof runoff is connected directly to the stormwater system. If required, low doses of slow release fertilisers should be applied. Regular checks should be undertaken to ensure the drainage outlets are unblocked.

GREEN FACADES

Green facades are climbers that are grown directly on the building wall (self clinging species) or on trellis systems adjacent to the wall (stem twining species). Climbers are either grown in site soil at the base of the wall or in elevated containerised planters. Plants grown in the ground have access to a larger root zone volume and are therefore less reliant on supplementary water than containerised plantings.

Engineering considerations

The structural capability (weight loading) of the wall is important, particularly if the design includes elevated containers planters and trellis systems attached to the building. The weight loading will influence the volume of growing medium in each container.

Self-clinging climbers may affect the wall that they are growing on.

An irrigation system should be designed for elevated containerised plantings to supply supplementary water.

Plant selection and plant supply

- High foliage density down to the base of the plant if screening is required
- Capable of growing to the necessary height
- Ease of access to maintain the green façade (primarily pruning) and the maintenance budget allocated
- Plant stock should:
  - » have extensive lateral branching and basal shoots
  - » be acclimatized to low light intensity may be important if the climbers are to be planted in in shaded areas (Rayner et al YEAR).

Growing media selection

If the green façade planting is required to cover low building heights, climbers can be preferably planted in the on-site soil.

A light-weight and well drained growing media should be used for the containerised plantings. The composition of the media will depend on the depth and volume of the containers. There are a growing number of examples of green façade systems being installed across Melbourne. It is worth considering both the successful and failed systems.

Maintenance

The maintenance required will generally involve regular pruning of the climbers.

GREENS WALLS

Outdoor green walls are plants growing in a support system that is attached to building wall and includes a waterproof membrane. These vertical gardens can be either modular or felt based system. Frequent supplementary water is required to support the green wall and is delivered by capillary action or drip irrigation.

In general, green walls are a less preferred element of green infrastructure in Moreland, due to the higher potential risk of failure of the entire planting. To ensure success, very careful specification and installation combined with high maintenance inputs are required for outdoor green walls.

PRODUCTIVE TREES

Productive street trees refer to trees that are planted along streets and in parks and produce fruit or nuts which can be picked eaten and shared by the public. Traditionally, Council have been nervous about encouraging the planting of productive trees in streets and parks because of potential risk arising from fruit litter such as slip hazards and poor pest and pathogen management. A large number of residents have already planted productive trees in front of their homes. While Council would prefer to ensure all street trees are planted in an appropriate and safe manner, there is significant value in retaining existing productive trees and exploring opportunities for new plantings in streets and parks where appropriate. The safe planting of productive trees should focus on wide nature strips or in parks. Productive tree plantings by residents should be authorised by Council and subject to a safety audit.

Productive trees can supplement urban fresh food production. Council supports increasing fruit and vegetable intake, normalising the growing of food while educating the community about growing food, encouraging people to grow their own food, as well as sharing and celebrating food.

Productive street trees can provide cities and towns with a range of social, economic and environmental benefits such as building equitable food access, increased opportunities for social engagement and connection to nature, and decreasing 'food miles'. This Strategy recommends a more open approach to productive trees and encourages discussion around the issue through the public consultation stage.

COMMUNITY GARDENS

Moreland has a strong food growing heritage and a community that is increasingly interested in growing food together. Many areas along our creeks and waterways were used for growing fresh vegetables and fruit as market gardens for over a century. A community garden is land gardened by a group. Some have individual plots and others are shared spaces.

Today, CERES and Harding Street are two remaining market gardens, but Moreland has several successful community gardens including Brunswick West Community Garden, Merri Corner and Mulberry Garden.

Community gardens are increasingly popular across Moreland possibly due to our desire to reconnect with food, nature and community, but also due to declining or disappearing backyards.

Community gardens are set up and run by a wide range of people across Moreland, with varying organisational designs and objectives, involve individual or communal plots, engage a wide range of knowledge from beginners to experts, and the levels of involvement differs significantly.

While the motivations for people becoming involved in community gardens varies, it is a great way to get to meet new people, help each other and share knowledge about gardening. Community gardens are great social binders in our community even when people are not particularly driven by social motivations for getting involved.

Table 6. Preferred Plants for Moreland Green Façades and Roofs

Botanical Name	Common Name	Height	Width	Native or exotic	Comment	
CLIMBERS						
Kennedia rubicunda	Dusky Coral Pea	6m	6m	Native	Stem-twiner	Green façade
Aphanopetalum resinosum	Gum Vine	1-2m	1-1.5m	Native	Stem-twiner	Green façade
Pandorea pandorana					Stem-twiner	Green façade
Kennedia nigricans					Stem-twiner	Green façade
Parthenocissus tricuspidata					Self clinging	Green façade
Ficus pumila					Self clinging	Green façade
VARIOUS						
Veronica gracilis						Green roofs
Podolepis jaceoides						Green roofs
Dianella revoluta						Green roofs
Dianella longifolia						Green roofs
Lomandra longifolia						Green roofs
Stylidium graminifolium var graminifolium						Green roofs
Pelargonium rodneyanum						Green roofs
Calocephalus citreus						Green roofs
Wahlenbergia communis						Green roofs
Wahlenbergia stricta						Green roofs
Stypandra glauca	Nodding Blue Lily	0.6m	1m	Native		Green roofs
Vittadinia cuneata var. cuneata	Woolly New Holland Daisy	0.2m	0.3m	Native		Green roofs
GRASSES						
Austrostipa scabra	Rough Spear-grass	0.4m	0.3m	Native		Green roofs
Deyeuxia quadriseta	Reed Bent-grass	0.2m (1m flowering stems)	0.4m	Native		Green roofs
Dichelachne crinita	Long-hair Plume Grass	0.5m	0.2m	Native		Green roofs
SUCCULENTS						
Lampranthus deltoides (syn. Oscularia deltoides)	Pink Iceplant	0.3m	0.8m	Exotic		Green roofs
Sedum xrubrotinctum	Jelly Bean Plant	0.2m	0.4m	Exotic		Green roofs
Sedum pachyphyllum	Jelly Beans	0.3m	0.6m	Exotic		Green roofs
Sedum spurium	Caucasian Stonecrop	0.2m	0.3m	Exotic		Green roofs
Senecio talinoides subsp. mandraliscae	Blue Chalksticks	0.3m	1m	Exotic		Green roofs
Sempervivum tectorum	Common Houseleek	0.05m	0.05m	Exotic		Green roofs
Aloe hybrids						Green roofs
Echeveria hybrids						Green roofs

# 11 AN OPTIMAL TREE PLANTING SCENARIO

Significant increases in environmental benefits can be achieved by selecting a larger or "optimal" tree species for a site based upon site restrictions (i.e. power lines, nature strip width, underground services) and the potential environmental benefits desired (i.e. summer shade, winter solar access, pollution removal). Each current, vacant and potential planting site in Moreland City Council has been assessed, and its site restrictions catalogued within the Moreland Street Tree Program 2016 Sites Data. For each site, an optimal tree species or tree size has been recommended, and the forecast value shown above reflects the value that each vacant site would attain once each planted tree has matured in 2050.
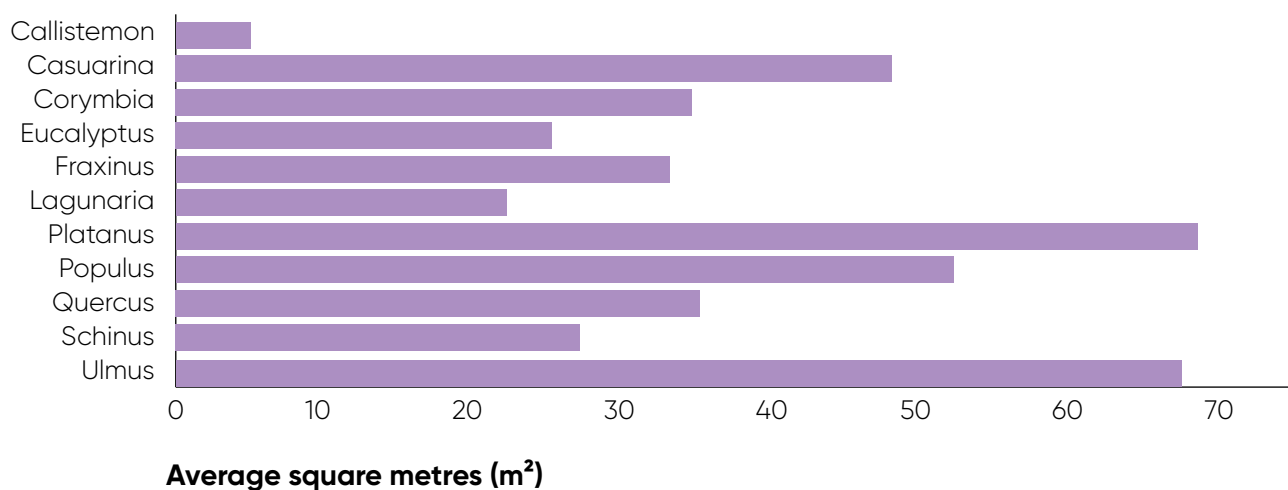
Under a tree canopy saturation scenario, Moreland's street trees alone could potential provide at least 14% canopy cover of the municipality or 75% streetscape canopy. Reaching 100% tree canopy saturation of Moreland's streetscapes would, however, be a very difficult goal to implement. This street tree plan reveals that Council could easily double and then more than quadruple Moreland's street tree canopy from the current 2.4% cover to 4.8% and then reach around 14% canopy cover from street trees alone. This would be achieved by utilising strategic tree species selection for vacant planting sites initially while gradually replacing underperforming or senescing trees.

The typical and most common tree planted in Moreland's streets is from the genus Callistemon, which has an average canopy cover less than 6 m^2. This is 90% less than the most effective Genera Platanus and Ulmus, which have greater mature canopy dimensions. The difference in average canopy cover between these trees is clearly illustrated in Table 7.

This Urban Forest Strategy proposes a dramatic change in tree selection and planting methods to ensure Council moves away from small trees (providing a minimal tree canopy) towards a medium to large tree (providing substantial canopy shade) for our streetscapes. Such a departure from business as usual will eventually require additional resource inputs to maintain the urban forest, including pruning programs, storm management and street sweeping, for example. Moreover, tree planting will be subject to site constraints. While this Strategy recommends a gradual reduction in the planting of the Callistemon genus, alternative small or columnar trees will play an important role in narrow streets with little to no building setbacks and overhead powerlines.

Table 7 reveals how a simple shift away from our current typical tree, the Callistemon, towards a mix of Corymbia, Eucalyptus, Quercus and Ulmus would transform Moreland's streetscapes.

Average square metres (m²)

Table 7. Average tree canopy cover for Moreland's top ten tree genera

Optimised planting with larger trees

- Optimised planting could attain approximately 15.6% canopy cover from street trees in 2050 by saturating (75% coverage) streetscapes without increasing the number of currently available planting sites.

- In contrast, continuing Council's current reliance on small, underperforming street trees in a business as usual approach would attain approximately 2.8% canopy cover from street trees in 2050.

- The optimised planting of larger canopy trees would increase the amenity values of street trees from $270 million to over $1.2 billion and deliver over $4.6 million in direct environmental benefits annually.

- Planting more and larger canopy trees in parks and reserves could contribute around 6% to overall tree canopy.

- Optimised planting in private property could attain approximately 40% canopy cover in 2050 with currently available private plantable spaces.

- Optimised planting of street, park and private trees could attain approximately 60% canopy cover by 2050.

Currently, species of *Callistemon*, *Lagerstroemia*, *Ligustrum*, *Pittosporum* and *Prunus* represent an estimated 35% of the current street tree population. These trees are typically small and thus represent planting sites that are underperforming. If these small underperforming trees were replaced or inter-planted with larger tree species (e.g. *Acer, Agonis, Eucalyptus, Gleditsia, Ulmus,* and *Waterhousea*), or with the largest tree suitable for the nature strip (e.g. *Eucalyptus, Platanus, Quercus)* then the environmental and amenity benefits could be significantly increased. These values take into consideration site restrictions (i.e. power lines, nature strip width, underground services) for each current and vacant site in Moreland City Council, and the forecast value shown above reflects the environmental value that would be attained once trees have matured in 2050.

Figure 14 shows how tree canopy cover has risen and fallen during the past three decades. In 1989, Moreland had very few street and park trees which were providing only 1.3% canopy cover. The majority of canopy cover was provided for on private land with 12.7% mostly in the front and back gardens of residents (Figure

14). This figure remained rather steady over the next two decades but started to decline from 2000 with urban consolidation. By 2005, canopy cover from private trees dipped to 12.1% but dramatically dropped to 9.2% as the pace of subdivision increased. At the same time, canopy cover from street and park trees has grown strongly from 1.9% and 1.6% respectively in 2005 to 2.4% and 2.6% by 2016 (Figure 14).
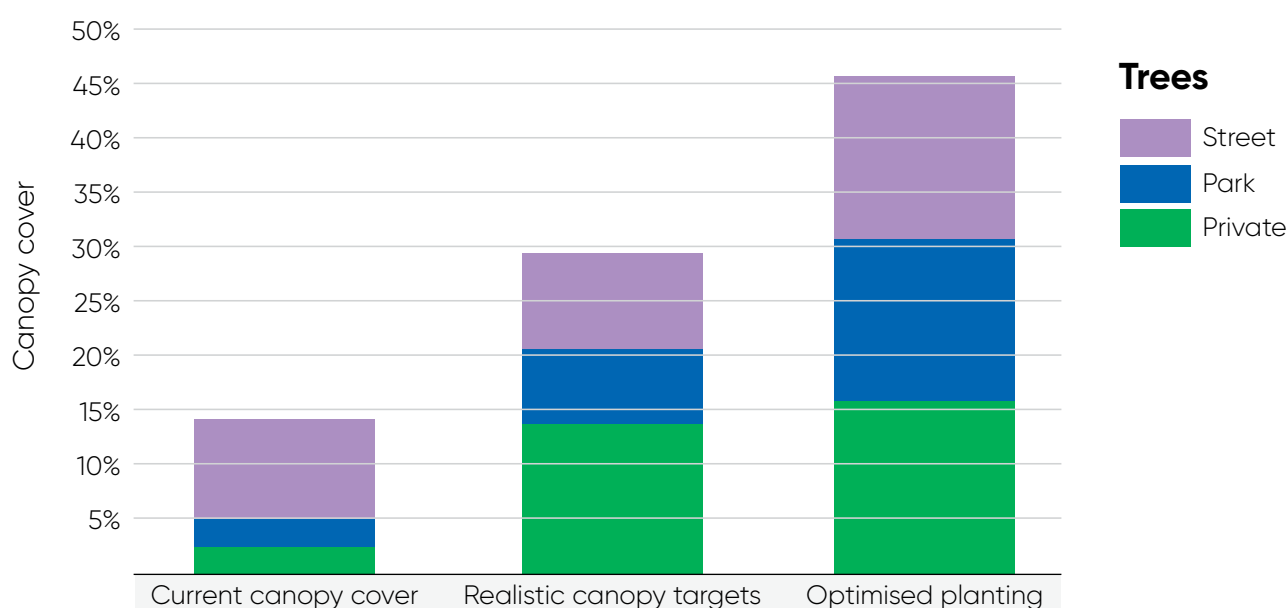
Moreland's current Planning Scheme provides little protection of existing trees and vegetation in the private realm outside of areas of environmental significance. In 2016, amendments (C153) were introduced to improve vegetation outcomes in residential zones. It will be necessary to monitor the implementation of these planning requirements to understand the impact.

The initial removal of vegetation through subdivision results in the instant loss of canopy. Requirements for planting semi-mature trees can take up to 20 years to realise effective canopy. Therefore, it is likely that private realm canopy cover is going to continue declining in the short to medium term. Current vegetation protection is mostly provided in areas under an Environmental Significance Overlay (ESO) which covers much of the Merri Creek and

Moonee Ponds Creek corridors. If Council adopts greater vegetation protection through amendments to the planning scheme and the local law, then it is anticipated that such measures will still take a decade to be realised in terms of canopy cover due to the lag time of new trees maturing to provide canopy cover.

This strategy recommends Council reviews the effectiveness of the current Planning Scheme and Local Law on private land to protect existing vegetation and encourage canopy tree planting. In addition, alternative programs to encourage the planting of vegetation in the private realm should be considered. A working group should be established to consider the scope and costings of any such protection measures and processes to ensure an effective and equitable approach is adopted.

Table 8 provides an optimised saturation canopy scenario which refers to the planting of medium to large canopy trees on all identified plantable land in both the public and private realm. Under this "Optimised planting" scenario, over 45% of Moreland could be covered by tree canopy. It is unlikely that this scenario is to be realised due to the current pattern of subdivision, competition with other services and diverse community values

Table 8. Current and 2050 canopy cover projections under optimised saturation and more realistic scenarios

towards canopy trees. Instead, a more realistic canopy target is proposed that is nevertheless very ambitious and without changes to Moreland's planning scheme and local law remains aspirational.

Under this ambitious, and yet more realistic, tree canopy saturation scenario, by 2050 Moreland's street trees alone could potentially provide at least 14% canopy cover of the municipality or 75% streetscape canopy. This could be achieved by utilising larger tree species selection for vacant planting sites and when replacing underperforming or senescing trees. A further 6.6% tree canopy could be provided by park trees through the adoption of a park tree planting program.

By 2030, the implementation of the recommended actions in Figure 39 and planting programs could increase the canopy cover provided by street and park trees to 5.5% and 3.8% respectively. Because urban trees often take up to 30 years to reach a mature canopy, a more realistic 2050 goal is around 13-15% from street trees with a further 5-7% from park trees. This would be equivalent to a City of Melbourne tree canopy figure of around 50% of the public realm and could be achievable by 2050 with the maturity of the urban forest.

Figure 23 highlights the relationship between the diameter of Moreland's street trees' trunk diameter and its canopy cover contribution. The current over-reliance on small trunk diameter trees (i.e. Callistemon species) will continue to make it difficult for Moreland to increase its tree canopy. For example almost
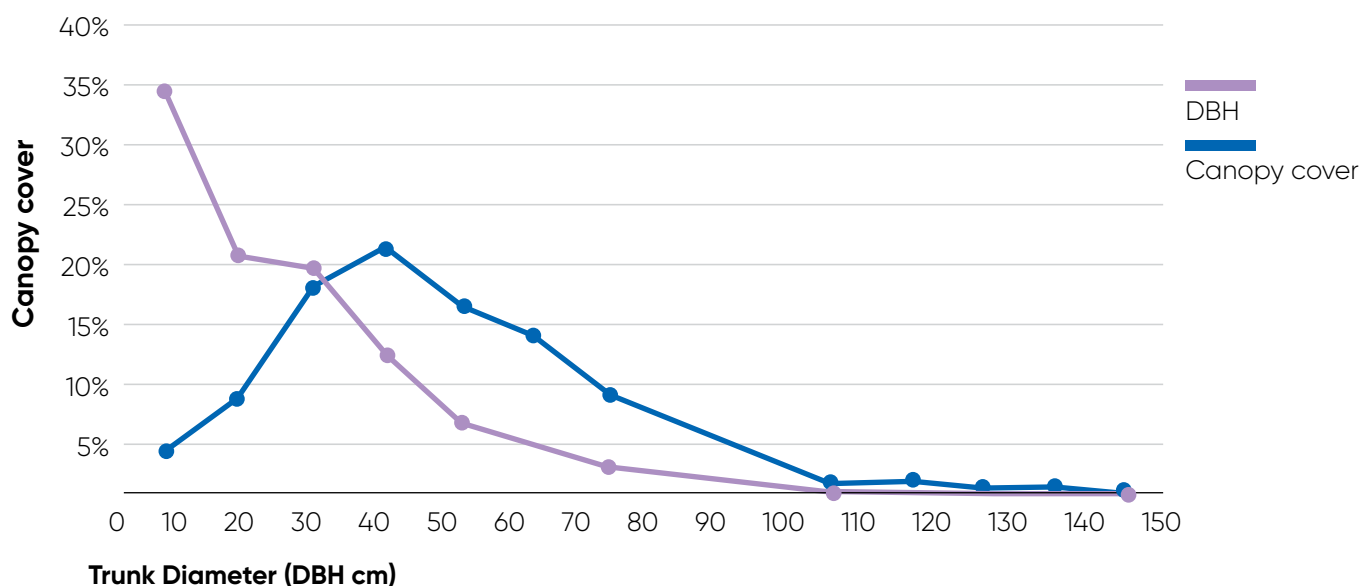
60% of the current street tree population will be unlikely to attain a trunk diameter greater

than 20 centimetres based upon their species. Trees with a trunk diameter less than 20 cm are currently only providing 12% of the current canopy cover; while trees with trunk diameters 20 cm – 60 cm are currently providing 68% of the current canopy cover within the streets of Moreland City Council. These trees are typically species of Eucalyptus, Melia and Melaleuca.

At a council level, there is potential for a further 23% of the municipality that can be planted with trees to provide additional canopy cover. However, only 9% of available plantable land is managed by Moreland City Council.

Table 9 and Figure 24 provide a useful comparison of the benefits of shifting away from the current reliance on small trees towards medium and large trees under the optimal planting scenario.

Table 9 provides a summary of the environmental and amenity values of the current street tree population; the future street tree population with all current vacant sites filled based upon a business as usual (BAU) approach; and a future street tree population with all current vacant sites filled based upon strategic planning, and improved tree species and planting site selection. The 2050 figures in Table 9 assume a stable, saturated street tree population and mature urban forest canopy.
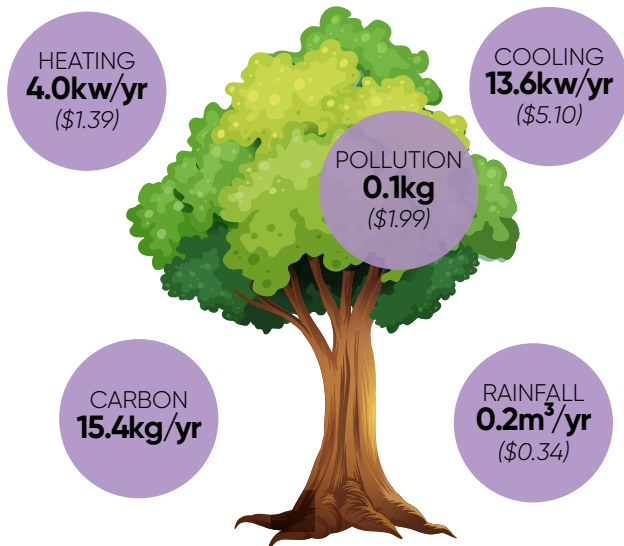
Figure 23. Relationship between the trunk diameter and canopy cover contribution of Moreland's street trees

Table 9. Environmental and amenity values of current and future street trees at maturity in 2050
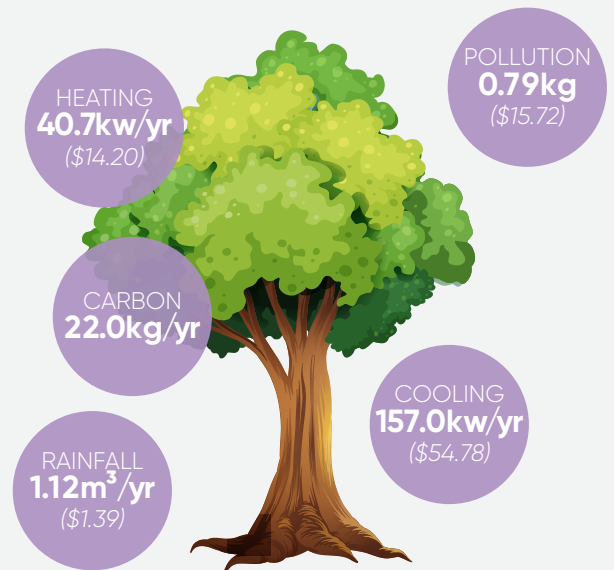
	Moreland Council 2016 (prior to 2016 planting season)	Moreland Council 2050 (BAU)	Moreland Optimal 2050
Estimated 2016 Street Tree Population	54,313	64,394	64,394
Total Canopy Cover (m²)	813,843	1,016,355	7,825,934
Carbon Storage (kg)	11,328,569	14,355,034	39,743,354
Annual Carbon Seq. (kg/yr)	912,080	1,155,745	1,416,530
Amenity Value	$271,179,839	$343,626,413	$1,222,260,806
Annual Heating (kWh)	187,193	237,202	2,619,742
Annual Heating (A$)	$65,646	$83,184	$914,290
Annual Cooling (kWh)	784,378	993,927	10,108,217
Annual Cooling (A$)	$273,800	$346,946	$3,527,767
Annual Heating & Cooling (kWh)	971,571	1,231,129	12,727,959
Annual Heating & Cooling (A$)	$339,446	$430,130	$4,442,057
Annual Pollution (kg)	5,839.7	7,399.8	50,870
Annual Pollution (A$)	$2,504	$3,172	$23,580
Annual Avoided Runoff (m²/yr)	8,412	10,659	72,112
Annual Avoided Runoff Value (A$)	$19,124	$24,233	$163,831
Most Common Tree	*Callistemon (22%)*	*Callistemon (22%)*	*Medium Sized Species*
Average Trunk Diameter (cm)	21.2	21.2	30.0
Average Height (m)	4.7	4.7	7.0
Average Canopy Width (m)	3.0	3.0	6.5

Figure 24. Comparison of environmental benefits between the current and optimal street tree planting program

Table 9 highlights how the strategic selection of tree species can maximise the environmental and amenity benefits arising from Moreland's Streetscapes. The current amenity value of the street tree population is estimated to be worth over $271 million and would rise to over $343 million after planting all vacant sites. If improved planting methods were adopted combined with optimal tree selection to ensure medium and large canopy trees were planted instead of the current over reliance on underperforming small trees then the amenity value of the street tree population by 2050 would exceed $1.22 billion. This finding reaffirms the finding that one large healthy tree that has access to adequate soil and water is equivalent to 8 smaller trees. It highlights the need to move away from annual planting targets based upon an over reliance on small trees, simple output-based targets (such as 5,000 trees), and instead focus on quality outcomes such as net gain, canopy cover and improved urban forest health and diversity.

The amenity value of the typical street tree would rise from the current $5,000 to $19,000. Figure 24 estimates the average annual environmental benefits of a current typical tree compared with an optimal tree, which

should dominant the street tree population by 2050. The transition to an optimal tree planting program reveals significant improvements in environmental benefits such as 10 times greater heating and cooling benefits from $430,130 to $4,442,057 per annum and a 30 percent improvement in carbon sequestration. The optimal planting is based upon strategic tree selection to maximise the environmental and amenity benefits of street trees. The pathway for achieving this optimal planting outcome is discussed in more detail in Part 2 of this report.

A useful way to illustrate the value of shifting towards larger trees in Moreland is by measuring the environmental benefits delivered by trees. If all currently available vacant planting sites were filled in accordance with business as usual (BAU) planting practices (i.e. small average species, health, size and location), then the annual increase of environmental benefits would be $62,197. Moreland's business as usual (BAU) approach would result in the continued population density of small tree species, restricting the potential environmental benefits that each tree site can attain.

Table 10. Estimated Environmental and Amenity Value of Vacant Sites

Available Quantity/Value of Vacant Plantings		
Environmental and Amenity Benefits	BAU Tree Species 2050	*Optimal Tree Species 2050*
Missing Canopy Cover (m^2)	138,164	*1,099,652*
Carbon Storage (t)	1,951	*5,641*
Annual Carbon Sequestered (t)	157	*201.1*
Annual Pollution Removal (t)	1	*7220.4*
Annual Pollution Removal (A$)	$431	*$3,347*
Annual Cooling Benefit (kWh)	135,115	*1,434,747*
Annual Cooling Benefit (A$)	$47,164	*$500,727*
Annual Heating Benefit (kWh)	32,245	*371,843*
Annual Heating Benefit (A$)	$11,308	*$129,773*
Annual Rainfall Interception (m^2)	1,449	*10,235*
Annual Rainfall Interception (A$)	$3,294	*$23,254*
Amenity Value	$46,712,848	*$173,486,098*

Figure 25. Current (pink dots) and Future (green dots) Optimal Canopy Cover Map

Table 10 highlights the contrasting environmental and amenity values that would be added to the Moreland street tree population by 2050 by filling current vacant planting sites according to current practices (business as usual) or with a more strategic plant species. If a more strategic plant species selection was utilised (i.e. an optimal tree for each site) for these vacant sites then the annual increase of environmental benefits would be ten times greater at $657,101.

Similar gains in tree canopy cover will result from switching from the current average small tree to a medium tree.

Figure 25 illustrate the significant tree canopy differences within the residential area of Glenroy (Postcode 3046) between the two scenarios of the current planting approach (BAU) and the optimal planting approach. By planting the largest tree species to maximise canopy benefits, Glenroy's street tree canopy cover would reach 26.7% or more than five times the current planting method (BAU) of 4.8%. The variation in canopy cover on some streets denotes the presence of powerlines and the selection of smaller canopy trees.

Table 11. Street Tree Canopy Cover Projections in 2050 as a Proportion of Land Area by Suburb

Suburbs	Current Street Tree Canopy	BAU Street Tree Canopy Cover 2050	Optimal Street Tree Canopy Cover 2050
Brunswick	1.7%	2.0%	12.4%
Brunswick East, Fitzroy North	2.1%	2.5%	16.2%
Brunswick West	1.6%	1.9%	15.9%
Coburg	2.5%	2.9%	16.3%
Coburg North	1.6%	1.9%	10.4%
Fawkner	1.4%	1.7%	17.3%
Glenroy	4.1%	4.8%	26.7%
Gowanbrae & Tullamarine	4.5%	5.2%	29.3%
Hadfield	0.7%	0.8%	4.6%
Oak Park	0.8%	0.9%	5.2%
Pascoe Vale	3.8%	4.4%	24.7%
Pascoe Vale South	2.3%	2.7%	15.0%
Moreland Council Total	**2.4%**	**2.8%**	**15.6%**

Table 11 provides a summary of the street tree canopy cover estimates for each suburb based upon optimal strategic plant species selection when compared to business as usual planting practices. It highlights the significant gaps between the current canopy cover and the optimal canopy cover. The figures are indicative only and need to be accepted cautiously without further detailed investigation.

As noted in Table 4, there are 6,317 vacant planting sites in nature strips across Moreland and a further 941 potential planting sites requiring design outcomes (subject to site constraints). If all vacant plantings were filled in accordance with business as usual (BAU) planting practices (i.e. average species, health, size and location), then the estimated canopy cover of the Council provided by street trees would be approximately 1–1.2m^2 million (2.8%) of the municipality in 2050, an increase of 0.4%.

However, if more strategic plant species selection was utilised (i.e. optimal largest tree for each site) for street trees together with existing nature strip areas, which represent 6.2% of Moreland City Council, then the maximum saturated canopy cover provided by street trees could be around 7.8m^2 million or 15.6% by 2050 (see Figure 14). If combined with opportunities for an additional 6.6% canopy cover in Moreland's parks and reserves, then this would bring the combined public realm canopy to 22.2%. If these projections included currently available private plantable areas (14% of Moreland's land area), and assumed that, firstly, there was no further urban consolidation and, secondly, an optimal tree could be planted, then a saturation estimate of the increase in canopy cover provided by private trees could be 30%. Therefore, the potential canopy cover that could be provided by street, park and private trees in 2050 could be greater than 50% of the total land area of Moreland City Council. While it is unlikely that these optimistic scenarios will ever eventuate in Moreland, they still provide a useful guide to what is possible.

It is more likely that canopy cover from private trees is to continue declining through the process of urban consolidation from 9% in 2016 to around 5% in 2030. It is envisaged that a rebound in private realm canopy can occur if the 2016 amendments realise the intent of greening the character of the urban environment, but this may take a decade or more to be realised. This strategy recommends ongoing monitoring of canopy cover to understand how the planning scheme and local law can better complement the introduction of incentives for tree planting together with community education to provide greater protection of existing vegetation and encourage the planting of new tree canopy. Such reforms could potentially return canopy cover from the private realm to around 9% by 2050. As shown in Figure 14, this would result in a doubling of canopy cover from 14% in 2016 to 29% in 2050. However, as noted earlier, the burden for an increasing proportion of this canopy cover falls upon Council with concomitant requirements for resourcing the maintenance and management of the urban forest.

Streetscape visualisations

Streetscape visualisations provide a very powerful tool for helping Council and the community with an opportunity to re-imagine their neighbourhoods. The following images (Figures 26 - 37) provide examples of how currently vacant streets could be transformed through the design and development of planting sites. Each streetscape visualises a different type of streetscape response that could potentially be adopted. The visualisations provide a useful conceptual design response to hopefully excite the community about what can be achieved by reimagining our streetscapes. They are not meant to represent actual planned responses for the example streets.

Figures 26 and 27 highlight how in-road planting can be incorporated into wide streets in conjunction with formal nature strip tree planting as part of traffic calming treatments. These in-road planting sites can be designed so as to accommodate a large canopy tree.

Figure 26. Chapman Avenue Glenroy in 2016

Figure 27. Visualisation of Chapman Avenue Glenroy in 2050

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Figures 28 and 29 highlight how formal nature strip tree planting can enhance the amenity and character of current industrial areas by providing large canopy shade to an identified urban heat island hot spot without impacting upon large vehicles.

Figure 28. Dawson Street Brunswick in 2016

Figure 29. Visualisation of Dawson Street Brunswick in 2050

Figures 30 and 31 highlight how in-road planting can be incorporated into wides streets in conjunction with formal nature strip tree planting. These in-road planting sites can be designed so as to accommodate a large canopy tree, and used to slow and direct traffic movement within a streetscape.

Figure 30. New Road Glenroy in 2016

Figure 31. Visualisation of New Road Glenroy in 2050

Figures 32 and 33 highlight how footpath pavement cut-outs can be incorporated into major roadways to accommodate a large canopy tree to provide greater shade which supports pedestrians and mitigates the urban heat island.

Figure 32. Nicholson Street Brunswick in 2016

Figure 33. Visualisation of Nicholson Street Brunswick in 2050

Figures 34 and 35 highlight how formal nature strip tree planting and in-road plantings can be used along railway corridors. These sites could be used to significantly improve pedestrian movement to transport nodes as well as provide valuable habitat connectivity.

Figure 34. Sages Road Glenroy (Gowrie Station) in 2050

Figure 35. Visualisation of Sages Road Glenroy (Gowrie Station) in 2050

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Figures 36 and 37 highlight how in-road planting can be incorporated into Gateway roads in conjunction with formal nature strip tree planting. These in-road planting sites can be designed so as to accommodate a large canopy tree and could be used to significantly improve the visual amenity of roadways that provide access into Moreland City Council. Tree and site selection for gateways often requires approval from VicRoads to ensure proposed designs are suitable and safe.

Figure 36. Sydney Road Fawkner in 2016

Figure 37. Visualisation of Sydney Road Fawkner in 2050

12 IMPLEMENTATION PLAN & FUNDING
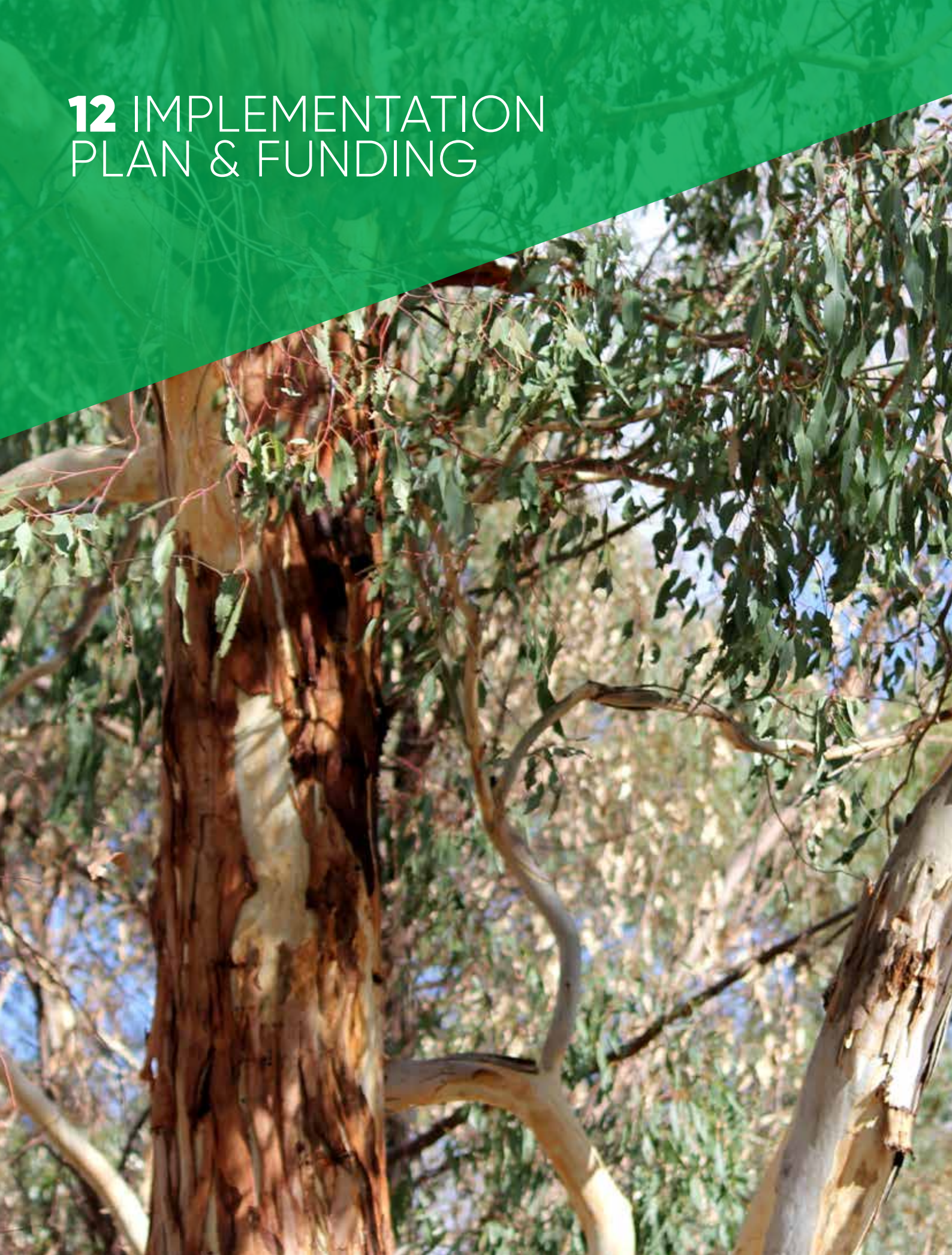
Council will regularly monitor and report on progress towards the successful implementation of the Urban Forest vision through three key performance indicators (KPIs) (Table 12).

Figure 39 provides further actions that will be adopted to ensure the successfully implementation of each of the objectives for a green Moreland. These actions, with timeframes and costings, relate to a range of Council units and are detailed in the Implementation Plan (Figure 39).

Figure 38 maps out the priority actions in a matrix which shows *Quick Win* action that require the least effort and/or cost but deliver the greatest benefits, such as planting larger

trees and a park tree program. It also shows actions requiring higher effort/cost that provide both high benefits (planning scheme amendments to protect private realm trees) and lower benefits (business as usual and undergrounding powerlines). This matrix should assist decision makers in understanding priority actions outlined in the Implementation Plan.
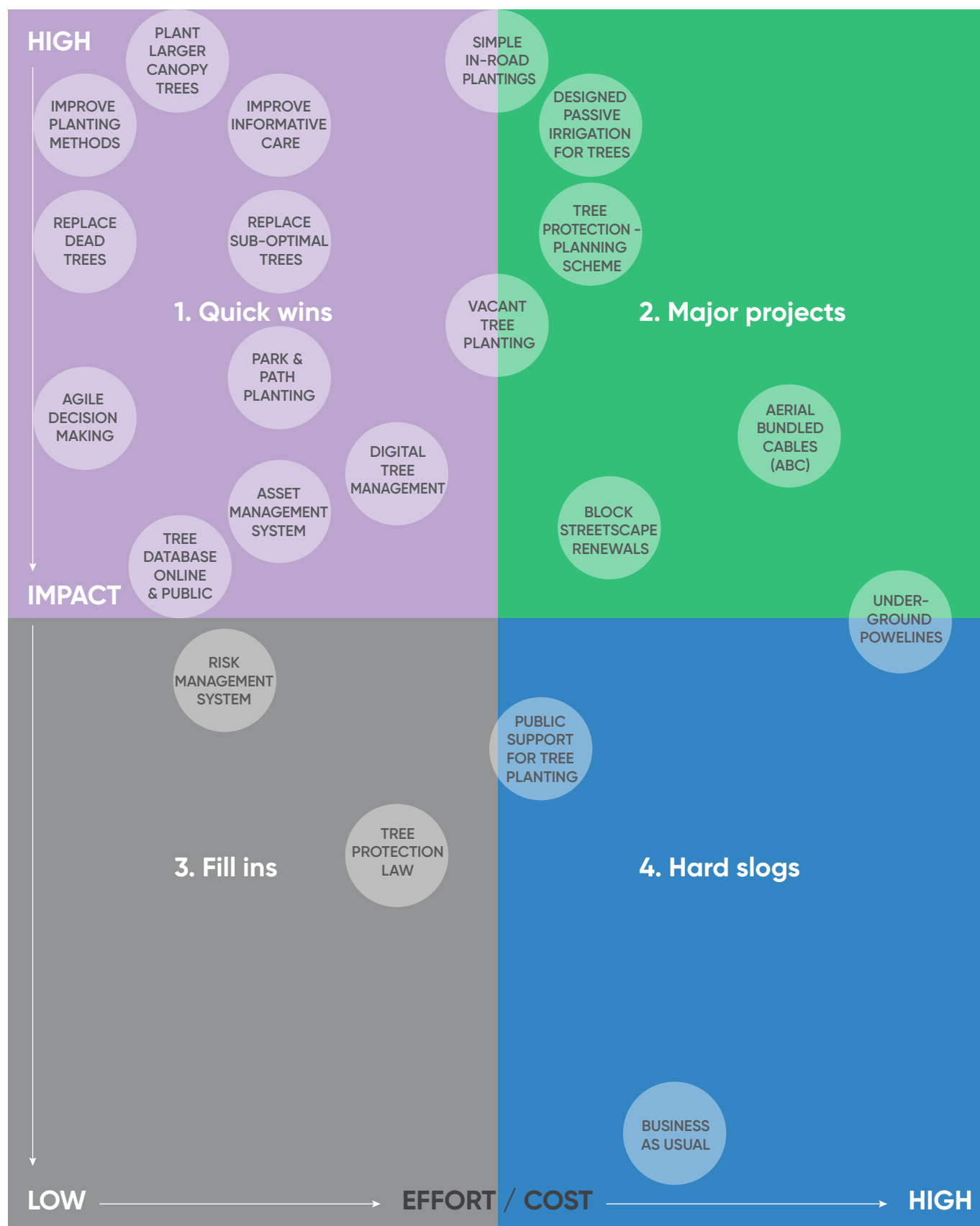
Understanding the implementation priorities for the urban forest strategies

Table 12. Urban Forest Strategy key performance indicators (KPI)

Indicator	Desired outcome	Reportable measure (every four years)
Canopy cover	Double public realm canopy cover across Moreland between 2017 and 2030 by increasing public and private canopy cover	Total urban forest canopy cover in the public and private realm (by suburb, vegetation type and land use)
Health of the urban forest	A healthy and diverse urban forest	At least 85% survival of new tree plantings survive at least 3 years 90% of trees in good health Well distributed age and species diversity Number of integrated water and vegetation projects
Community satisfaction	The Moreland community are satisfied with actions taken to maintain the urban forest	Level of satisfaction with Council actions

Figure 38. Priority implementation action matrix

HIGH

IMPROVE PLANTING METHODS

PLANT LARGER CANOPY TREES

IMPROVE INFORMATIVE CARE

SIMPLE IN-ROAD PLANTINGS

DESIGNED PASSIVE IRRIGATION FOR TREES

REPLACE DEAD TREES

REPLACE SUB-OPTIMAL TREES

TREE PROTECTION - PLANNING SCHEME

1. Quick wins

VACANT TREE PLANTING

2. Major projects

AGILE DECISION MAKING

PARK & PATH PLANTING

AERIAL BUNDLED CABLES (ABC)

DIGITAL TREE MANAGEMENT

ASSET MANAGEMENT SYSTEM

BLOCK STREETSCAPE RENEWALS

TREE DATABASE ONLINE & PUBLIC

IMPACT

UNDER-GROUND POWELINES

RISK MANAGEMENT SYSTEM

PUBLIC SUPPORT FOR TREE PLANTING

3. Fill ins

TREE PROTECTION LAW

4. Hard slogs

BUSINESS AS USUAL

LOW → **EFFORT / COST** → **HIGH**

Figure 39. Urban Forest Strategy implementation program

	ACTION	MEASURE	TIMEFRAME Short (1–3 years); medium (4–7 years); long (8–10 years); ongoing	RESPONSIBLE UNITS (lead agency in bold)	COSTING
1.	**CANOPY COVER TARGETS**				
1.1	Prioritise tree canopy protection and creation in all Council activities where reasonable	Vegetation protection; canopy cover targets; resourcing planting and maintenance	Ongoing	All Council Units; Open Space Design and Development	Existing base budget
1.1.1	By 2030, double Moreland's public realm urban forest canopy cover from 5% to 10% by 2030	Canopy cover target	Ongoing	Open Space Maintenance	Existing base budget to 2020; from 2021 require maintenance resourcing assessment
1.1.2	Double overall vegetation canopy cover across Moreland between 2016 and 2050 by increasing overall canopy cover to 29% including 9% from private vegetation	Aspirational canopy cover target	Ongoing	Dependent upon findings of Action 2.6	Existing base budget; post-2022 costs dependent upon maintenance resourcing assessment
1.2	Prioritise tree planting in identified urban heat island hot spots such as activity centres and along the public pedestrian network and key shared path routes (in line with the Urban Heat Island Effect Action Plan)	Canopy cover by priority areas; opportunities identified for new canopy cover in road reconstruction projects	Ongoing	Places; Urban Design; Open Space Design & Development; Open Space Maintenance; Transport; Roads; Engineering Services	Existing base budget within Structure Plan
1.3	Prepare, cost and introduce a tree planting program in and around parks, reserves, play spaces and pathways to provide a shady, sheltered environment	Park tree program; Tree shade audit of Council play spaces and shared paths; Open Space and pathways tree program	Short	Open Space Design & Development; Open Space Maintenance; Recreation; Strategic Transport	Existing base budget
1.4	Fill all identified vacant tree sites with the largest feasible canopy tree where appropriate to the site	Vacant sites	Medium	Open Space Maintenance	Existing base budget
1.5	Replace all sub-optimal street trees with the largest feasible canopy tree	Tree health; Average tree size	Medium; ongoing	Open Space Maintenance	Existing base budget

	ACTION	MEASURE	TIMEFRAME Short (1–3 years); medium (4–7 years); long (8–10 years); ongoing	RESPONSIBLE UNITS (lead agency in bold)	COSTING
1.6	Encourage planting in the private realm	Council to work with community, kindergartens, nursing homes, childcare centres, scouts/guides, state and private schools, hospitals and large landholders to encourage canopy tree planting	Medium; ongoing	Open Space Design and Development; Sustainability; MEFL	Existing base budget; Grants
1.7	Develop and adopt TechNote for in-road at grade tree pits that are considered for all road projects.	In-road tree pit TechNote adopted and used; Quarterly meeting to review forthcoming road projects	Short	Open Space Design and Development; Engineering Services; Urban Design;	Existing base budget
1.8	Set up program and guidelines for greening car parks, lanes and dead end roads in Activity Centres	Green Lane and Car Parks Program	Medium	Open Space Design and Development; Engineering Services; Urban Design; Open Space Maintenance	Existing base budget
2	**VALUE THE URBAN FOREST AS A CORE ELEMENT OF OUR URBAN SPACE**				
2.1	Ensure vegetation activities are sustainably resourced and maintained in line with best practice	External review of resourcing and maintenance report	Short; Ongoing	Open Space Maintenance	Existing base budget
2.2	Maintain, resource and plan public realm trees and vegetation through Council's Asset Management System (AMS)	AMS includes urban forest assets and values; Sustainably resource tree maintenance programs to ensure trees are maintained to maximise the delivery of current and future benefits	Medium	Assets; IT; Finance; Open Space Maintenance	Existing base budget
2.3	Ensure all relevant capital works projects realise quality greening outcomes that enhance urban character and amenity for current and future generations	Landscaping included in relevant CAPEX; Sign off; Quarterly meetings; Landscaping technical specifications	Medium; ongoing	Capital Expenditure Committee; Asset Planning; Capital Works; City Development; Places; Recreation; Urban Design; Open Space Deign & Development; Engineering Services	Existing base budget

	ACTION	MEASURE	TIMEFRAME Short (1–3 years); medium (4–7 years); long (8–10 years); ongoing	RESPONSIBLE UNITS (lead agency in bold)	COSTING
2.4	Ensure core Council strategies and policies (including the Planning Scheme, Structure Plans, Local Law and Urban Design Framework) protect and enhance the urban forest in both the public and private realm	Review and actions	Short	All Council Units; **Open Space Design and Development**	Existing base budget
2.4.1	Review the 2017 reformed residential zones when released to understand the 'garden area' requirements within these zones and the extent to which this will impact on other actions identified in this Strategy	Review to inform working group established under Action 2.4.5	Short	**Strategic Planning;** City Development; Open Space Design and Development	Officer time
2.4.2	Review existing Residential Landscape Guidelines 2009 to ensure all relevant development applications realise quality greening outcomes with consideration of adequate setbacks, soil volumes, water availability, canopy space for shade trees and landscape bond	Amended residential landscape guidelines adopted; quarterly review meetings	Short	Construction Management Program; City Development; **Strategic Planning;** City Development; Urban Design; Open Space Deign & Development; Engineering Services; Asset Protection	Existing base budget
2.4.3	Establish a Significant Tree Register	Significant Tree Register	Short	**Strategic Planning;** Compliance; Communications; Open Space Maintenance; Open Space Design and Development;	Officer time
2.4.4	Establish a working group to review a range of mechanisms and actions (such as planning scheme provisions, local law, educational, incentives and other) for protecting vegetation in the private realm, including cost and resourcing implications.	Working Group Report	Short	**Strategic Planning;** City Development; Compliance; Asset Protection, Communications; Open Space Maintenance; Open Space Design and Development	Officer time

	ACTION	MEASURE	TIMEFRAME Short (1–3 years); medium (4–7 years); long (8–10 years); ongoing	RESPONSIBLE UNITS (lead agency in bold)	COSTING
2.4.5	Develop a Moreland Tree Protection Strategy including a review of best practice of other metropolitan councils which have planning overlays that protect vegetation, and report back to council on appropriate measures for Moreland	Moreland Tree Protection Strategy	Short	Strategic Planning; City Development; Compliance; Asset Protection, Communications; Open Space Maintenance; Open Space Design and Development	Officer time
2.4.6	Assess and review development impacts upon vegetation	Develop PD for Planning Arborist position including schedule of charges	Short	Open Space Maintenance	Self-funded
2.5	Protect Council's urban forest assets	Train and authorise Open Space officers	Short	Compliance; Asset Protection; Open Space Maintenance; City Development	Self-funded
3	**MAINTAIN THE HEALTH OF THE URBAN FOREST**				
3.1	Ensure annual street and park tree plantings meet tree canopy, age and species diversity, and health targets	Live street tree database; regular audit	Short; ongoing	Open Space Maintenance	Existing base budget
3.1.1	Ensure at least 95% of newly planted trees survive the first three years	Annual audit	Ongoing	Open Space Maintenance	Existing base budget
3.1.2	100% of all plantings adopt best practice planting practices	Audit to ensure all tree plantings meet minimum tree planting guidelines	Short	Open Space Maintenance	Existing base budget
3.1.3	Construct an irrigated holding facility	Construct an irrigated holding facility to protect Council planting programs and adequately isolate stock so as to protect against ingress and spread of pest and disease	Short	Open Space Maintenance	Existing base budget
3.1.4	Ensure a minimum 90% of Moreland's urban forest is healthy	Annual audit	Ongoing	Open Space Maintenance	Existing base budget

	ACTION	MEASURE	TIMEFRAME Short (1–3 years); medium (4–7 years); long (8–10 years); ongoing	RESPONSIBLE UNITS (lead agency in bold)	COSTING
3.1.5	Ensure an even age distribution of trees with no age category representing greater than 50% of the tree population	Live street tree database; regular audit	Ongoing	Open Space Maintenance	Existing base budget
3.1.6	Ensure tree establishment and maintenance is programmed rather than reactive	Annual audit	Ongoing	Open Space Maintenance	Existing base budget
3.1.7	Improve canopy shade along shared and pedestrian paths	Develop costing for vegetation inspections and actions	Short	Roads; Transport; Open Space Maintenance	Existing base budget
3.1.8	Audit of Council's Pest and Weed Management Policy implementation including use of signage	Audit of herbicide usage and training in line with Policy	Short	Open Space Maintenance	Existing base budget
3.2	Improve soil moisture levels and tree health				
3.2.1	Integrate tree and vegetation planting with opportunities to capture stormwater through WSUD, passive irrigation and tree canopy interception	Refer to UHIe AP action	Ongoing	Engineering Services; Open Space Maintenance; Transport; Open Space Design & Development; Sustainability; Urban Design; City Development; Recreation; Street Cleansing	Existing base budget
3.2.2	Review Council's WaterMap 2020 to include improved vegetation outcomes in open space	Adoption of an open space and street tree water plan to protect vegetation health and ensure cooling outcomes	Medium	Open Space Maintenance; Open Space Design & Development; Sustainability	Grants; Existing base budget
3.2.3	Maximise the extent of permeable surfaces and soil volumes for all vegetation in new streetscape and open space projects to improve soil health	Consider soil volumes from Better Apartment Design Guidelines	Ongoing	Engineering Services; Open Space Maintenance; Transport; Open Space Design & Development; Sustainability; Urban Design; Recreation; Capital Projects	Existing base budget

	ACTION	MEASURE	TIMEFRAME Short (1–3 years); medium (4–7 years); long (8–10 years); ongoing	RESPONSIBLE UNITS (lead agency in bold)	COSTING
3.3	Manage impacts and remediate vegetation and soil health post-construction works	Adopted in landscape specifications. Refer to Construction Management Project	Ongoing	Engineering Services; Open Space Maintenance; Transport; Open Space Design & Development; Sustainability; Urban Design; City Development; Recreation; Property; Facilities; Capital Projects	Self funded
3.4	Review tree removal process	Revised tree removal procedure	Short	City Development; Open Space Design and Development; Open Space Maintenance; Sustainability; Capital Projects	Self funded
3.5	Develop formal position for considering solar access for street tree planting to balance household PV, solar hot water and passive light with community greening	Formal solar greening position	Short	Open Space Maintenance	Officer time
3.6	Review relevant parts of the Sustainable Sites Initiative approach for managing soil health and contaminated soil in Moreland	Workshop and roll out	Medium	Strategic Planning; Engineering Services; Transport; Open Space Design & Development; Sustainability; Capital Projects; Risk	Existing base budget
4	**PROTECT URBAN ECOLOGY**				
4.1	Strengthen and fill gaps in habitat connections between waterways and parks along streets				
4.1.1		Develop a 5 year plan to sustainably fund open space renewal and revegetation works to strengthen biodiversity corridors	Short; ongoing	Open Space Maintenance; Open Space Design & Development	Existing base budget; Public Reserve Fund; Grants

	ACTION	MEASURE	TIMEFRAME Short (1–3 years); medium (4–7 years); long (8–10 years); ongoing	RESPONSIBLE UNITS (lead agency in bold)	COSTING
4.1.2		Develop, maintain and resource a comprehensive network of biodiversity corridors across Moreland	Medium	Open Space Maintenance; Open Space Design& Development	Based on 5 year plan to sustainably fund
4.1.3		Work with state, community and private stakeholders along habitat corridors to revegetate and restore habitat	Ongoing	Open Spaces Maintenance; Open Space Design & Development	Existing base budget; Public Reserve Fund; Grants
4.2	Improve the delivery of essential ecosystem services by protecting and enhancing biodiversity and urban ecology	Ensure tree palette provides biodiversity outcomes	Ongoing	Open Space Maintenance; Open Space Design& Development	Existing base budget
4.2.1		Retain and protect habitat trees in parks and waterways where appropriate	Ongoing	Open Space Maintenance; Open Space Design& Development	Existing base budget
4.2.2		Undertake experimental habitat pruning on mature trees in open space	Ongoing	Open Space Maintenance	Existing base budget
4.2.3		Training and adoption of measures to protect native flora and fauna during maintenance works	Ongoing	Open Space Maintenance	Existing base budget
5	**MANAGE AND MITIGATE URBAN FOREST RISKS**				
5.1	Incorporate hazard abatement in to programmed and reactive vegetation maintenance programs including staff training	Staff training, auditing and process adoption	Short	Open Space Maintenance; Risk	Existing base budget

	ACTION	MEASURE	TIMEFRAME Short (1–3 years); medium (4–7 years); long (8–10 years); ongoing	RESPONSIBLE UNITS (lead agency in bold)	COSTING
5.1.1	Ensure tree risks are managed and programmed with corrective measures undertaken in responsible timeframes	Monitor and analyse risk data to identify hot spots: locations, species – review age, planting type	Short	Open Space Maintenance; Assets	Existing base budget
5.1.2	Determine Council's legal maintenance responsibilities for the Urban Forest	Legal brief on Council Urban Forest maintenance responsibilities	Short	Open Space Maintenance; Risk	Existing base budget
5.1.3	Ensure vegetation hygiene protocols are managed to best practice (ISO1400)	Adoption of best practice hygiene vegetation protocols	Short	Open Space Maintenance; Assets	Existing base budget
5.1.4	Protect the heritage character of the landscape	Cost the development of a tree management program for park and streetscape heritage plantings	Short	Open Space Maintenance	Existing base budget
5.1.5	By 2040 ensure a diverse palette of appropriate species are planted as street trees across the municipality	Overall street tree population should not consist of: • more than 40% of one family • more than 15% of one genus • more than 5% of one species	Ongoing	Open Space Maintenance	Existing base budget
5.1.6	Adopt and implement transparent tree risk assessment procedures	Adoption and training	Short	Open Space Maintenance; Risk	Existing base budget
5.1.7	Drought response	Review current drought management processes and adopt management plan	Short	Open Space Maintenance	Existing base budget
5.1.8	Refine current storm management response process	Revised storm management response process	Medium	Open Space Maintenance	Existing base budget
5.1.9	Respond to and manage current and emerging pest and pathogen issues	Pest and pathogen management process adopted	Short; Ongoing	Open Space Maintenance	Existing base budget

	ACTION	MEASURE	TIMEFRAME Short (1–3 years); medium (4–7 years); long (8–10 years); ongoing	RESPONSIBLE UNITS (lead agency in bold)	COSTING
5.2	Produce and publish online a series of urban forest decision making process flow charts to make the process clear	Urban forest decision making process flow charts	Short	Open Space Maintenance; Open Space Design& Development	Existing base budget
5.3	Ensure Urban Forest Strategy reference documents remain accurate and relevant	Review Urban Forest Strategy Reference Documents	Every 2 years	Open Space Maintenance; Open Space Design& Development	Existing base budget
5.4	Review the plant palette to ensure appropriate species are planted given the constraints of urban soils, adjoining assets, services, climate change and the management of pest and disease threats while acknowledging the importance of native vegetation for habitat and local character and opportunities for productive street trees.	Reviewed plant palette	Ongoing	Open Space Maintenance; Open Space Design& Development	Existing base budget
5.5	Undertake a performance based risk monitoring research project	Analyse 5–10 years of after-hours call out data, insurance claims, tree assessments and customer service requests and applying them against spatial intelligence and tree species so as to conclude where your greatest risk tree populations are, and, evaluate the performance of select groups of tree/species or the entire tree population to evaluate specific maintenance programs. Data source: tree inventory data set	Medium	Open Space Maintenance; Open Space Design& Development; Academic researchers	External research funding

	ACTION	MEASURE	TIMEFRAME Short (1–3 years); medium (4–7 years); long (8–10 years); ongoing	RESPONSIBLE UNITS (lead agency in bold)	COSTING
5.6	Develop a program to fund aerial bundle cabling of powerlines in streets where significant avenues of trees exist, and undergrounding of powerlines in streets that have been designated as high priority areas for large, canopy trees to be planted, such as priority pedestrian routes and heritage areas	Bundling and undergrounding of powerline project business case	Medium	Open Space Maintenance; Open Space Design& Development; Places	Existing base budget
5.7	Develop tree site selection protocol to encourage safe streets based on the evidence base	Tree site selection protocol	Medium	Open Space Maintenance; Open Space Design& Development; Urban Design; Engineering Services; Roads; Strategic Transport	Existing base budget
6	**MONITOR AND REVIEW PROGRESS TO MEASURE SUCCESS AGAINST BEST PRACTICE**				
6.1	Establish an effective review process of the implementation of the Urban Forest Strategy with resourcing implications	Establish Working Group to produce implementation progress report and resourcing gap analysis every 3 years	Ongoing	Open Space Maintenance; Open Space Design & Development	Existing base budget
6.2	Monitor and review tree planting practices to ensure they are aligned with best practice and the emerging evidence base	Monitor and report every 4 years	Ongoing	Open Space Maintenance; Open Space Design & Development	Existing base budget
6.3	Monitor and review tree fatalities and removals to understand symptoms and causes	Monitor and report every 4 years	Ongoing	Open Space Maintenance; Open Space Design & Development	Existing base budget
6.4	Monitor and report on urban forest canopy cover change and delivery of environmental, social and economic services from the urban forest	Every 4 years monitor and report on changes by type, land use and suburb and include sample iTree Eco analysis	Ongoing	Open Space Maintenance	Existing base budget
6.5	Undertake baseline and regular community biodiversity surveys	Participate in regular academic and community baseline and ongoing biodiversity surveys	Ongoing	Open Space Maintenance; Open Space Design& Development	Existing base budget; external grant funding

	ACTION	MEASURE	TIMEFRAME Short (1–3 years); medium (4–7 years); long (8–10 years); ongoing	RESPONSIBLE UNITS (lead agency in bold)	COSTING
6.6	Research, trial and monitor performance of tree species and review palette	Introduce at least one new trial species annually	Ongoing (report every 4 years)	Open Space Maintenance; Open Space Design& Development	Existing base budget; external grant funding
6.7	Ensure Council officer qualifications remain current and best practice with access to relevant education, training and professional development opportunities	Leave and funding support for urban forest professional development and training	Ongoing	All Council units; Open Space Maintenance	Existing base budget
6.8	Actively participate in industry and academic urban forest research projects and collaborations	Ongoing participation in research projects Staff membership of, participation in, and presentations to industry and academic events	Ongoing	Open Space Maintenance; Open Space Design& Development	Existing base budget
6.9	Develop business case and Position Description for Greening Officer position	Business case and Position Description for Greening Officer position	Short	Open Space Maintenance; Open Space Design& Development	Subject to business case
7	**STRENGTHEN COMMUNITY CUSTODIANSHIP AND ENGAGEMENT OF THE URBAN FOREST**				
7.1	Improve community satisfaction with Council's urban forest activities	Included in Council's annual satisfaction surveys	Short; Ongoing	Governance; Communication	Officer time
7.2	Produce a summary Urban Forest Strategy document	Summary Urban Forest Strategy	Short	Open Space Design& Development; Communication	Existing base budget
7.3	Ensure urban forest database, processes and reports are live and publically accessible online (individual tree species, overlay species and dominant species)	Online urban forest platform	Medium	IT; Open Space Maintenance; Communication	Existing base budget
7.4	Strengthen Moreland's acknowledgement of its traditional urban forest custodians, the Wurundjeri			Social Policy	
7.4.1	Protect past, present and future Wurundjeri sites of significance	AAV mapping; CHMP database; add new sites	Ongoing	IT; Social Policy; Open Space Design & Development; Communications	Existing base budget

	ACTION	MEASURE	TIMEFRAME Short (1–3 years); medium (4–7 years); long (8–10 years); ongoing	RESPONSIBLE UNITS (lead agency in bold)	COSTING
7.4.2	Improve interpretative communication of Moreland's indigenous heritage	Scope a Wurundjeri atlas of Moreland that combines the cultural stories of the Wurundjeri people with the biophysical (forest cover, geology, wildlife, plants)	Ongoing	IT; Social Policy; Open Space Design & Development; Communications	Existing base budget
7.4.3	Prioritise the engagement of indigenous staff and consultants in vegetation planning and management	Explore funding opportunities for the development and support of new and existing indigenous training programs	Medium	Open Space; Social Policy; MCMC	External grant program
7.4.4	Adopt traditional land management practices in the management of vegetation	Review of natural resource management land practices for waterways and grasslands	Short	Open Space Maintenance; Open Space Design& Development; Social Policy; MCMC	Existing base budget; External grants
7.5	Increase community opportunities to engage and connect with the urban forest	Organise events; update website	Short	IT; Communications; Open Space Maintenance	Existing base budget
7.5.1		Explore opportunities for engaging community service providers in planting and sourcing of plants	Short	Governance; Open Space Maintenance; Open Space Design& Development	Existing base budget
7.5.2		Review Open Space engagement and contribution to Advisory Committee	Short	Governance; Open Space Maintenance; Open Space Design& Development	Existing base budget
7.5.3		Request a street tree program	Short	IT; Communications; Open Space Maintenance; Open Space Design& Development	Existing base budget
7.5.4		Introduce community notification processes for street tree planting	Short	Open Space Design & Development; Open Space Maintenance; Communications	Existing base budget

	ACTION	MEASURE	TIMEFRAME Short (1–3 years); medium (4–7 years); long (8–10 years); ongoing	RESPONSIBLE UNITS (lead agency in bold)	COSTING
7.5.5		Support and funding for community greening activities	Ongoing (report every 4 years)	Open Space Design & Development; Open Space Maintenance; Sustainability; Communications; MEFL;	Existing base budget
7.5.6	Encourage neighbourhood nature strip plantings	Revised nature strip guidelines Area of beautified nature strips	Short (report every 4 years)	Open Space Design & Development	Existing base budget
7.5.7	Review nature strip beautification guidelines with community groups	Revised nature strip guidelines that encourage community greening while ensuring safe and presentable streetscapes	Short	Open Space Design & Development; Roads; Asset Protection; Compliance; Open Space Maintenance	Existing base budget
7.5.8	Neighbourhood nature strip risk assessment	Scope audit of neighbourhood nature strips	Medium	Open Space Design & Development	Existing base budget
7.5.9	Targeted greening outcomes on the private realm and on utility land	Trial a NeighbourWoods program; promote Sustainability Street and greening on utility land	Short	Open Space Design & Development; Open Space Maintenance	Existing base budget; external grant
7.5.10	Business sponsorship of community planting and street trees	Review introduction of business sponsorship program and activities	Short–Medium	Economic Development; Places; Urban Design; Open Space Design & Development	Existing base budget
7.6	Develop precinct based planting program with community input	Precinct based planting program	Short	IT; Open Space Design & Development; Communications; Open Space Maintenance	Existing base budget

13 RELATIONSHIP TO KEY COUNCIL STRATEGIES AND POLICIES

This Urban Forest Strategy builds upon and complements current and former Council plans and policies, notably the Council Plan, 2025 Community Vision, the Street Landscape Strategy, the Municipal Strategic Statement, Structure Plans, the Health and Well Being Plan, Pedestrian Strategy, WaterMap 2020, Open Space Strategy, Moreland Play Strategy, Zero Carbon Evolution Strategy and the Urban Heat Island Effect Action Plan.

These key council strategies and policies are described below and Figure 40 shows the relationship between the Urban Forest Strategy and these key council policies and strategies.

2012 Moreland Street Landscape Strategy

The 2012 Moreland Street Landscape Strategy (MSLS) is the foundation document for the Urban Forest Strategy. It has guided Council and residents about the management and planting of street trees. This Urban Forest Strategy broadens out and builds upon the strong basis of the MSLS.

The MSLS argued that integral to successful implementation of strategy is planting the maximum number of the largest trees possible within the constraints of available space and existing infrastructure. The preference is areas that are easy to plant and have adequate available space for larger sized trees first. Where existing street infrastructure or space does not allow a tree to be grown satisfactorily in the nature strip or footpath it is recommended to consider planting trees in the parking lane or in the centre of the road. The strategy noted that these planting approaches will be extensively used within the southern areas of the Moreland City Council, in shopping centres and along main roads.

2025 Community Vision

The Moreland 2025 Community Vision sets out the vision in which our community hopes to live, work and play in the near future.

The Community Vision is the first step towards aligning the activities, decisions, plans and strategies of those who shape the city – the many community groups and organisations, individuals, service providers, Council and other levels of government.

The Community Vision identified 26 desired outcomes for the municipality, 11 of which guide the Urban Forest Strategy. These are:

- Moreland community members are mentally and physically healthy, and active;
- The Moreland community feels safe and is safe;
- People have access to local places and open spaces;
- Attractive, clean and well maintained built environment, streetscapes and landscapes;
- The historical places of Moreland continue to be enhanced;
- The Moreland community is water and energy efficient;
- Moreland community is environmentally aware and active;
- Moreland's natural environment is preserved and enhanced;
- Partnerships are used to deliver community outcomes;
- The Moreland community participates in decision making; and,
- Moreland is financially responsible taking account current and future needs.

Council Plan

Following elections in late 2016, a new Council Plan (2017–2021) is to be developed providing a comprehensive overview of Council's values, commitments and activities. It includes clear goals and objectives against which Council and its administration measures its performance.

The desired outcomes of the Council Plan reinforce the 2025 Community Vision and closely relate to the Urban Forest Strategy in terms of ensuring Moreland is safe and accessible, supports community health and wellbeing, and creates an attractive and resilient environment.

Municipal Strategic Statement

The Municipal Strategic Statement sets out the overall vision to guide future land use and development in the municipality and includes key strategic directions relating to the Urban Forest Strategy, such as the status of protecting existing vegetation and identifying space for vegetation in building setbacks in line with neighbourhood character. By exception, this Strategy includes tree canopy outcomes arising from the existing strategic direction on urban consolidation that highlights the need for careful consideration of setbacks and tree protection in the planning scheme to reverse the steady decline in vegetation from the private realm.

Structure Plans

Moreland has three long–term structure plans for each of the Glenroy, Coburg and Brunswick activity centres. The structure plans guide Council decisions about future development on both private and public property. The current plans provide little scope and opportunity for greening and canopy trees due to site constraints, such as narrow footpaths and roads, the lack of building setbacks, requirements for building awnings and concentration of underground and above ground services, such as power, gas, sewer, communications, stormwater and water. And yet trees play a significant role in creating, reinforcing and enhancing the urban character and identity of these areas. Moreover, it is effective to prioritise heat mitigation in areas where large numbers of the public are active outdoors such as public transport interchanges, recreational spaces, outdoor shopping strips, schools, care facilities and pedestrian thoroughfares. The Structure Plans do seek to maximise opportunities for greening and canopy trees and the consequent streetscape capital works projects being rolled out in each centre do the same. Therefore, innovative greening solutions will need to be embraced to ensure they can become welcoming and liveable spaces.

Health and Well Being Plan

The Municipal Health and Well Being Plan outlines the state of community health and ways to support the vision of placing "people's health and wellbeing at the centre of all planning and decision making". The Plan will be developed to align with the Council Plan 2017–2021 and reflect community priorities identified in the Moreland Community Vision and the Moreland Human Rights Policy.

The Plan references a goal to reduce UHIE through sustainable housing design to include green walls and roofs, to provide climate education activities and improving community information on strategies in relation to climate change.

Pedestrian Strategy

Moreland's Pedestrian Strategy 2010–19 provides a vision for encouraging active and sustainable movement across the municipality. The Strategy outlines objectives and actions Council can implement to support sustainable communities and are closely related to the Urban Forest Strategy including:

• Improving the walking network,

• Improving the walking environment, and

• Promoting walking.

WaterMap 2020

Watermap 2020 sets Council's strategic direction for the sustainable management of water resources in Moreland, with the ambition for Moreland to become a "water sensitive city" – a healthy, green, productive and resilient city. The objectives of Watermap 2020 are complementary of the Urban Forest Strategy and can be extended through passive irrigation and improved WSUD design to ensure healthy canopy trees and open spaces.

Watermap 2020 references many targets to improve water usage across the municipality by 2020 including; reducing Council's potable water usage by 30%, improving sportsground irrigation efficiency to 75%, treat 11% of Council's stormwater treatments to best practice, 25% reduction in community potable water consumption and 50% of community households have a water tank installed.

Open Space Strategy

The Moreland Open Space Strategy (MOSS 2012–2020) outlines the direction for the future provision, planning, design and management of publicly owned open space that is set aside for leisure, recreation and nature conservation purposes. The main aim of the Strategy is to preserve and enhance environmental values and provide for future community needs through the provision of quality open space. The strategy refers to the critical role of the urban forest in complementing the desired outcomes of quality open space.

The MOSS highlights climate change as a key issue, specifying UHIE as a key issue moving forward. Key actions of this strategy include increasing tree canopy throughout the municipality, and developing a tree management program to manage tree health within parks. Other key strategies of the MOSS are to develop a policy for appropriate use of water on Open Space, to implement Water Sensitive Urban Design (WSUD) in Urban Planning and to encourage more sustainable planting practices.

Urban Heat Island Effect Action Plan

The Urban Heat Island Effect Action Plan identifies Council and community actions to help reduce the impacts of urban heat island effect and prepare for a hotter future. This Plan provides a strong evidence base for many actions in the Urban Forest Strategy including: expanding tree canopy cover; capturing stormwater to use in open space and raingardens; and promoting green walls and roofs.

Zero Carbon Evolution Strategy

The Zero Carbon Evolution (ZCE) Strategy (2014–2020) is a plan to reduce Moreland's carbon emissions by 22% by 2020. The Urban Forest Strategy is aligned with this strategy through the critical role of trees in capturing carbon dioxide, improving thermal comfort through shade and making our streets more attractive for active modes of transport such as walking and cycling. The ZCE Strategy also highlights vulnerable areas relating to UHIE. Key goals of this strategy include increasing canopy cover through Water Sensitive Urban Design initiatives by 35% by 2020. This is in line with Council's goal of planting 5000 trees annually.

Moreland Play Strategy

The Moreland Play Strategy (2016–2020) recommends future actions to enhance play opportunities for the community and provides a guide to the management and maintenance practices of existing play spaces, as well as identifying priorities for design, development and funding allocation for future play space developments. It is aligned with the objectives of the Urban Forest Strategy of prioritising nature based play, natural shade in our parks and creating a safe and attractive environment for play.

Merri and Moonee Ponds Creek Strategies

Moreland's creeks and waterways form an environmental, heritage and recreation corridor which link areas of environmental, heritage and recreation values. Creek corridors such as the Merri, Moonee, Edgars, Merlynston, Westbreen and Campbellfield all contribute to biodiversity, habitat, and recreation. Several key strategies and policy documents are relevant to the Urban Forest Strategy, including the Chain of Ponds (2017), Moonee Ponds Creek Strategic Plan (2011), Merri Creek Shared Trail Review, the Merri Creek Environs Strategy (2010), the Merri Creek Trail Review (2007), the Merri Creek Land Tenure Investigation and Mapping Report (2003), The Moonee Ponds and Merri Creek Resting Places Strategy, Moreland City Council (2002), Development Guidelines for the Merri Creek, Merri Creek and Environs Strategy Steering Committee (1999), The Moonee Ponds Creek Landscape Revival Strategy (1997). The documents guide Council direction for managing the creeks and waterways while highlighting the importance of protecting and enhancing indigenous vegetation and fauna. Much of the revegetation work along Moreland's waterways has been community led and supported by critical groups such as the Merri Creek Management Committee and numerous Friends groups.
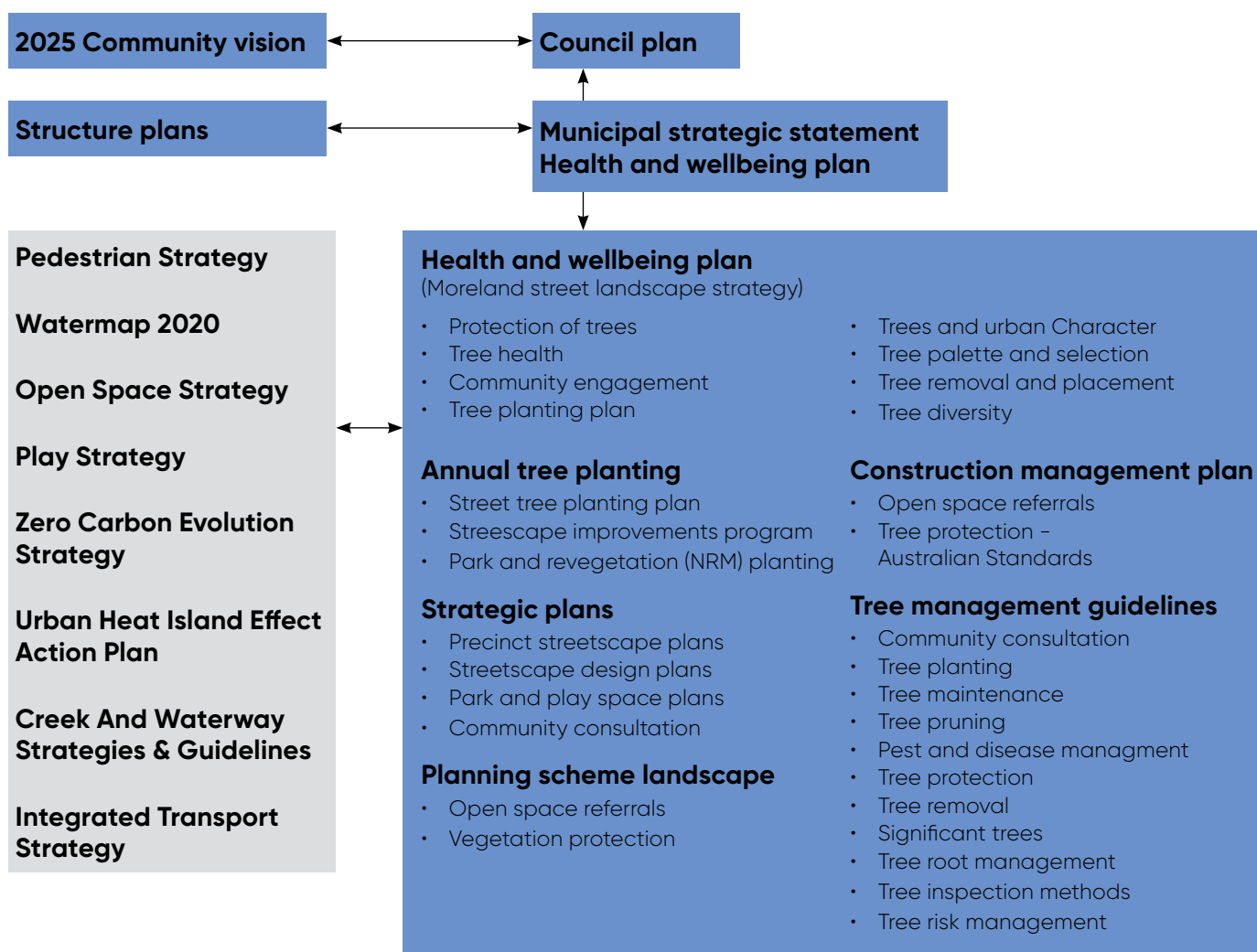

Figure 40. Relationship between Moreland's Urban Forest Strategy and other council policies and strategies

GLOSSARY

Amenity value Amenity Value recognises a tree as a financial asset and derives a value based upon the City of Melbourne's Amenity Tree Valuation method. The valuation derives the real value of trees and recognises the amount of time and resources needed to get them to maturity in our harsh urban landscape. A value is calculated which emphasises the real value of trees and the loss of amenity for the community if the tree is removed.

Biodiversity The variety of all life forms on earth. The different plants, animals micro-organisms and the ecosystems of which they are part.

Canopy cover Canopy cover is often used as a proxy for measuring the contribution of trees to urban greening. In this report, canopy cover measures the physical coverage (breadth, height and density of canopy) of street tree canopy over land.

Community Plan Provides a community vision for the future of the Municipality.

Council Plan Outlines Council directions, strategies and actions for a four year period.

Diameter at breast height (DBH) Measures the trunk diameter at 1.4 metres above ground level

Diversity Refers to structural, species and age diversity to ensure a variety of species and age distribution are planted to increase the resilience of the urban forest including mid and lower storey vegetation..

Exotic species A plant introduced from another country or regions where it was not indigenous.

Green infrastructure Street trees comprise a significant component of the wider urban forest (all public and private trees). These components are referred to as a city's green infrastructure. The concept of green infrastructure is based on the awareness that natural systems can perform a range of engineering, environmental and human functions. The key features of green infrastructure which distinguish it from grey infrastructure are multi-functionality and connectivity. That is, it can deliver multiple benefits from the urban space it occupies, compared with single purpose engineering infrastructure and it 'value adds' by linking and connecting existing green assets

Indigenous species A plant endemic to the Moreland area (Planning Scheme refers to Indigenous as Victorian vegetation.

iTree Eco and iTree Canopy Urban forest tools developed by the US Forestry Service and adapted to Australian conditions that analyse certain tree parameters to determine the environmental value of vegetation (iTree Eco) and the coverage of vegetation canopy and land-use (iTree Canopy). Combining the two tools provides accurate measures of changing environmental values of trees and the urban forest including air pollution, carbon sequestration and storage, energy saving benefits, stormwater flow reductions and an amenity value.

Liveability An assessment of what a place is like to live in, considering environmental quality, education and health provision, access to shops and services, crime and safety, recreational facilities and cultural activities.

Municipal Strategic Statement Sets out the council's strategic planning objectives and underpins the land-use and development provisions of the Moreland Planning Scheme.

Native vegetation A plant found to occur in Australia

Nature strip Naturestrips are the area of public land between the paved footpath (or the private property boundary where there is no footpath) and the road kerb and gutter. Nature strips provide safe public walkways and contribute significantly to the character of our neighbourhoods and streetscapes.

NeighbourWoods	NeighbourWoods will be a Council-led pilot program to encourage local people to plant canopy trees in the private realm. The program will include private households, and large landholders, such as schools, industrial sites and shopping centres. Activity Centres and identified Urban Heat Island Hot Spots will be a priority for the program.
Park tree	A tree planted or located within Council's open space network of parks and reserves
Private land	Refers to the following land-use classes; residential, commercial, industrial and other land-use types.
Private tree	A tree planted or located on private land
Public land	Refers to the following land-use classes: Public Park, Education, Health and Community, Transport, Cemetery, Crematorium, Local Government, Conservation Zone, and other public use or service area.
Passive irrigation	Describes the integration of water cycle management into urban planning and design, such as at grade tree cut outs or raingardens.
Remnant vegetation	A plant or plants of any taxa and their progeny as part of the floristics of the recognised endemic ecological community remaining in a given location after alteration of the site or fragmentation by activities on that land or on adjacent land.
Resilience	Refers to the capacity of the urban forest to deal with major changes, such as human or natural disturbance, and continue to develop.
Significant vegetation	Vegetation with special qualities that make a contribution to biodiversity or the amenity of an area and should be protected unless they are dead, diseased, dying or dangerous. Significant trees are defined as taller than 6 metres or listed on a proposed significant tree register. Significant vegetation is listed in the Moreland Indigenous Vegetation Assessment.
Street tree	A tree planted or located within the road reserve (street, road, footpath or nature strip)
Streets	Refers to streets, roads and nature strips.
Tree	A long lived woody perennial plant, greater than three metres in height with one or relatively few main stems or trunks.
Tree health	Refers to a tree's exposure to pests and pathogens and stress and its capacity or vigour to grow, and to resist pest, disease and stress. Tree health is closely related to tree condition which includes the overall state of the tree which refers to not only health and vigour, but also structure. Tree health is measured as excellent, good, fair, poor or dead.
Tree Protection Zone (TPZ)	An area around a tree that is protected by a physical barrier from negative impacts, usually from construction activities and is measures as 12 times the DBH.
Urban forest	Refers to all trees and other vegetation in urban public and private spaces and includes, for example, street and park trees, front and backyard trees, grasslands, wetlands, nature strips, balcony plants, and green roofs and walls.
Urban Heat Island Effect	When urban areas are warmer than surrounding rural areas due to heat retention in hard surfaces such as buildings and roads. This build-up of heat is re-radiated at night time, increasing air temperatures which can have serious human health consequences particularly during heatwaves. The most cost effective and efficient mitigation tool is increasing tree canopy cover.
Useful life expectancy (ULE)	ULE does not refer to the biological life expectancy of a given tree species, but relates to how long a tree can be usefully retained within a given site with consideration to the trees condition, aesthetics, management inputs, and risk management.
Water sensitive urban design (WSUD)	The integration of the water cycle into urban planning and design by recognising all water streams in the urban environment as a potential resource e.g. rainwater, stormwater, grey water and blackwater. WSUD is often used to describe the infrastructure built to capture and reuse stormwater.

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SUPPORTING REFERENCE DOCUMENTS

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2 – TREE MANAGEMENT GUIDELINES

3 – TREE PROTECTION GUIDE

4 – AMENITY VALUE FORMULA (CITY OF MELBOURNE METHOD)

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Moreland City Council

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