



Moreland City Council Significant Tree Review 2021



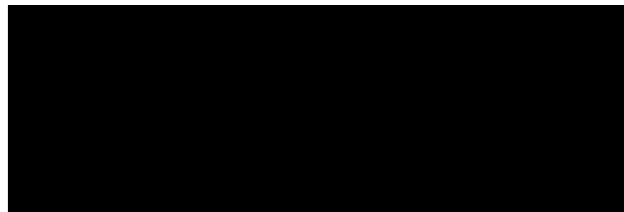
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Executive Summary

Moreland City Council has undertaken a comprehensive significant tree study to identify as many trees as possible on private land that are eligible for a Significant Tree Register.

A Significant Tree Register aims to identify and protect significant trees within a city and is an important part of protecting a city's natural heritage. These trees are of significant value for several reasons including their visual, aesthetic, historical, social, cultural, or horticultural/botanical characteristics and age or size (Figure 1). Some are also located prominently in the landscape contributing to the streetscape or wider landscape.

The trees identified for this register have been done so taking Moreland's tree population into consideration.

The aim is to protect these trees, reduce the removal of large canopy trees on private property and to maintain canopy cover in the City of Moreland. Following completion of this initial study, it is proposed to revisit the register periodically to update existing records and assess new nominations.

A previous preliminary desk top study and drive-by identification was undertaken by Greenwood Consulting in 2019. This captured medium to large canopy trees in private property within the municipality of Moreland.

Homewood Consulting analysed and assessed this data at the beginning of 2020 and potentially significant trees were identified. These trees as well as public nominations by residents and stakeholders were then inspected to consider if they met any of the significant criteria to be included on a Significant Tree Register. This method aimed to capture all large trees still leaving scope for further nominations of trees that fall into other categories such as historical, rare species and cultural.



Figure 1: Tree 517 *Brachychiton populneus* (Kurrajong) assessed as significant for Outstanding Size, Particularly Old and Outstanding Example of the Species

In 2021, 770 properties were visited for a detailed assessment of potentially significant trees. Those that met at least one of the significant criteria were assessed, located, recorded and

photographed. In total 576 records, representing a total of 704 trees were obtained. These records consisted of single trees, pairs, groups and rows of trees within a single private property. Those that did not meet any of the significance criteria were not recorded. This equated to approximately 194 trees from the original list. The data was then reviewed and analysed.

Structure and condition of trees was also considered and those with 'Poor' structure or in decline with reduced useful life expectancy were not considered suitable for the register.

In total 394 records representing 492 trees have been recorded as being suitable and worthy of inclusion into the Significant Tree Register. 131 trees were not considered significant, and 51 trees are 'borderline' significant. These will be considered by a peer review or at a later date.

Of the 394 significant trees, 367 of these were located on private land, 5 on council land, 2 on Vic Roads land, 2 on Vic Track land, 24 on education (schools) land (19 privately owned and 5 publicly owned).

Works have been recommended where faults were identified and to reduce the risk the tree may present in the landscape. It is the owner's responsibility to carry out any works required.

It is recommended that:

- Council list 394 records containing 492 trees on its Significant Tree Register and explore options for the protection and enhancement of the significant trees.
- A peer review is undertaken of the significant trees and borderline significant trees prior to adoption into the planning scheme.
- Trees assessed as borderline (51 records) are reviewed later to see if fit into any of the significant tree criteria.
- The register is reviewed periodically to update existing records and assess new nominations.
- Owners of trees on private land are encouraged to actively manage their trees so that they represent an acceptable risk in the landscape and are within pruning codes, i.e. pavement and property clearance.
- The Tree Protection Zone (area to be protected around a tree) and Structural Root Zone (area to be protected for structural stability of the tree) information (Section 8.2) is referred to when there is construction or excavation activities near significant trees. When designing built structures near significant trees, a qualified arborist is consulted to assess the impact and make recommendations.
- A program is developed and communicated by the council outlining the financial and intangible value of having a significant tree on private property and the benefits it provides to the property owner and the wider community.
- Active management of tree canopies that are close to targets (buildings, pedestrians and vehicles) including built structures, walkways and car parks is undertaken. This involves deadwood pruning, structural pruning and weight reduction pruning.
- Improving soil moisture to trees that have sparse canopies. Applying mulch under the canopy of these trees will provide a more stable soil moisture environment which will assist the trees in staying healthy and in good condition.
- Ensuring that any future development or change in soil condition does not encroach on the trees. This can be implemented with the use of Tree Protection Zones (AS 4970) to ensure that construction is an appropriate design and distance from the tree.

Addressing these points will ensure that the majority of the significant trees will have a long life expectancy and provide amenity for decades to come.

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1. Introduction

In 2020, Moreland City Council engaged Homewood Consulting to undertake a significant tree assessment. This included assessing trees identified through public nominations and a previous desktop search, as well as inspections to ascertain trees worthy of inclusion on a Significant Tree Register. The inspections could not be undertaken until 2021 due to Covid.

The aim is to provide a comprehensive Significant Tree Register that will be revisited and updated periodically to update records and assess any new nominations. This process is to provide for specific planning controls to protect the more significant trees within private land throughout the Municipality.

2. Key Objectives

- Review previous data and assess new nominations to identify potentially significant trees on private land throughout the municipality of Moreland.
- Conduct site visits to each address to determine if potentially significant trees meet one or more criteria to be worthy of inclusion onto a significant tree register.
- If identified to meet the criteria; locate, assess, record and photograph trees.
 - Provide an assessment of the health and structure of all tree specimens assessed.
 - Assess and report on the significance of each tree based on the National Trust Significant Tree Criteria.
 - Provide recommendations for management of the trees for the short to long term.
- Consider structure, condition and location of trees in determining a final list of trees worthy of inclusion into the Significant Tree Register.

3. Council Policy Context

A key priority of Moreland Council is to increase tree canopy cover, aiming to create a municipality where healthy trees and vegetation are a core part of the urban environment. This is recognised in a number of current strategies, including:

3.1 Moreland Urban Forest Strategy

The Moreland Urban Forest Strategy 2017-2027 (the Strategy) was adopted by Council in August 2017 and is the strategic document which guides Council's approach to protecting and enhancing vegetation across the municipality. This includes actions which seek to protect and enhance the urban forest in both the public and private realm and includes establishing a Significant Tree Register.

3.2 Moreland Urban Heat Island Effect Action Plan (2016-2026)

The Moreland Urban Heat Island Effect Action Plan (the Plan) identified that Moreland's highly urbanised environment is experiencing a high urban heat island effect. Detailed analysis of Moreland's urban heat island effect vulnerability found that there is a high number of extremely hot areas and very few cool places. Thus during heatwaves most parts of Moreland can be four to seven degrees warmer than surrounding areas. The analysis highlighted that Moreland has a community that is vulnerable to heat due to an increased amount of hard surfaces that absorb and radiate heat, limited vegetation to shade and cool, heat production from machines and activities, and air pollution creating local greenhouse effects.

The Plan identified the protection of existing vegetation on private land as one of the ways to combat the urban heat island effect and change the urban ground cover through providing shade and moisture in the air to keep Moreland cool. An action from the Plan was the implementation of a Local Law to protect mature trees on private land.

3.3 Plan Melbourne and Living Melbourne

The State Government's strategy Living Melbourne – Our Metropolitan Urban Forest, proposes a series of actions to help Melbourne better protect, connect, and enhance the city's urban forest to help deliver Plan Melbourne 2017-2050, Strategic Direction 6.4 Make Melbourne cooler and greener. Of particular relevance is Action 3: Scale up greening in the private realm, which seeks to encourage private landholders to protect and enhance the urban forest.

3.4 Planning Scheme Amendment

Amendment C189 has recently been approved by the Minister for Planning. C189 introduces new landscaping requirements in the Moreland Planning Scheme that will ensure canopy trees are included in the design of new dwellings.

Through the development of a Significant Tree Register, Council aims to improve protection of existing canopy trees in Moreland, acknowledging the importance of existing tree canopy within the municipality.

4. Protection Strategies

4.1 Local Law versus Planning Overlay

A Local Law tends to cover all trees and requires a significant investment to administer. This includes Local Law permits, approvals, administration and a review process. It deals with each tree on a case by case basis. It is generally a relatively quick provision to implement and can be easily updated on a more regular basis than a planning overlay.

Issues have arisen in regards to the overall enforcement of Local Laws (which impose minimal penalties) and the conflicts that a Local Law can have with the Planning Scheme. Planners are not required to consider Local Law in their decision making and therefore, protection can be limited when it comes to other factors that planners must consider, whether it be use or development. This can lead to trees being approved for removal in a planning permit without an assessment being undertaken within the Local Law process.

Vegetation Protection Overlays (VPO) or Environmental Significance Overlays (ESO) are common for protecting Significant Trees, however, their implementation necessitates an amendment to the Planning Scheme which requires ministerial approval. The process takes far longer than a Local Law process as it has a built-in review process (Third party Planning Panel and the Planning Minister). While this is the case, overlays offer Significant Trees individual protection at a greater level than the Local Law provisions and tree protection can be specified for the individual specimen or applied broad scale for avenues, rows and groups of trees.

While planning enforcement penalties do not generally represent a significant deterrent to tree removal, there is greater control through the Planning Scheme overlays and further avenues exist to prosecute for illegal tree removal. It is noted that there are also opportunities to include tree valuation in the enforcement process.

4.2 Adoption of the Environmental Significance Overlay (ESO)

Our experience indicates that the VPO/ESO pathway provides better outcomes for property owners and for protection of individual trees.

There are several different overlays that can protect significant trees. These are the Environmental Significance Overlay (ESO), the Vegetation Protection Overlay (VPO), the Significant Landscape Overlay (SLO) and the Heritage Overlay (HO). All these overlays provide a number of advantages and disadvantages in regards to vegetation protection and the gaps in their ability to protect Significant Trees were identified.

While the VPO was shown to have the most consistent intent in regards to protecting vegetation, the overlay falls short in protecting the area around the tree from external factors such as use and development. The ESO is an overlay that identifies environmental constraints and ensures that development or use within proximity to the tree is sensitive to ensure its future viability.

The City of Moonee Valley have implemented an ESO for the protection of their Significant Trees. The Panel report prepared as a result of the panel hearing discusses the choice of the ESO over other overlays such as the VPO. The panel stated the following:

The ESO has been chosen and is considered the most appropriate tool to achieve the desired outcomes for the protection of Moonee Valley's significant vegetation. It seeks a permit to remove, destroy or lop the trees, as well as a permit for any buildings and works within the tree protection zones, thereby further protecting the root structure of an identified tree. The ESO has been used in accordance with the 'VPP Practice Note 'Vegetation Protection in Urban Areas, August 1999' since the register was formalised in 2001.

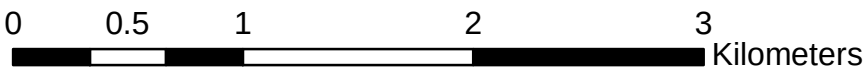
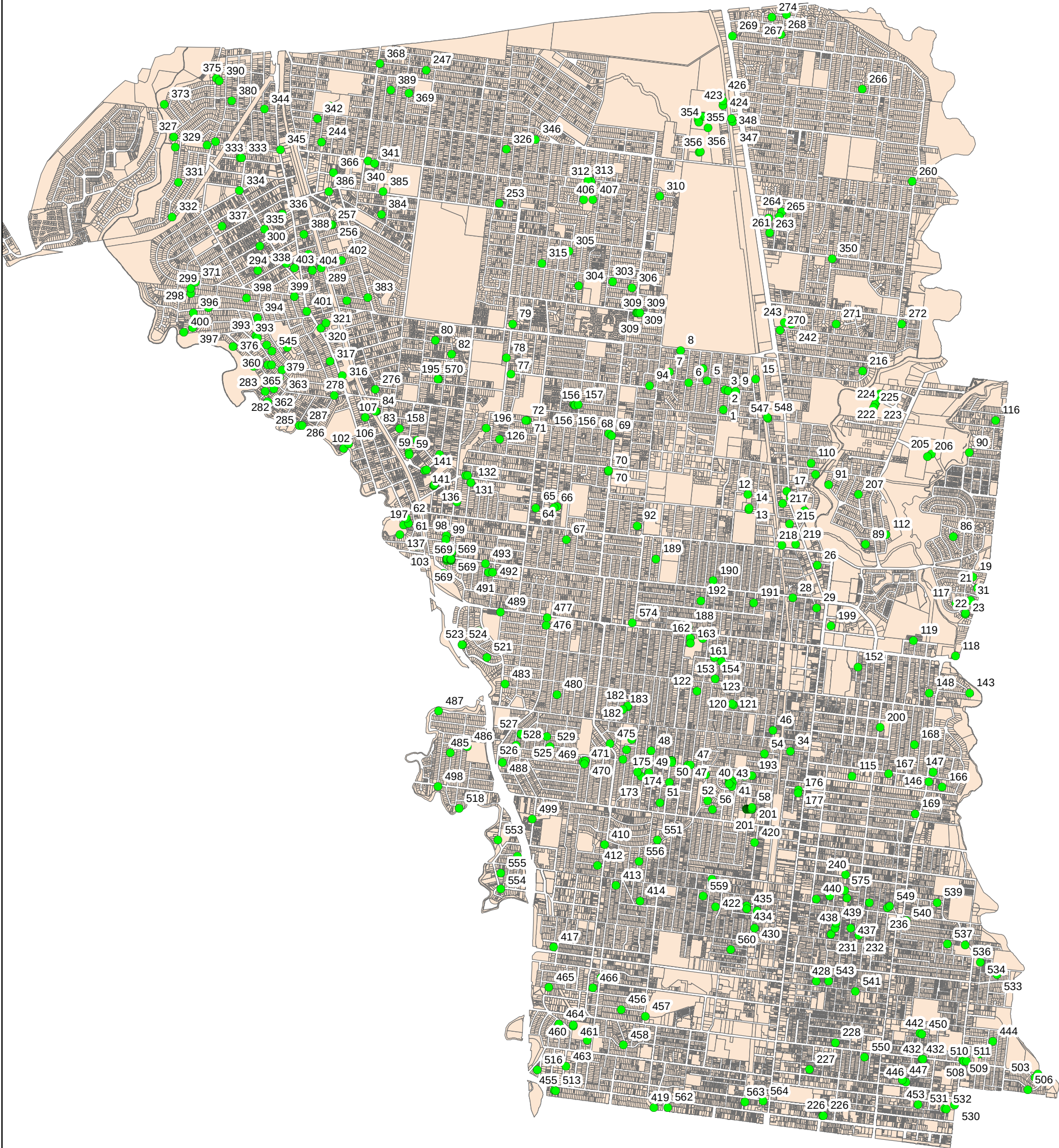
The viability of any potential future development on a site is not considered a relevant consideration when determining the significance of trees. This amendment seeks to preserve vegetation with identified environmental values, as defined through the National Trust Criteria for Significant Trees. Future development proposals on affected sites would be balanced with the consideration of Significant Trees through the planning permit process.

(Planning Panels Victoria, 2018)

Table 1: Different Council's adoption preferences for protection of significant trees

Statutory Mechanism	Environmental Significance Overlay (ESO)	Vegetation Protection Overlay (VPO)	Significant Landscape Overlay (SLO)	Heritage Overlay (HO)	Local Law
Purpose	Environmental constraints Environmental Values	Protects significant native and exotic vegetation Apply to individual trees, stands of trees or areas	Significant landscapes Has broader applicability than the VPO	Protect places of heritage significance (including trees, gardens)	Identify problem Meet Council objective Consider alternatives
Examples of Councils using the protection	Moonee Valley Banyule Frankston Maribyrnong City of Melbourne	Banyule Whitehorse	Banyule Frankston Whitehorse	Moonee Valley Banyule Frankston Whitehorse	Boroondara Bayside

5. Overall Site Map



Overview Map of Significant Trees Located in the City of Moreland



Date: September 2021
Projection: Map grid of Australian GDA94 Zone 55
Base Cadastral Data supplied by City of Moreland
All tree locations and assessments completed by Homewood Consulting



6. Methodology

6.1 Analysing Previous Data

Previous data and photographs of 1,503 potentially significant trees was obtained via a desktop search, drive-by and council records. This was submitted to Homewood Consulting for analysis and the number of trees worthy of further assessment for potential significance was determined. Letters were sent to 770 residents informing them that a potentially significant tree had been identified on their property. The owner then had an opportunity to make an enquiry and/or appointment for inspection of the tree.

6.2 Site Inspections

Inspections for all trees were carried out by Homewood Consulting, an independent arboricultural company, between 12th April 2021 and 28th May 2021. Any appointments made by residents following the letters were attended during this time. Trees that did not fit into any of the significant criteria (see Appendix 1) were not assessed.

Limitations of this process arose for residents that did not make an appointment or contact Homewood Consulting to give permission to enter the property. In these cases, the trees were assessed from the nearest vantage point i.e., street or laneway and all parameters such as height, width, DBH (Diameter at Breast Height), basal measurement and tree condition was estimated. In some cases, a further assessment, Level 2 visual Inspection, has been recommended to determine significance and condition of the tree. This information was recorded in the comments of each citation sheet

Some other reasons trees did not make the register include, poor structure, reduced useful life, or tree causing visible structural damage to property.

6.3 Assessment Methodology

All trees have been given a unique identification number by Homewood Consulting.

When assessing pairs, rows or groups of trees a representative in the group has been selected and assessed to provide a benchmark Tree Protection Zone (TPZ) for the trees. When mapping multiple trees for inclusion in a planning overlay the benchmark TPZ can be applied to all trees to create a single area requiring protection. This is shown in the citation sheets on the map for records that contain multiple trees.

It is acknowledged that the precise TPZ required for individual trees within the multiple tree records will vary due to differences in size, species and health. However, the use of a benchmark TPZ will ensure that a conservative boundary is applied to the trees that is likely to provide an appropriate buffer. This will allow for further investigation and more accurate measurement of individual trees if a permit is triggered under any future Statutory Protection.

Each tree was GPS located. GPS accuracy is to approximately 1m. It is advised that if an approval is required in relation to a tree, its location is reassessed more accurately.

Each tree was photographed twice using a Nikon D5500 SLR digital camera. The first photo shows a full frame of the tree and the second photo shows either a different angle of the tree or highlights points of interest, trunk, growing conditions or the major branching structure of the tree.

Tree height, width (largest width), trunk diameter at breast height (DBH) and trunk diameter at the base above the root flare (for calculating tree protection requirements) was measured for each tree or the representative tree within a group/pair. Tree heights were measured with a TruPulse 360B laser range finder providing 300mm accuracy. Trunk diameters were measured at a height of 1.4m above ground level with a diameter tape.

All assessments of the trees were conducted from ground level. No destructive tests were conducted, or invasive instruments used, and any assessments of decay are qualitative only. Trees with major structural defects reducing useful life expectancy were assessed but not recommended for inclusion.

6.3.1 Data Collection Fields

The following data were collected for each tree whilst onsite:

- Unique ID
- GPS Location
- Cadastral Address
- Street Planted/Park Name
- Location
- Botanical Name
- Height
- Canopy Width
- Estimated age of Tree
- Diameter at Breast Height (DBH)
- Trunk diameter above root flare (SRZ)
- Land Use
- Ownership of tree
- Number of Trees (if a group, avenue or row)
- Health
- Structure
- Useful Life Expectancy (ULE)
- Recommended Works
- Works Priority
- Risk Assessment (QTRA)
- List of Defects
- Pest and Diseases
- Significance (based on National Trust criteria)
- 2 Photos
- Inspector
- Inspection Date

6.3.2 Post Processed Data

The following data were added to the data set post process. This included:

- Common Name
- Tree Protection Zone radius (AS4970-2009)
- Structural Root Zone radius (AS4970-2009)

For all definitions of data collected, see Appendix 1 and Appendix 2.

6.3.3 Map Development

Maps have been created for each citation sheet to show the location of each tree assessed. The maps may show either one tree or multiple trees depending on the localised density of the trees. The maps have been created using ESRI ArcMap by overlaying the tree location data with aerial imagery and base cadastral information. Where multiple trees are shown in one record, the Tree Protection Zone (TPZ) from the assessed tree has been overlaid onto the other trees, to provide a benchmark TPZ. If greater accuracy is required for trees in pairs, individual measurements should be taken.

6.3.4 Tree Significance

The trees were assessed against criteria based on the National Trust's Register of Significant Trees considering Moreland's tree population. For an individual municipality within the state of Victoria, such as the City of Moreland, the trees are assessed at a local level rather than a state level.

The 12 significance categories include:

- Horticultural or Genetic Value
- Location of Landscape Context
- Rare or localised distribution
- Particularly Old
- Outstanding Size
- Aesthetic Value
- Curious Growth Form
- Historical Value
- Connection to Aboriginal Culture
- Outstanding Example of Species
- Remnant Vegetation
- Outstanding Habitat

Each tree was assessed by the consulting arborist to determine if it fitted into any of the categories above.

'Outstanding Size' takes into account the species of the tree, for example if a *Jacaranda mimosifolia* (Jacaranda) is 12m high then this would be considered 'Outstanding Size' as they rarely grow taller than 10m, where as a *Eucalyptus camaldulensis* (River Red Gum) at 12m high would not be considered to be of 'Outstanding Size'. A tree can be given this category based on its height, width and/or girth size.

The category 'Location of Landscape Context' was mainly given to trees that were dominant within the landscape. For example, a large tree in a rear setback that can be seen from afar or a medium to large tree in a front setback that stands out and provides a contribution to the landscape. It can also include a tree as a landmark, one that stands out from a distance, a tree that significantly adds character to the landscape and it would be highly noticeable if it were removed.

Other categories such as Historical Value and Connection to Aboriginal Culture, largely relied on nominations and council knowledge of the history of the tree and associated areas.

Each tree must be accredited in at least one 'Significance Category' to be considered for the Moreland Significant Tree Register. Some trees are in multiple significance Categories, ie, 'Outstanding Size' and 'Particularly Old'. The significance categories are explained in more detail in Appendix 1.

7. Observations

Across the City of Moreland, approximately 900 trees in private property were marked as being potentially significant. Trees were identified through community member nominations and desk top search. Following a more detailed assessment by Homewood Consulting 394 trees, individuals or pairs have been assessed and recorded as being suitable and worthy of inclusion into the Significant Tree Register. The trees worthy of inclusion are located across 12 suburbs in Brunswick, Brunswick East, Brunswick West, Hadfield, Oak Park, Pascoe Vale South, Pascoe Vale, Fitzroy North, Coburg, Coburg North, Glenroy, Fawkner.

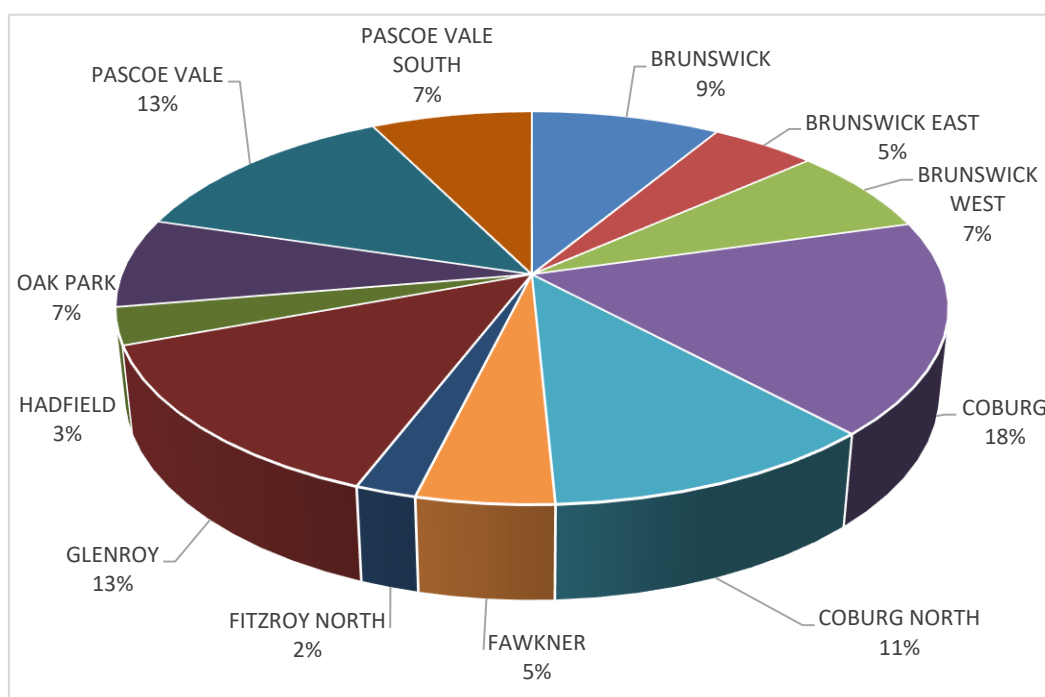


Figure 2: Distribution of significant trees by suburb

7.1 Physical Dimensions

The most common 'Significance Category' for a tree to be nominated was 'Outstanding Size' and 'Location of Landscape Context'.

The tallest tree recorded is a 29m tall *Corymbia citriodora* (Lemon-scented Gum). Six trees had a height of greater than 24m.

The widest recorded girth is a *Schinus mole* (Peppercorn Tree) with a diameter at breast height (DBH) estimated to be 238cm in diameter (see Figure 3).

The trees with the widest canopies are a *Eucalyptus camaldulensis* (River Red Gum), *Quercus robur* (English Oak), *Eucalyptus saligna*, (Sydney Blue Gum) and *Ulmus glabra* 'Lutescens' (Golden Elm), all with a canopy width of 25m.



Figure 3: Tree 121 *Schinus molle* has the widest girth

7.2 Health and Structure

Across the city, the trees worthy of inclusion were generally in 'Good' health with minimal dieback and full and healthy canopies. The structure of the trees was generally 'Fair' to 'Good' with 2 trees having 'Poor' structure. Some of these trees require structural works to improve their structure, extend their useful life expectancy and reduce the risk they present in the landscape. Trees with major structural faults that reduced the tree's overall useful life expectancy and could not be improved through pruning were not considered for inclusion into the Significant Tree Register.

7.3 Useful Life Expectancy (ULE)

Most of the trees have a long ULE with over 85% expected to exist in the landscape for over 20 years. ULE is an estimation of how long a tree can be retained in the landscape at an acceptable level of risk with an appropriate level of management and resources.

The categories of '21-40' years and '40+' years may be extended substantially if the trees are managed and tree health is maintained. Some of the species recorded are long-lived and it is possible that trees in the '40+ years' ULE category could possibly last for 100 years or more.

7.4 Recommended Works

Works have been recommended for some trees and these mainly consist of risk reduction pruning, canopy lifts and deadwood removal. The aim of the works is generally to improve structure, reduce risk or increase ULE. Some trees have one or more works associated with them and all works have been given a priority of 'Urgent', 'High', 'Moderate' or 'Low'.

Works should be completed within the timeframes set out below in Table 2. Individual works and priorities are outlined on the Individual Tree Reports in the appendices. A description of works for the trees assessed is described in more detail in Section 8.3.

It is important to note that private landowners are under no obligation to undertake the recommended works. However, council should inform the landowner of the works required; and as a matter of safety and to extend the useful life of the tree, recommended works should be undertaken in a timely manner.

7.4.1 Works Priority

Table 2. Works Priority Timeframe

Category	Definition
Urgent	Recommended works should be carried out as soon as possible.
High	Recommended works should be carried out within six months
Moderate	Recommended works should be carried out within twelve months
Low	Recommended works should be carried out within two years

7.5 Risk Assessment

A risk assessment using Quantified Tree Risk Assessment, Version 5 (2015) has been conducted on all trees. The risk assessment method has the following components:

- Probability of failure (PF). The probability of failure rating is attributed to the tree part that is most likely to fail under normal conditions within the next 12 months.
- Size of part likely to fail (FS). The failure size rating is attributed to the branch or trunk that is most likely to fail and cause the most damage under normal conditions over the next 12 months.
- Target occupancy (TO). The target occupancy is attributed to the object that is most likely to be hit / injured / damaged in the event of failure.

The QTRA Risk Score methodology is probabilistic and the lower the value the higher the risk. The risk score is presented as a numeric value however it is properly expressed as a fraction e.g. Risk Score = 1,440 indicates that the predicted event has a 1/1,440 chance of occurrence. 1/1 indicates that an event is certain to occur and 1/10,000,000 indicates that it is extraordinarily unlikely.

QTRA Version 5 uses Monte Carlo simulations to arrive at a mean value for the risk score values. In short, Monte Carlo simulations mean QTRA calculators work out the 'most likely' Risk of Harm from 10,000 possible outcomes for each combination of PF, FS and TO Range.

QTRA Risk Harm of Score has been categorized by Homewood Consulting as ranging from 'Very High' to 'Very Low' risk of harm. The incremental rise between categories increases by orders of magnitude as the risk assessment operates on an exponential scale.

Table 3. Summary of the RATS risk assessment categories

Risk Category	QTRA Risk of Harm Score
Very High	<1/4,000
High	1/5,000
Moderate	1/10,000 to 1/1,000,000
Low	1/3,000,000 to 1/5,000,000
Very Low	>1/10,000,000

The method does not provide predictions of what will or will not happen but an estimate of the risk from any particular tree hazard. The purpose of QTRA is not necessarily to provide high degrees of accuracy, but rather to provide for the quantification of risks and to assist in the prioritisation of tree works within a group of trees.

Further detail regarding the Risk Assessment method and definitions for the categories assigned can be seen in Appendix 2.

Amongst the trees assessed within the city, the risk presented by the trees is predominantly 'Moderate', 'Low' or 'Very Low'. This is largely due to the locations of many trees existing in back and front gardens away from buildings and in locations with a low target rating. No trees included on the register had a 'High' risk rating.

8. Discussion

Management works for trees on private property are the responsibility of the land owner and they will need to be informed of works and priority timeframes that are required on their trees. A list of works is described in Section 8.3.

8.1 Tree Management

- Active management of tree canopies that are close to targets including built structures, walkways and car parks. This involves deadwood pruning, structural pruning and risk reduction pruning.
- Improving soil moisture to trees that have sparse canopies. Applying mulch under the canopy of these trees will provide a more stable soil moisture environment which will assist the trees in staying healthy and in good condition.
- Ensuring that any future development does not encroach on the trees. This can be implemented with the use of Tree Protection Zones (AS 4970) to ensure that construction is an appropriate design and distance from the tree.

Addressing these points will ensure that the majority of the significant trees will have a long life expectancy and provide amenity for decades to come.

Other management issues are discussed below.

8.1.1 Leaf and Fruit Drop

Trees that drop leaf matter and fruit on the pavement and roads may cause a 'slip' hazard. Owners of significant trees on private property should be encouraged to keep the pavements, crossovers and roads under the canopy of their tree clear.

8.1.2 Canopy Clearance for Trees on Private Property

Tree canopies on private property that overhang pavements require pruning to ensure easy pedestrian access. Works should be carried out by professional arborists and conform to the Australian Standard Pruning of Amenity Trees (AS-4373 2007).

8.1.3 Building Clearance Pruning

While ensuring that building clearance is maintained, it should be noted that it is acceptable for branches to overhang a building, provided a vertical clearance of approximately 2 metres is maintained (Figure 4).

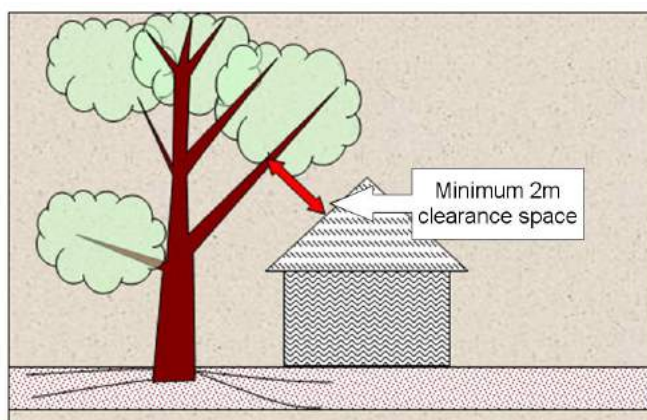


Figure 4: Pruning requirements near buildings

8.1.4 Gutter Guarding

For trees adjacent to or overhanging roofs, leaf and fruit drop is inevitable. The nuisance is usually related to blocked gutters. The installation of sturdy 'Gutter Guarding' is advisable to ensure that gutters do not become blocked, posing a flooding risk (Figure 5).

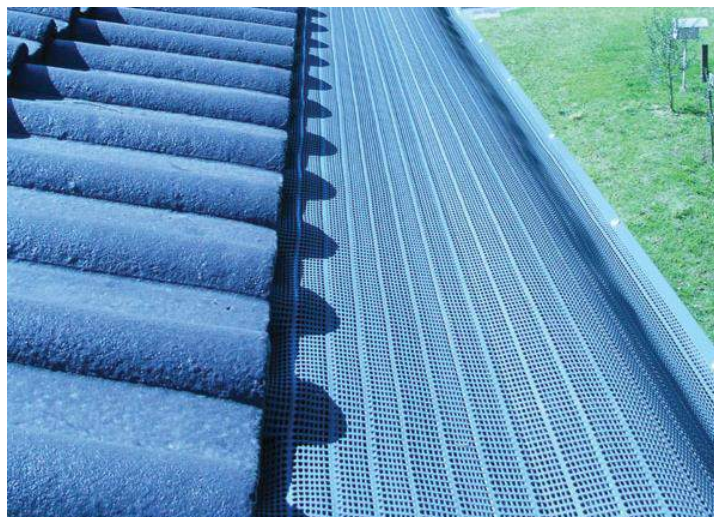


Figure 5: Example of gutter guarding on a tiled roof.

8.2 Considerations for Trees near Buildings and Development

8.2.1 Tree Protection Zones

Considering any current or future construction, development or installation of features, buildings or hard surfaces, the tree's protection requirements should be considered to avoid any irreparable damage to the tree. Damage to trees during development can be direct and indirect.

Direct damage includes mechanical injury to the trunk, the severing of roots, or alterations to the soil environment in the immediate vicinity of tree roots (i.e. compaction or loss of organic matter).

Indirect effects of site development are usually related to soil hydrology. This includes alterations to soil moisture content, changes in the level of the water table and drainage patterns (Coder 1995).

The most common method of protecting trees during construction is by setting up a Tree Protection Zone (TPZ). Using the Australian Standard for *Protection of Trees on Development Sites* (AS 4970-2009), The method calculates a TPZ as 12 times the trunk diameter at 1.4m above ground level (DBH). Palms have a fibrous root system that does not spread but instead tends to form a large ball of roots under the trunk. Due to this, their TPZs are calculated differently. The width of the canopy divided by 2 and plus 1. Therefore, a palm with a canopy width of 6 would have a TPZ of 4m radius from the trunk of the palm.

A TPZ should act as a physical barrier of protective fencing that is a minimum of 1.8m high. It is erected around specimens (at the edge of the TPZ) before any site works commence (Figure 6).



Figure 6: TPZ fencing is erected around retained trees prior to site works.

8.2.2 Tree Protection Zone Guidelines:

During the construction process, there are many ways for trees to be damaged. Careful adherence to the following exclusions and inclusions helps to maintain the health and longevity of trees throughout any construction process.

Exclude the following from taking place within any TPZ (adapted from AS 4970-2009):

- built structures or hard landscape features (i.e. paving, retaining walls)
- materials storage (i.e. equipment, fuel, building waste or rubble)
- soil disturbance (i.e. stripping or grade changes)
- excavation works including soil cultivation (specifically surface-dug trenches for underground utilities)
- placement of fill
- lighting of fires
- preparation of chemicals, including preparation of cement products
- pedestrian or vehicular access (i.e. pathways).

Include the following procedures in setting up and maintaining any TPZ (adapted from AS 4970-2009):

- erect warning signs at regular intervals along the entire length of any protective TPZ fencing (Figure 7)
- construct TPZ fencing to prevent pedestrian access into the protected area.
- mulch the TPZ area to a depth of 150mm with woodchips (if available, use woodchips generated from on-site tree clearing).
- irrigate TPZs periodically, as determined by the consulting arborist.

TPZ guidelines need to adhere to all stages of the design and construction process and are relevant to all on-site utilities.

TPZ dimensions have been provided for each tree in the individual tree reports.



Figure 7: Example of a TPZ warning sign clearly displayed on TPZ fencing

8.2.3 Minor TPZ encroachment

Encroachment of less than 10% of the TPZ and outside the Structural Root Zone (SRZ) is deemed to be minor encroachment according to AS 4970-2009. Detailed root investigations should not be required but must be compensated with an extension to the TPZ elsewhere (Figure 8). Variations must be made by the project arborist considering other relevant factors including tree health, vigour, stability, species sensitivity and soil characteristics.

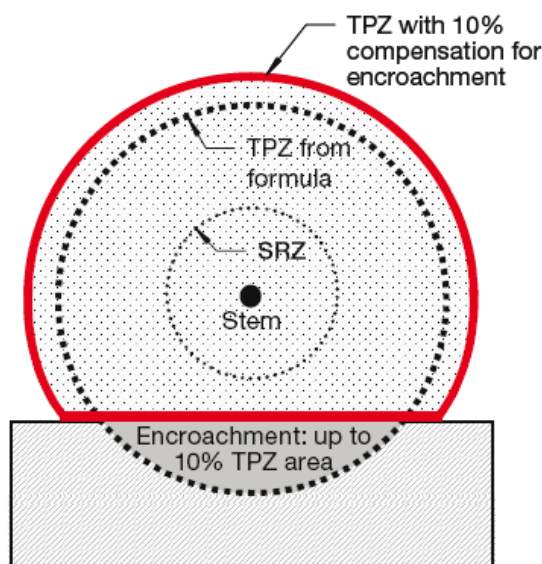


Figure 8: Example of TPZ encroachment and compensatory offset (image from AS 4970-2009)

8.2.4 Major TPZ encroachment AS 4970-2009

Encroachment of more than 10% of the TPZ or into the SRZ is deemed to be major encroachment according to AS 4970-2009. The project arborist must demonstrate that the tree(s) would remain viable. The area lost to this encroachment should be compensated for elsewhere and contiguous with the TPZ. This may require root investigation by non-destructive methods and consideration of relevant factors tree health, vigour, stability, species sensitivity and soil characteristics.

8.2.5 Structural Root Zones

The Structural Root Zone (SRZ) is an area surrounding the tree where construction should not take place at all. SRZs are calculated according to Australian Standard, *Protection of Trees on Development Sites* (AS 4970-2009). The SRZ is the minimum volume of roots required by the tree to remain stable in the ground. If the SRZ is breached the chances of windthrow are significantly increased. Windthrow is an event where the entire tree fails/falls over.

It is important to note that the SRZ is not related to tree health. It refers to the physical volume of roots required for the tree to remain stable in the ground. It is in no way related to the physiological requirements of the tree but is the minimum volume of roots required for the tree to remain standing (Mattheck and Breloer 1994) (Figure 9).

SRZ dimensions have been provided for all trees in the individual tree reports.

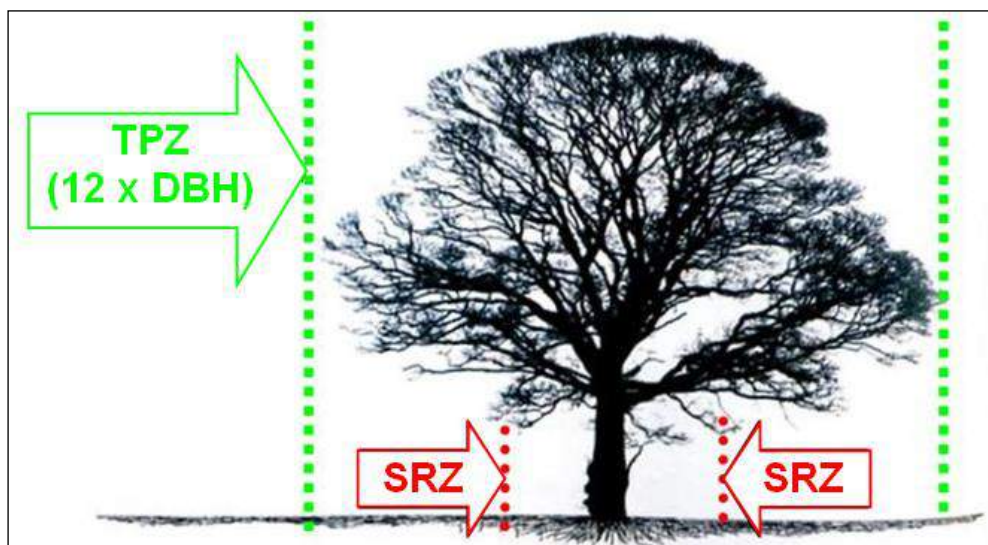


Figure 9: The SRZ = minimum volume of roots required for tree stability.

8.3 Recommended Works

Pruning works should be carried out by fully qualified arborists with demonstrated experience in the management of large significant trees or be directly supervised by qualified arborists. At least one fully qualified arborist should always be present on-site during pruning operations.

All pruning undertaken must conform to the Australian Standard Pruning of Amenity Trees (AS-4373 2007).

8.3.1 Description of Works

Below is a description of the works that have been recommended for some of the trees.

8.3.1.1 Structural Prune

Structural, or correctional pruning, aims to alleviate or remove an existing fault. The fault may relate to a weak or included branch union, crossing or rubbing branches or damaged or wounded limbs. Structural pruning usually involves skilled arboricultural practices including knowledge of Natural Target Pruning (NTP) and appropriate climbing techniques.

8.3.1.2 Deadwood Removal

Remove deadwood down to 50mm in diameter from the canopy of the tree. These works will need to be completed by a qualified and experienced arborist. Removing deadwood helps prevent disease and decay entering the tree and reduces risk of harm through failure.

8.3.1.3 Broken Branch Removal

Where a branch has completely or partially broken and is hung up in the canopy. These broken branches often fall without warning and should be removed.

8.3.1.4 Risk Reduction Pruning

Canopy, branch or stem reduction pruning of overextended limbs can reduce the possibility of failure. The aim is the selective pruning of long and extended branches starting in the 3rd order branching, back to a shorter, more compact growing point (Figure 10). This reduces the overall weight, length and leverage on the branch union.

Undertaking a risk reduction pruning program of the upper canopy of a tree reduces the risk of branch and stem failure to a manageable level and extends the tree's Useful Life Expectancy

(ULE). It should be noted that risk reduction pruning only **reduces** the chances of branch and trunk failure. It does not remove the potential for failure entirely.

Long or over-extended branches should be selectively pruned to reduce the 'end' or tip weight. This should start from the ends of branches (3rd order) and work back to prevent 'Lion Tailing' (Figure 10). In some cases, it may be necessary to additionally remove 2nd order branching to achieve a particular outcome; however, cuts should be limited to a size of no greater than 30-100mm diameter where possible. The aim of this pruning is to reduce the potential for large limb failure by reducing the force exerted upon the union. These works will require qualified and experienced arborists to complete. The works generally involve high climbing and limb reduction.

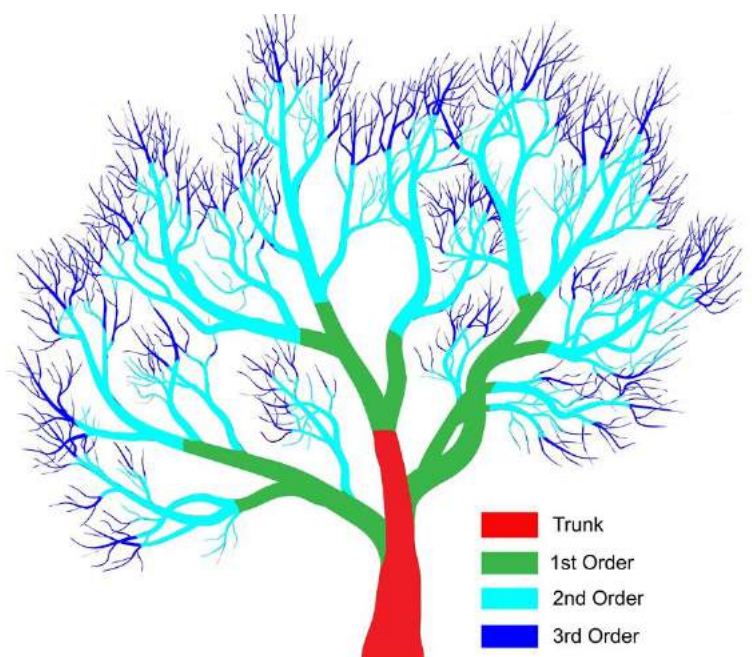


Figure 10: Tree structure representing multiple branching orders.

8.4 Updating and Managing the Significant Tree Register

Although an extensive desk top search and drive by inspections have been carried out, there will still be trees within the municipality worthy of being included on the register. These may be smaller significant trees that cannot be seen on aerials and/or are in back gardens or trees not visible from the street. There may also be trees of historical significance or aboriginal cultural significance that have not yet been identified. It is recommended that nominations continue to be accepted for potentially significant trees and these trees are assessed. The Significant Tree Register should be updated periodically with inclusion of these trees into the planning scheme.

9. Conclusion

An assessment of potential significant trees within private property has been undertaken. This involved analysing data previously obtained of potentially significant trees within private property in the municipality and assessment of public nominations by residents and stakeholders.

1503 medium and large trees were identified from a desk top search and nominations. Of these 576 were worthy of assessment as potentially significant, and 394 records containing 492 trees have been deemed significant for inclusion into the Significant Tree Register.

367 of these were located on private land, 5 on council land, 2 on Vic Roads land, 2 on Vic Track land, 24 on education (schools) land (19 privately owned and 5 publicly owned).

Most trees are in 'Good' health, have 'Fair' to 'Good' structure and are expected to remain viable in the landscape for many years.

In order to retain them at an acceptable level of risk and in a healthy condition, management practices are recommended. These include:

- active canopy management
- target exclusion where and when necessary
- improving soil moisture by mulching
- general ongoing maintenance.

Addressing these points will ensure that the majority of the significant trees will have a long life expectancy and provide amenity for decades to come.

It is recommended that the Significant Tree Register is revisited periodically to update existing records and assess any new nominations.

10. Recommendations

It is recommended that:

- Council list 394 records containing 492 trees on its Significant Tree register and explore options for the protection and enhancement of the significant trees.
- A peer review is undertaken of the significant trees and borderline significant trees prior to adoption into the planning scheme.
- The register is reviewed periodically to update existing records and assess new nominations.
- Owners of trees on private land are encouraged to actively manage their trees so that they represent an acceptable risk in the landscape and are within pruning codes, ie pavement and property clearance.

- The Tree Protection Zone (area to be protected around a tree) and Structural Root Zone (area to be protected for structural stability of the tree) information is referred to when there are construction or excavation activities near significant trees. When designing built structures near significant trees, a qualified arborist is consulted to assess the impact and make recommendations.
- A program is developed and communicated by the council outlining the financial and intangible value of having a significant tree on private property and the benefits it provides to the property owner and the wider community.
- Active management of tree canopies that are close to targets (buildings, pedestrians and vehicles) including built structures, walkways and car parks. This involves deadwood pruning, structural pruning and weight reduction pruning.
- Improving soil moisture to trees that have sparse canopies. Applying mulch under the canopy of these trees will provide a more stable soil moisture environment which will assist the trees in staying healthy and in good condition.
- Ensuring that any future development or change in soil condition does not negatively impact on the trees. This can be implemented with the use of Tree Protection Zones (AS 4970) to ensure that construction is an appropriate design and distance from the tree.

11. References

AS 4373, 2007, *Australian Standard, Pruning Amenity Trees*, 2nd Edition Standards Australia

AS 4970, 2009, *Australian Standard, Protection of Trees on Development Sites*, Standards Australia

Coder, K. D., 1995, 'Tree quality BMPs for developing wooded areas and protecting residual trees', in *Trees and Building Sites, Proceedings of an International Workshop on Trees and Buildings*, Edited by G. W. Watson and D. Neely, International Society of Arboriculture, Champaign, Illinois.

Ellison, M.J., 2015, 'Quantified tree risk assessment used in the management of amenity trees', *Journal of Arboriculture*, 31(2) March 2015, International Society of Arboriculture, Champaign, Illinois, USA.

Mattheck, C. and Breloer, H. 1994, *The body language of trees: a handbook for failure analysis*, London: HMSO.

Appendix 1. Data Collection Definitions

The information collected on each specimen was based on the assessor's experience and opinion of each of the trees. Included are the descriptions for each of the listed categories. The following information was collected on each tree.

1.1 Unique ID

Tree identification number

1.2 Name

The genus, species, common name and origin of the tree.

1.3 Height

Measured with a laser range finder to the nearest metre.

1.4 Width

Measured diameter of the tree canopy at its widest point, to the nearest whole metre.

1.5 DBH

Measured using a diameter tape at 1.4m above ground level to the nearest centimetre

1.6 Number of Trunks

The number of trunks that were measured to calculate the DBH.

1.7 Approximate Age

Approximate or known age of the tree in categories: 0-20, 21-40, 41-60, 61-80, 80-100, 100+

1.8 SRZ measurement

Diameter of trunk above the root flare measured with a diameter tape.

1.9 Maturity

Table 4. Maturity Definition

Term	Definition
Young	The tree has recently been planted (within the last 3 – 5 years). The tree's age is within the first 10% of the total ULE for that species
Semi-mature	The tree has become established in the site and its age is more than 10% but less than 30% of the total ULE for that species. The tree may be approaching its expected mature size. If correctly maintained the specimen will continue to grow to maturity.
Mature	The tree's age is more than 30% of the total ULE for that species. Usually the tree will have reached the expected size for the species in the site. It is expected that the tree will slowly increase in size and girth and require normal periodic inspection until in senescence.

1.10 Health

Table 5. Health Definition

Term	Definition
Good	The tree is demonstrating good or exceptional growth. The tree should exhibit a full canopy of foliage and have only minor pest or diseases problems.
Fair	The tree is in reasonable condition and growing well. The tree should exhibit an adequate canopy of foliage. There may be some deadwood present in the crown. Some grazing by insects or possums may be evident.
Poor	The tree is not growing to its full capacity; extension growth of the laterals is minimal. The canopy may be thinning or sparse. Large amounts of deadwood may be evident throughout the crown. Significant pest and disease problems may be evident or symptoms of stress indicating tree decline.
Very Poor	The tree appears to be in a state of decline. The tree is not growing to its full capacity. The canopy may be very thin and sparse. A significant volume of deadwood may be present in the canopy or pest and disease problems may be causing a severe decline in tree health.
Dead	The tree is dead.

1.11 Structure

Table 6. Structure Definition

Term	Definition
Good	The tree has a well-defined and balanced crown. Branch unions appear to be strong, with no defects evident in the trunk or the branches. Major limbs are well defined. The tree is considered a good example of the species.
Fair	The tree has some minor problems in the structure of the crown. The crown may be slightly out of balance, and some branch unions may be exhibiting minor structural faults. If the tree has a single trunk, it may be on a slight lean or exhibiting minor defects.
Poor	The tree may have a poorly structured crown. The crown may be unbalanced or exhibit large gaps. Major limbs may not be well defined. Branches may be rubbing or crossing over. Branch unions may be poor or faulty at the point of attachment. The tree may have suffered root damage.
Very Poor	The tree has a poorly structured crown. The crown is unbalanced or exhibit large gaps with possibly large sections of deadwood. Major limbs may not be well defined. Branches may be rubbing or crossing over. Branch unions may be poor or faulty at the point of attachment. Branches may exhibit large cracks that are likely to fail in the future. The tree may have suffered major root damage.
Failed	The tree has a very poorly structured crown. A section of the tree has failed or is in imminent danger of failure.

1.12 Useful Life Expectancy (ULE) Rating

Useful Life Expectancy is approximately how long a tree can be retained safely and usefully in the landscape.

Table 7. ULE Definition

Term	Definition
Unsafe	The tree is considered dangerous in the location and has no significant amenity value.
Less than 5 years	The tree, under normal circumstances and without extra stresses being imposed on it, should be safe and have value for up to five years, but will need to be replaced. During this period, normal inspections and maintenance will be required. If possible, replacement trees should be planted.
5 – 10yrs	The tree, under normal circumstances and without extra stresses being imposed on it, should be safe and of value for up to ten years. During this period, normal inspections and maintenance will be required.
9 – 20yrs	The tree, under normal circumstances and without extra stresses being imposed on it, should be safe and of value for up to twenty years. During this period, normal inspections and maintenance will be required.
20 – 40 years	The tree, under normal circumstances and without extra stresses being imposed on it, should be safe and of value for up to forty years. During this period, normal inspections and maintenance will be required.
Greater than 40 years	The tree, under normal circumstances and without extra stresses being imposed on it, should be safe and of value for greater than forty years. During this period, normal inspections and maintenance will be required.

1.13 Defects

The defects field will list defects that are a significant issue associated with the tree that may require management/attention in the short to medium-term. They are generally divided into defects associated with the roots, trunk or canopy and can list multiple defects.

This will include defects such as:

- Soil Compaction
- Exposed Roots
- Unstable in the ground
- Mechanical damage to roots
- Ground Heave
- Filled Soil
- Trunk Codominant
- Trunk Decay
- Trunk Lean
- Trunk Lopped
- Trunk Included Bark
- Trunk Active Split
- Trunk Bracket Fungi
- Trunk Mechanical Damage
- Trunk Cavity
- Canopy Hollow
- Canopy Codominant
- Canopy Extended Branches
- Canopy Deadwood
- Canopy Included Bark
- Canopy Active Split
- Canopy Mechanical Damage
- Canopy Broken Branch
- Canopy Lopped
- Pest and Disease

1.14 Significance Criteria

The significance criteria are based on the National Trust of Victoria Significant Tree Register.

1.14.1 Horticultural or Genetic Value

Any tree which is of horticultural or genetic value and could be an important source of propagating stock, including specimens that are particularly resistant to disease or exposure. This could include Australian native, locally indigenous or exotic tree species.

A tree or group of trees that are of ecological or environmental significance. These trees may provide habitat value or contribute significantly to a greater habitat corridor.

1.14.2 Location of Landscape Context

The tree or trees occur in a unique location or context, so as to provide a unique contribution to the landscape. This includes the following categories:

- Historic Garden or Park
- Historic Cemetery
- Important Landmark
- Habitat Trees
- End of Natural Range
- Contribution to Landscape
- Historic Town
- Historic Planting Style
- Environmentally sensitive site (eg. Riparian, wetland)

1.14.3 Rare or Localised Distribution

Any tree of a species or variety that is rare, or is of very localised distribution. This could include:

A threatened indigenous or endemic species within its locality

- End of natural range
- Disjunct community
- A rare exotic specimen

1.14.4 Particularly Old

Any tree that is particularly old or venerable.

1.14.5 Outstanding Size (Girth height spread)

The outstanding size of a tree will relate specifically to the tree species and may vary considerably depending.

- Height
- Canopy Spread
- Diameter at Breast Height (DBH)

1.14.6 Aesthetic Value

The tree is a particularly well-formed example of the species that is in a location that makes it striking in the landscape. The loss of a tree in this category would result in a substantial change to the local landscape.

1.14.7 Curious Growth Form

Any tree which exhibits a curious growth form or physical feature such as abnormal outgrowths, natural fusion of branches, severe lightning damage or unusually pruned forms.

- Abnormal Outgrowths
- Fusion of Branches
- Unusually Pruned
- Unusually Damaged

1.14.8 Historical Value

The tree is of importance in the culture and natural history of the City of Moreland. Any tree commemorating a particular occasion, individual or associated with an important historical event may be considered in this category. This includes but is not limited to:

- Cultural Groups
- Important Individuals
- Commemorative Plantings
- Public Feature
- World War I and II
- Avenues of Honour
- British Royalty
- Non-British Royalty
- Visiting Dignitary
- Australian Public Figure
- Victorian Public Figure

1.14.9 Connection to Aboriginal Culture

A tree associated with aboriginal activities or culture. For example:

- Scarred trees

- Corroboree trees

1.14.10 Outstanding Example of Species

Any tree that is an outstanding example of the species at an International / National / State / Regional / Local level or of particular aesthetic value.

1.14.11 Remnant

Any tree that is likely to predate European development of the area. This puts the trees in the region of 100-200 years old.

1.14.12 Outstanding Habitat

The tree is observed to have significant hollows for avian fauna or is clearly being used as a major food source for fauna. The presence of large raptor nests or numerous nests may qualify a tree in this category.

Appendix 2. Risk Assessment Methodology

2.1 Risk Score Overview

Many organisations now require an assessment of the potential risk or hazard that each tree presents. Risk scores, generated as part of the data collection methodology, often link to digital photography.

Risk scores and data collection methodology methods are not standardised and can vary. The Quantified Tree Risk Assessment (QTRA) (Ellison 2015) method has been adopted here and has the following elements:

QTRA methodology is probabilistic – the lower the value the higher the risk. The risk score is presented as a numeric value however it is properly expressed as a fraction. For example, a risk score of 344 indicates that the predicted event has a 1/344 chance of occurrence, 1/1 indicates that an event is certain to occur and 1/10 000 000 000 indicates that it is extraordinarily unlikely.

An accepted threshold for the Tolerable Region of risk scores as defined by the Tolerability of Risk Framework (ToR) (HSE 2001) is a 1/10 000 chance of occurrence. Any tree that incurs a risk score lower than 10 000 would be expected to be worked upon within the next twelve months.

2.2 Target Presence (Occupancy)

The target presence is attributed to the object that is most likely to be hit / injured / damaged in the event of failure.

For example: If a tree is overhanging a road it is unlikely that the road will become damaged in the event of tree failure, passing vehicles are more likely to be affected.

Therefore the target range would be attributed according to the volume and frequency of vehicles on that road as shown in Table 8.

Table 8: QTRA Target Ranges

Target Range	Property (repair or replacement cost)	Pedestrian frequency	Vehicular frequency (number per day)	Probability Ratio
1	>\$240,000	Occupation: Constant – 2.5 hours/day Pedestrians & cyclists: 720/hour – 73/hour	28,000 – 2,900 vehicles @ 100km/h 32,000 – 3,300 vehicles @ 80km/h 42,000 – 4,300 vehicles @ 60km/h 47,000 – 4,800 vehicles @ 50km/h	1/1 - >1/10
2	>\$24,000 - \$240,000	Occupation: 13.4 hours/day – 15 min/day Pedestrians & cyclists: 72/hour – 8/hour	2,800 – 290 vehicles @ 100km/h 3,200 – 330 vehicles @ 80km/h 4,200 – 430 vehicles @ 60km/h 4,700 – 480 vehicles @ 50km/h	1/10 - >1/100
3	>\$2,400 - \$24,000	Occupation: 14 min/day – 2 min/day Pedestrians & cyclists: 7/hour – 2/hour	280 – 29 vehicles @ 100km/h 320 – 33 vehicles @ 80km/h 420 – 43 vehicles @ 60km/h 470 – 48 vehicles @ 50km/h	1/100 - >1/1,000

Target Range	Property (repair or replacement cost)	Pedestrian frequency	Vehicular frequency (number per day)	Probability Ratio
4	>\$240 - \$2,400	Occupation: 1 min/day – 2 min/week Pedestrians & cyclists: 1/hour – 3/day	28 – 4 vehicles @ 100km/h 32 – 4 vehicles @ 80km/h 42 – 5 vehicles @ 60km/h 47 – 6 vehicles @ 50km/h	1/1,000 - >1/10,000
5	>\$24 - \$240	Occupation: 1 min/week – 1 min/month Pedestrians & cyclists: 2/day – 2/week	3 – 1 vehicles @ 100km/h 3 – 1 vehicles @ 80km/h 4 – 1 vehicles @ 60km/h 5 – 1 vehicles @ 50km/h	1/10,000 - >1/100,000
6	≤\$24	Occupation: <1 min/month – 0.5 min/year Pedestrians & cyclists: 1/week – 6/year	None	1/100,000 - 1/1,000,000

Where a tree exists over several layers of human traffic frequency it is important to consider the probable failure that is likely to occur from the tree in question in determining the appropriate occupation statistic to identify a target range.

For example a tree may exist within an open park zone for which the human traffic may be in target range 4 (>3 pedestrians per day but <1/hour) attracting a relatively low probability ratio, however, it may also be adjacent to an arterial path with associated human traffic for categorisation in target range 2 (8-72 pedestrians/hour).

If the likely failure from the tree is away from the path, then a target range of 4 would be appropriate. However, if the likely failure is toward the path, then the appropriate target range would be 2.

If the likely failure is of dead wood which is evenly distributed throughout the canopy, then the higher range would be used.

If there are several possible types of failure with different failure sizes over different zones of human occupation around a tree, then each should be assessed and the values that will produce the highest risk score should be used.

If there is no obvious potential for failure, then the higher human occupation range should be used.

2.3 Probability of failure

The probability of failure rating is attributed to the tree part that is most likely to fail under normal conditions within the next three – five years. Strictly speaking this methodology is only concerned with the next twelve months but a greater time frame must be considered because very few trees are actually inspected every twelve months.

Probability of failure is very closely related to the structure of the tree. If a tree has good structure it should generally not be attributed a relatively high probability of failure range value for significant tree parts. However if the part most likely to fail is dead wood then it may be appropriate for the probability of failure range value to be relatively high.

Failure potential is attributed to the tree *prior to works being completed*. Following the completion of works, the probability of failure requires reassessing to ensure that the probability range is updated.



Figure 11. High failure potential

Table 9: QTRA Probability of Failure Ranges

Probability of Failure Range	Probability of Failure Ratio	Probability of Failure Percentage	Description
1 (Severe)	1/1 – >1/10	>10% - 100%	The structure of the specimen has large and very significant faults and defects. Active failure is often present and branch or trunk failure is imminent. Failure within the next twelve months would appear certain. The probability of failure over the next twelve months is 10 – 100%.
2 (High)	1/10 – >1/100	>1% - 10%	The structure of the specimen has large and significant faults and defects. Branch or trunk failure within the next twelve months would appear likely. The probability of failure over the next twelve months is 1 – 10%.
3 (Moderate)	1/100 – >1/1,000	>0.1% - 1%	The structure of the specimen has significant faults and defects. Branch or trunk failure within the next twelve months would appear possible. The probability of failure over the next twelve months is 0.1 – 1%.
4 (Low)	1/1,000 - >1/10,000	>0.01% - 0.1%	The structure of the specimen has some faults that may result in failure but failure is unlikely. The probability of failure over the next twelve months is 0.01 to 0.1%.
5 (Very Low)	1/10,000 - >1/100,000	>0.001% - 0.01%	The structure of the specimen has some minor faults that may result in failure but failure is very unlikely. The probability of failure over the next twelve months is less than 0.01%.
6 (Negligible)	1/100,000 - >1/1,000,000	>0.0001% - 0.001%	The probability of failure is highly unlikely, between 0.01 to 0.001%.
7 (None)	1/1,000,000 - >1/10,000,000	>0.00001% - 0.0001%	The probability of failure can be considered none, less than 0.0001%.

2.4 Failure size

The failure size rating is attributed to the part of the tree that is most likely to cause the most damage under normal conditions over the next three to five years.

Table 10: QTRA Size Ranges

Size Range	Size of part most likely to fail (diameter likely to impact target)	Impact Potential
1	>450mm	1/1 - >1/2
2	260mm – 450mm	1/2 - >1/8.6
3	110mm – 250mm	1/8.6 - >1/82
4	25mm – 100mm	1/82 - >1/2,500

2.5 Examples

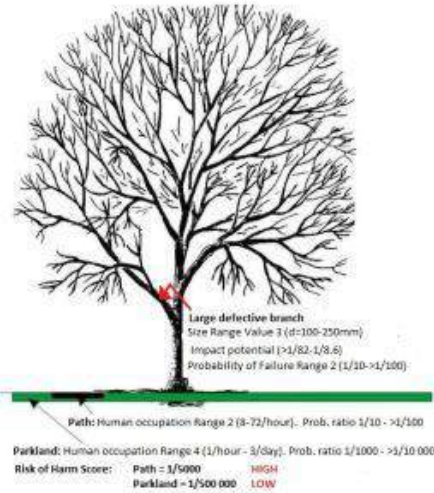


Figure 12. Risk Assessment Example 1

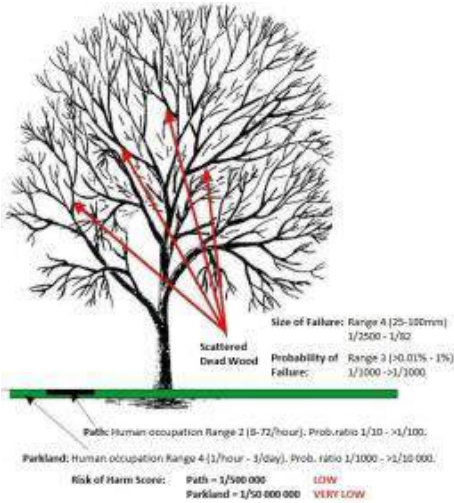


Figure 13. Risk Assessment Example 2