Tree Planting, Inspection and Removal Policy

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Authorisation	Council: 10 October 2022
Review date:	10 October 2026
Responsible officer:	Operations Manager
Policy owner	Parks Coordinator

1. Purpose

a) To provide direction for the planting, inspection and removal of trees on land owned or managed by Council.

b) To ensure that Council's tree asset base is maintained in accordance with relevant environmental legislation and to Australian Standard 4373.

c) To support the net annual increase of tree coverage across the City.

d) To document Council's current tree inspection regime and set out clear policy obligations in respect to the inspection of council trees on the basis of categorised risk and location.

e) To provide a uniform methodology for policy users to identify and assess tree risks in accordance with Council's risk management methodology as set out in its Enterprise Risk Management Policy and Enterprise Risk Management Plan.

f) To provide an objective set of standards that all policy users can uniformly adhere to, in the exercise of tree risk management practices in accordance with Council's risk management methodology as set out in its Enterprise Risk Management Policy and Enterprise Risk Management Plan.

g) To minimise the risk of Council being liable for damage caused by tree risks, either directly from mismanaged property damage/ nuisance claims or from a lack of properly managed records on behalf of council resulting in a failure to prove Council has acted reasonably to the standard required by a court and prescribed by law.

h) To prevent unnecessary council expenditure arising from disproportionate risk control measures, such as unnecessary tree removal or numerous expensive consultants' reports.

i) To create a register of tree management data, in which to securely retain all records of policy compliance in a permanent form, and avoid liability risk as legal claims for property damage may not emerge for prolonged periods of many months or years.

j) To set a period for review of the policy in defined time periods to assess its effectiveness and to keep it current in accordance with industry trends and standards.

2. Scope

This policy applies to staff, volunteers and contractors working with or in the vicinity of Council's tree assets and each is required to abide by the policy and their decisions must reflect the policy intent at all times.

This policy does not remove any responsibility that is vested with Developers during any applicable landscape establishment, defects maintenance or warranty periods imposed upon them by Council.

In the event that a Council tree asset is protected under an existing legislative framework this policy is to be applied subject to the application of that existing legislative framework.

3. Definitions

Word/Term	Definition
allotment	Residential, commercial, or industrial zoned parcel of land with a clear title.
Amenity	The scenic quality of the precinct based on the tree, garden, lawn, and other soft landscape features.
Arborist	A trade qualified or recognised practitioner in possession of either a traineeship in Horticulture (Arboriculture) or whom holds a Certificate 3 in Arboriculture or equivalent issued by a registered training provider in Australia.
Asset Custodian	The Manager Operations for Council or their nominated delegate/s from time to time, which shall include the Parks Coordinator unless such nomination is revoked after the date of this Policy.
canopy cover	The area which the elevated crown of a tree occupies measured by its drip line.
Council	Melton City Council
Direct Damage	Actual physical damage to property directly caused by a Council tree asset without any intervening events. Cause and effect are immediately linked to the Council tree asset i.e. root lifted and cracked footpath. Does not include any time element loss or damage such as business interruption or extra expense and inconvenience arising from the inability to use damaged property and excludes incidental, consequential, special, or indirect damages suffered.
indirect damage	Damage arising only indirectly related to a Council tree asset or where cause and effect are not immediately linked to the Council tree asset due to an intervening event or the intervention of third parties related to a Council tree asset. For example:

	• The drying of soil resulting in ground movement that may potentially be attributable to the presence of tree roots in the vicinity; • termites are found to be living in Council tree, nearby house becomes infected by termites; or • a driver crashes their car into a Council tree which falls onto a resident's property causing damage due to the collision. Includes any time element loss or damage such as business interruption or extra expense and inconvenience arising from the inability to use damaged property and incidental, consequential, special, or indirect damages suffered.
Intramaps	Intramaps is Council's chosen web-based information portal which uses collated data to create digital mapping solutions.
legislative framework	Any relevant State or Federal legislation or regulations and any Council Local Laws or policies.
liability risks	In the event of Direct Damage occurring as a result of a Council tree, the risk that Council will be held liable for that damage because it is unable to prove it has acted reasonably to the standard required by a Court to engage the protections afforded in the Act and/or at common law.
necessary	An item that is essential for daily function as opposed to desirable.
net loss zero	On project completion the tree population has not declined.
open space	Public land provided for community use.
poor form	Tree has not met desired outcomes as a result of poor growth, tree selection or physical damage.
seek to	Make every effort within their power or control.
tree asset	A tall perennial woody plant having a main trunk and branches forming a distinct elevated crown and sub surface root system.
tree risk	The risk of personal injury, property damage and nuisance claims arising from Direct Damage caused by Council tree assets.
Council's Arborist	A qualified arborist contractually engaged or directly employed by Council or a Contractor engaged by Council for the purposes of providing Arboreal or Tree Maintenance Services from time to time to inspect and assess tree assets in accordance with this policy or in response to claims of Direct Damage by residents etc.
Council tree asset	Any tree identified on Council land deemed to be the property of Council or under its management and control and recognised as a tree asset regardless of condition, location, or origin

4. Policy

Council:

- recognises the significant environmental, health and amenity benefits trees provide to the municipality;
- acknowledges the connection our people have with trees and its role as custodian of these living assets; and
- Further acknowledges that trees are living assets and grow in an uncontrolled environment and so each tree presents a varied degree of risk and it is not practical nor realistic to eliminate all risks entirely.

In light of the above matters, Council seeks via this Policy to minimise as far as practicable the level of risk Council Tree Assets present in the community whilst enhancing the environment of the City of Melton.

This policy demonstrates Council's commitment across all functions of Council to the preservation and growth of trees by working towards zero net loss of its tree asset base within the Municipality.

4.1 Authorisation

a) All tree planting, pruning and removal activities on Council owned and managed land must be undertaken only with written permission from Melton City Council.

b) Penalties may apply to persons who perform (or engage others to perform) tree planting, pruning and removal activities on Council owned and managed land without appropriate consent.

c) To support policy users the Asset Custodian will direct personnel in applying the policy including on guidelines applying to conducting inspections and implementing tree risk management practices.

d) Whilst an inspection regime can be performed by any appropriately skilled professional working for Council's Arborist, remedial or removal works can only commence with approval from the Asset Custodian.

e) In the event of conflicting advice from Council's Arborist or multiple Council Arborists, or uncertainty at any stage of the decision-making process, the Asset Custodian reserves the right to form a final view on how to proceed.

4.2 Tree Planting

a) Tree planting in streetscapes will seek to achieve a minimum of one tree at the front and two at the side of each allotment and minimum 30% canopy cover.

b) Tree planting will seek to provide the best species for the location in accordance with Councils street tree strategy currently under development.

c) Council will not deny any reasonable request to undertake tree planting works or refer to future programs.

d) All Council approved tree planting programs will seek to have a minimum 24 month establishment period.

e) Tree planting will seek to equal or exceed the number of trees removed to work towards achieving 'net loss zero' depletion of tree assets across the municipality.

f) During all stages of the planting process consideration shall be made to Council's Street Tree Strategy and the location of nearby property or infrastructure that may be compromised as any tree proposed to be planted reaches maturity.

g) Equally property owners must consider the environment and existing trees and soil types when purchasing a property or throughout their construction phase.

h) A future focused approach by all parties to Council Tree Assets will assist in reducing unnecessary risk.

4.3 Tree Register

a) All Council street tree assets are required to be recorded in a digital tree register (and assigned an ECM Asset Number), to facilitate scheduled inspections, to monitor tree risks and manage risk management compliance.

b) The register also identifies Council tree assets in public open space within 30m of a building, home, playground, skate park, BMX track, pergola, rotunda, shade structure, pedestrian or bicycle path, car park, truck bay, bus stop, driveway, laneway.

c) The Tree Register is maintained by the Tree Asset Custodian and may be inspected upon request.

4.4 Tree Inspections and Risk Assessments

a) Councils assessment methodologies of Council Tree Assets are based on the Quantified Tree Risk Assessment Method (QTRA) which originated in the UK and is now used extensively around the world. This method seeks to provide a consistent, accurate and transparent assessment to quantify the risk of each Council Tree Asset.

b) The QTRA Practice note is provided at Appendix 4 to this policy to inform policy users of the framework that underpins the Arboriculture assessment process.

c) The conceptual framework for identifying and differentiating tree risks is based on factors such as the tree's location, proximity to high traffic areas or public space, and its potential to cause damage. Notwithstanding any risks must be considered in parallel with any environmental legislation or other legislative framework.

d) The above inspection should be performed by an appropriately skilled professional engaged by the Council Arborist.

e) Risks that are to be inspected for include (but are not limited to):

- Damage to the trunks/appendages of trees which may result in the tree falling over or branches falling off with a potential to damage structures;
- Tree foliage damaging services infrastructure constructed and maintained by utility service providers (for example electrical wiring and telecommunications cables);
- Roots damaging footpaths, underground pipes, fences, supporting structures for fences or buildings, disrupting surface topography (causing uniform surfaces to become uneven and misshapen), undermining structural integrity of above-ground structures, and like matters.

f) All tree inspections and assessments are to formally be undertaken in accordance with Council's risk management methodology as set out in its Enterprise Risk Management Policy and Enterprise Risk Management Plan.

4.5 Zoning of municipal areas

a) In order to identify and differentiate between levels of risk across the municipality, this framework includes reference to areas within certain categories of risk / 'risk zones'. Detailed in the table below (as derived from United States Department of Agriculture's '*Urban Tree Risk Management: A Community Guide to Program Design and Implementation*')

b) Within the tree data assets are classified into 3 categories.

Standard A: Annual Inspection

Standard B: Bi-Annual Inspection

Rural: Inspected Upon Request. (Greater than 30m from built form/infrastructure or non-urban roadside trees).

Both the contractor and Council officers have the discretion to modify the category of a tree. This may result in inspection at any frequency deemed necessary to adequately address risk. In completing an assessment of a tree, the arborist must have a level of confidence in the assessment outcome. There may be some instances where an additional inspection is deemed necessary i.e. on a high wind day to satisfy all inspection criteria.

Hazard Zone Categories	Colour Codes	Examples
Very High Hazard	**Red**	1. Emergency access routes 2. Trees encroaching electrical lines 3. In high-use parks/public areas: permanent structures 4. Individual trees or neighbourhoods with very high-risk tree characteristics such as: • standing dead trees or those with very poor condition class ratings • severely storm-damaged trees • trees that visually obstruct traffic signs, stop lights, or security lights • tree roots causing severe sidewalk buckling that cannot be resolved via other means.
High Hazard	Orange	1. High-use parks, playgrounds, and picnic areas 2. Parking lots adjacent to high-use public areas 3. Bus stops along high-use thoroughfares 4. Individual trees or neighbourhoods with high-risk tree characteristics such as: • old growth trees

		• high density of large diameter, mature, or “problem” tree species • root injury caused by sidewalk or road construction • storm-damaged trees
Moderate Hazard	Yellow	1. Secondary roadways: congested intersections and visually obstructed traffic signs and stoplights 2. Neighbourhoods with a moderate density of large diameter, mature or “problem” tree species
Low Hazard	Green	1. Trees within 3 metres of Moderate-use parks, playgrounds and picnic areas 2. Parking lots adjacent to moderate-use areas 3. Low-use roads and public areas with dispersed recreation 4. Golf Courses 5. Open areas, woods, riparian zones, and peripheral areas with limited use or access 6. Neighbourhoods with a low density of large diameter mature or ‘problem’ tree species.
Very Low Hazard	White	1. Trees greater than 30m from built form/infrastructure. 2. Trees that are less than 24 months old.

c) Using this information Council is to update and maintain a register of trees and ‘tree risk’ zoned areas in the municipality which are then inspected at set internals (outlined in the table below) and then reviewed alongside the policy to ensure compliance with current industry trends/practices and legislation.

d) The Parks Co-ordinator in conjunction with Operations Manager are responsible for arranging the identification and recording of tree zoning areas, and the creation of a register/ ‘Intramaps’ document to be referred to by policy user as a guide/reference.

e) The Operations Manager is responsible when updating ‘Intramaps’ zoning to correctly identify risk areas to ensure compliance with (the level of response required to meet Council’s obligations and this process is to be formally be undertaken in accordance with Council’s risk management methodology as set out in its Enterprise Risk Management Policy and Enterprise Risk Management Plan.

- An example of this is Councils responsibility for keeping trees clear of public electrical lines under section 84C of the *Electrical Safety Act* 1998 (Vic). Council must provide the appropriate direction to policy users so that the required inspection frequency and risk management actions are taken to prevent the risk of urban and bush fires.

- A further example is the required zoning of Crown Land Reserves that have been vested in the municipality. Where an order is given by the Governor in Council under s 16 of the *Crown land (Reserves) Act* 1978 to grant land to the City of Melton for recreational purposes. That land becomes land managed by Council and subject to this policy.

4.6 Inspection Schedule

These designated areas are also used as a method for implementing inspection schedules.

Hazard Zone Categories	Colour Codes	Timing of Inspections	Suggested Inspection Methods	Comments
Very High (individual trees)	Red	1 year	Inspection of Specific Tree Assets on the High Risk Register (Standard A)	
High	Orange	2 Years	Makes a determination based on the tree and need for on foot close inspection	
Moderate	Yellow	2 Years	TBD on site at time of inspection.	
Low	Green	2 Years	Zone work inspection from car	
All related Zones	All	- 2 Years Duration After Severe Storms, or - 14 Days Duration After Receiving Notice from the Public	Reactive requests component to the Tree Services Contract requires inspection within 14 days (to complete whole task)	If potentially hazardous trees are detected, follow-up with individual tree inspections and an assessment for removal

4.7 Actions following inspection

a) Maintain a record of inspections within the tree register. The officer in charge of inspections must accurately record their observations, and findings from each inspection so that it can more easily be predicted by the Parks Co-ordinator/ Responsible Officer where the category of risk may increase or whether more direct management of risk is required.

b) Where an inspection has been completed, and a potential hazard has been identified as a real risk of materialising this inspection triggers a (and in the case of high and critical risks, potentially urgent) tree removal. Council's Arborist has the authority to program removals in accordance with this policy. Where removal cannot be fulfilled within a timely manner for any reason, escalation to the Operations Manager for a decision to be made to remove the risk considering the following factors:

i) What Council knows, or ought to reasonably know, about the risk, and ways of eliminating or minimising the risk;

ii) The availability and suitability of ways to eliminate or minimise the risk; an

iii) The cost associated with available ways of eliminating or minimising the risk, including whether the cost is wholly disproportionate to the risk

c) The Operations Manager may then exercise their discretion in addressing the risk, and request the appropriate measure be taken in accordance with industry best practice and relevant legislative obligations.

d) Where relevant, the Manager should consider risk control measures including scheduled maintenance and other partial measures, before recommending that the tree be wholly removed in order to promote the conservation purpose of the policy. Where considered appropriate, Management may also seek that specialist external advice be sought when making critical decisions about a particular risk or tree conditions from appropriately qualified personnel such as an arborist.

4.8 Assessment for Tree Removal

a) The Asset Custodian is authorised to arrange for the removal of Council maintained trees where that tree has been identified as meeting a relevant level of risk to the community if maintained or where from a planning and development standpoint the continued maintenance of a tree conflicts with the broader objectives of Council. and meets the criteria for removal (see 4.6).

b) Council's Arborist is delegated the authority to fulfil the day to day inspection, removal, and planting programs for Council. Guidance, support, and direction is available from Council officers for more complex matters.

c) Council's removal of tree policy on the basis of risk, is to be discussed in terms of what actions policy users must take in order to 'reasonably have regard to the degree of risk' a tree poses.

The degree of risk is to be determined in accordance with the methodology and requirements of Council's Enterprise Risk Management Policy and Enterprise Risk Management Plan with reference to:

i) The likelihood of the risk occurring;

ii) The degree of harm that might result from the risk;

d) In order to uniformly identify risks,and assist policy users to classify these risks in terms of minor risks, moderate risks, major risks, and critical or urgent risk situations. Policy users are to exercise their discretion when completing observational reports and where needed seek guidance from the factors below.

e) Council will not remove a tree based on it growing too large or it dropping an excessive amount of leaf litter, alone.

f) Council will not remove a tree where an alternate practical solution exists to resolve the issue. i.e if a tree has grown to a size where roots are lifting the footpath the tripping hazard should be managed under Council's Road Management Plan first and rectified with asphalt wedging and bay replacement in the first instance. Where there are no viable options to ensure Road Management Plan compliance, tree removal will then be considered as an option.

g) In order to address this, the Policy requires that a higher level of frequency in the inspection of high hazard zones (4.3), and for the objective observations of officers to be included in inspection reports (see 4.4(a)).

h) Where damage is sustained to Council owned and managed infrastructure such as the road pavement, footpath, kerb and channel, buildings etc Council may remove a tree as a last resort option. Council should and will elect in the first

instance to replace or modify the footpath in the interests of retaining the tree and abating the nuisance.

i) Where Direct Damage is sustained to a resident's private property and is significant in nature Council will fulfil tree removal in consultation with the resident.

j) Minor damage such as lifting pavers or discoloring a pattern paved driveway will not result in tree removal.

k) To facilitate investigation, residents are expected to provide evidence of Direct Damage through the engagement of appropriate professionals. For example:

a. a plumber's report for damaged pipes; or

b. a structural engineer's report for dwelling damage.

TREE Condition Metrics.	
Primary Defects	• Cables • Co-dominant trunks • Epicormic shoots • Heat stress • Bificated leader or 'V' crotch • Malicious damage • Mechanical damage • Possum/Animal damage • Root damage • Significant decay • Suckers • Water/Basal shoots
Secondary Defects	Same field as above (used if there is one more defect that is worth noting)
Disease/Insects	• Bracket fungi • Borer • Elm Leaf Beetle • Fungal infestation • Root rot • Scale • Termite
Canopy	• Good • Fair • Poor
Deadwood	• 0-25% • 26-50% • 51-75% • 76-100%
Structure	○ **Excellent** 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. The tree is unlikely to suffer trunk or branch failure under normal conditions. The tree is considered a good example of the species with a well-developed form.

	○ **Good** 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 exhibit minor structural faults or have the potential to create faults. If the tree is single trunked, this may be on a slight lean or be exhibiting minor defects. These defects are not likely to result in catastrophic trunk or branch failure although some branch failure may occur under normal conditions. ○ **Fair** The tree has significant problems in the structure of the scaffold limbs or trunk. It may be lop-sided or have few branches on one side or have large gaps in the crown. Large branches may be rubbing or crossing over. Branch unions may be poor, and faults at the point of attachment or along the branches may be evident. The tree may have a substantial lean. The tree may have suffered significant root damage. The tree may have some degree of basal or trunk damage. These defects may predispose the tree to major trunk or branch failure. ○ **Poor** The tree has some very significant problems in the structure of the crown. It may be lop-sided or have few branches on one side or have large gaps in the crown. Branches may be rubbing or crossing over and causing damage to each other. Branch unions may be poor, and faults at the point of attachment or along the branches may be evident. The tree may have a substantial lean. The tree may have suffered major root damage. The tree may have extensive basal or trunk damage. These defects are likely to predispose the tree to trunk or scaffold limb failure
Condition	○ **Excellent** Crown full, with good foliage density. Foliage is entire with average colour, minimal or no pathogen damage. Above average growth indicators such as extension growth, leaf size and canopy density. Little or no canopy die-back. Generally, no dead wood on the perimeter of the canopy. Good wound wood development. Tree exhibits above average health and no works are required. ○ **Good** Tree may have more than 30% dead wood or may have minor canopy dieback. Foliage density may be slightly below average for the species. Foliage colour may be slightly lower than average, and some discolouration may be present. Typical growth indicators, e.g. extension growth, leaf size, canopy density for species in location. Average wound wood development. The tree exhibits below average health and remedial works may be employed to improve health. ○ **Fair** Tree may have more than 30% dead wood and canopy die back may be present. Leaves may be discoloured and/or distorted, often small, and excessive epicormic growth may be present. Pathogens and/or stress agents may be present that could lead, or are leading to, the decline of tree. Poor wound wood development. The tree exhibits low health and remedial works, or removal may be required.

	○ **Poor** The tree has more than 30% dead wood. Extensive canopy die back is present. Canopy is very sparse. Pathogens and/or stress agents are present that are leading to the decline of the tree. Very poor wound wood development. The tree exhibits very low health and remedial works, or removal are required. ○ **Dead** Tree is dead and generally should be removed

The Risk Matrix

The table below is further illustrative of the processes and requirements set out in Council's Enterprise Risk Management Policy and Enterprise Risk Management Plan which particular emphasis on the context of Council tree assets:

11.2.Risk Likelihood Table:

Likelihood	Probability		
Certain	Event is expected to occur in most circumstances.	The event is expected to occur more than once per year or is already happening.	>80% chance of occurring
Likely	The event may occur in most circumstances.	The event may occur once a year.	50-80% chance of occurring
Possible	The event may occur under some circumstances.	The event may occur once in 3 years.	30-50% chance of occurring
Unlikely	The event may occur under particular circumstances.	The event may occur once in 10 years.	10-30% chance of occurring
Rare	The event may occur in exceptional circumstances.	The event may occur once in over 10 years.	<10% chance of occurring

11.3.Risk Matrix:

Consequence > Likelihood v	Insignificant	Minor	Moderate	Major	Critical
Certain	**Medium**	**High**	**High**	**Extreme**	**Extreme**
Likely	**Medium**	**Medium**	**High**	**High**	**Extreme**
Possible	**Low**	**Medium**	**Medium**	**High**	**Extreme**
Unlikely	**Low**	**Low**	**Medium**	**Medium**	**High**
Rare	**Low**	**Low**	**Low**	**Medium**	**High**

11.4.Risk Levels and Recommended Actions:

Level of Residual Risk	Recommended Actions
Extreme Risk	Immediate action required by Council. Obligation to inform those at risk and escalate to Operations Manager. Eg – risk of tree falling in a Very High Hazard Zone.
High Risk	Heightened priority on schedule of rectification. Eg - >80% chance of a limb falling in a High Hazard Zone Rectification works to be undertaken within 48 hours of inspection.
Medium Risk	Rectification works to be undertaken within 10 working days Eg – 30% to 50% chance of limb falling in a Moderate Hazard Zone.
Low Risk	Manage through existing processes and procedures. (ie re-inspect in 2 years)

4.9 Verification and Audit Process

Where an Assessment of Risk has been completed and a calls for specific action has been made the responsible officer must document the steps they have taken to address the risk as required by Council's Enterprise Risk Management Policy and Enterprise Risk Management Plan.

This includes staff, contractors and those responsible for the supervision of volunteers.

4.10 Strategic Planning Tree Removals

a) From a Planning and Development standpoint tree removal will be undertaken where one or more of the below criteria are met:

A	Tree is dead and ceases to provide any value to the community.
B	Tree is infected with a significant disease where control is not considered practical.
C	The tree has poor form / structure and ceases to provide any value to the community.
D	A necessary vehicle access point can't be provided to a titled allotment without removal of a tree.[1]
E	Re-engineering of paths, roads, or other infrastructure with the view to retain the tree/s cannot be achieved.[2]
F	Development of land is appropriate to satisfy State and/or Local Planning Policies.

[1] Approval is granted pending payment of appropriate fees to offset removal, replacement and lost amenity value of tree. Refer appendix one.

[2] The project manager must seek to achieve no net or amenity loss of tree assets as part of the project scope. Refer appendix two.

Any Council Tree Assets to be removed pursuant to this section must have the applicable criteria to which reference is made confirmed by Council's Arborist and Asset Custodian in writing as applicable.

b) 'net loss zero':

Trees removed to allow for development purposes must be offset appropriately.

Where one or more of the above criteria have been met, tree removal will be considered by Council provided that no net loss in overall tree assets can be reasonably achieved.

Compensation for tree removal to achieve net loss zero must be at least to the value of the tree as determined by the Maurer Hoffman Formula and can involve:

i) Tree planting undertaken as part of the development or project in accordance with approved landscape plans.

ii) Landscape treatments and other improvements to the visual amenity of the precinct.

iii) Financial contribution to Council in accordance with the Maurer-Hoffman formula, with monies to be used by Council for additional tree planting.

4.11 Further guidance on tree management practices

a) If policy users are seeking further guidance beyond the measures described in this policy (similarly to 4.6 (d)) they may elevate their concern to the Asset Custodian.

b) The Asset Custodian may consult further reference materials such as the suite of 'Minimum Industry Standards' resources developed by Arboriculture Australia, or a Specialist Arborist as required.

4.12 Council's obligation in respect to roadside trees

a) Council obligations in respect to ensuring roadside safety under the Road Management Act 2004 s(34(3)(b)) extends to maintaining road risks caused by trees.

b) Council maintains a road register identifying roads and road surfaces it is responsible for maintaining. Road register data is available through 'intramaps' and should be used to assist the Operations Manager and Parks Coordinator to correctly zone road areas and differentiate between trees managed by Council or State Authority.

c) Council must be cognisant of the inherent environmental values that exist in these corridors and in particular opportunities for habitat.

d) Council may defer to a Coordinating State Road Authority for the removal or partial removal of trees/vegetation effecting a freeway or arterial road used by through traffic for the municipality. (s 36, sch 3 s10 of the Road Management Act *2004).*

4.13 Limits on Council Liability

Council will only be liable for Direct Damage under this Policy if legal liability for that damage is actually established at law as arising directly from damage caused by a Council Tree Asset and all other legal preconditions to that liability arising are satisfied.

Under no circumstances shall Council be responsible under this Policy for Indirect Damage to any property, persons, or things arising from any Council Tree Asset or for incidental, consequential, special or indirect damages suffered as a result of any Council Tree Asset howsoever caused.

This Policy sets out an aspirational schedule for inspections and guidelines for staff to adhere to a maintenance schedule, non-compliance with this policy does not automatically determine, crystalise, or resolve Council's liability for property damage.

It should be noted that Council has a range of statutory defences to claims against it for property damage resulting from tree risks pursuant to the Wrongs Act 1958.

Among other things:

- When responding to a claim for compensation the courts must consider the financial and other limitations on statutory authorities such as Councils.
- Council may rely on evidence of its compliance with general procedures and applicable standards for the exercise of its functions as evidence of providing the standard of care.
- Council will not be liable for breach of a statutory duty unless the act or omission was in the circumstances so unreasonable that no public authority having the functions of the authority could properly consider the act or omission to be a reasonable exercise of its functions.

4.14 Schedule for Review

This policy, the tree register and the 'Intramaps' zoning infrastructure must be reviewed at set intervals to ensure continued compliance with current industry trends/practices and legislation.

The schedule is as follows:

- Tree maintenance data updated weekly.
- Aerial imagery data updated annually.
- Tree policy reviewed 4 yearly.

5. Responsibility /Accountability

5.1	**Parks Coordinator**
	• Responsible to administer the policy and provide guidance and direction in its application and assist the Manager Operations with their responsibilities as Asset Custodian.
5.2	**Asset Coordinator**
	• Responsible for maintaining the Tree Register and Intramaps zoning.
5.3	**Operations Manager.**
	• Responsible for ensuring the policy is adhered to and acting as Asset Custodian. • Responsible for ensuring the Asset Coordinator is maintaining the Tree Register and Intramaps zoning • Responsible for ensuring compliance with and identification of statutory requirements arising from related legislation.
5.4	**GM Planning and Development**
	• Responsible, as a delegate of the Asset Custodian, for authorising tree removals where the amenity value exceeds $50,000 or under category 'H' in section 4.2.

6. References and links to legislation and other documents

Appendix 1	*Cross Over Applications*
Appendix 2	*Council / Developer Works*
Appendix 3	*Tree Valuations in the City of Melton*
Appendix 4	*QTRA Practice note*
Council's Risk Management Framework	Enterprise Risk Management Policy Enterprise Risk Management Plan
Relevant Legislation	*Local Government Act 2020* *Road Management Act 2004* *Crown Land (Reserves) Act 1978 (Vic)* *Electricity Safety Act 1998 (Vic) – s84C*
Local Law	*General Local Law 2015*

Tree Removal

Cross Over Applications

Appendix 1.

Step 1

- Cross over **can not** be relocated to allow retention of tree.
- The cross over is deemed **'neccesary'** in accordance with policy definition (F) or proposed development is required to satisfy planning policy (H).

• If both cases apply proceed to step 2.

Step 2

- Removal cost of tree is estimated according to size. (A)
- Amenity value of tree is estimated using valuation formula. (B)
- Replacement tree cost is added. (C)
- Costs A, B and C are outlined as a permit condition to applicant.

• Permit costs are calculated and issued by engineering to proceed.

Step 3

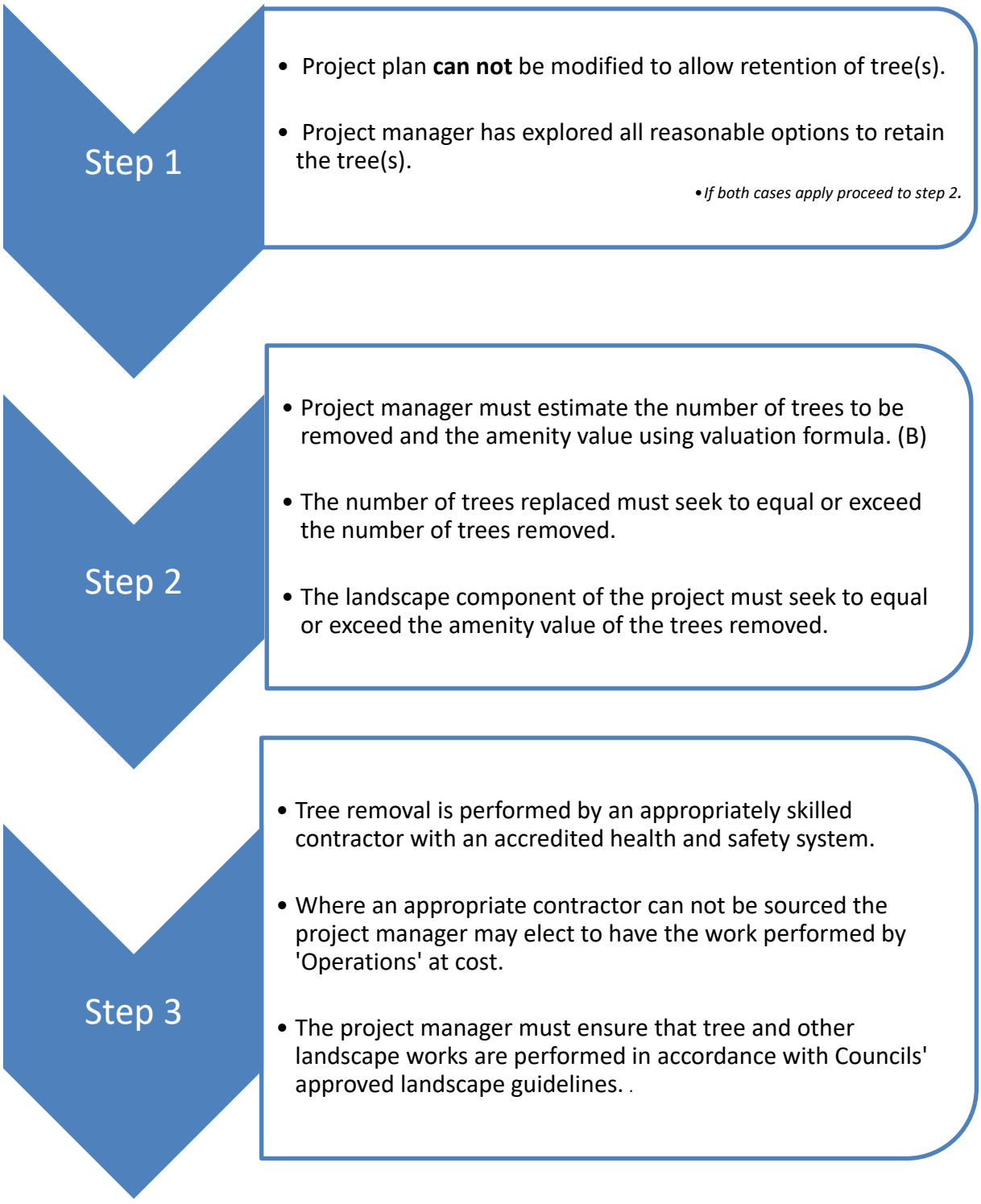
- Resident makes applicable payment to customer service.
- Customer service log CAR's for tree removal and replacement.
- Operations undertake planting to offset loss of tree asset.

• Tree is removed within 28 days by Operations and new tree planted in season.

Tree Removal

Council / Developer Works

Appendix 2.



TREE VALUATIONS IN THE CITY OF MELTON.

The following process is intended as a guide to quantify a monetary value for a tree asset.

The costs associated with removal of a public tree include the below 3 items:

1 – Removal Costs	Amounting to the fees incurred by Council for physically removing the tree.
<3m	Small Tree……..$100
3-6m	Medium Tree…….$200
>6m	Large Tree……..$300
	These costs are a guide only. Council reserves the right to seek quotations to determine specific costs.
2 – Amenity Value ***For trees in excess of 2m and 24 months.***	Calculated in accordance with Maurer-Hoffman Formula. **Value (V) = Basic Value ($) x Species (S) x Aesthetics (A) x Locality (L) x Condition (C)**
3 – Reinstatement Costs	Calculated in accordance with Council's costs for supply plant and maintenance of a new tree. Approx $ 250.00

1 - REMOVAL COSTS

Costs will be based on the current costs of tree removal. It includes the physical removal of the tree and the stump.

2 - AMENITY COSTS

The following formula has been prepared to assist in estimating the monetary value of an established tree. This is derived from the Maurer-Hoffman Formula and is extensively used within local government for this purpose.

Basic Value ($)

The basic monetary value of a tree is determined by matching the trunk diameter at breast height (DBH) with its corresponding base value. This information is generally available within the asset layer of intramaps:

DBH cm	Base Value		DBH cm	Base Value
6-10	$ 309.92		60-65	$30,992.16
10-15	$ 860.89		65-75	$42,183.77
15-25	$ 3,443.57		75-85	$55,097.17
25-35	$ 7,748.04		85-95	$62,199.54
35-45	$13,774.29		95-105	$69,732.35
45-55	$21,522.33		105-115	$ 86,089.33
			Base Value	

Species Factor (S)

A tree is assessed according to its known natural life span and its rate of growth in a particular environment. For example, a long-lived tree species will be scored higher than a short-lived tree. Identification of tree species is generally available within the asset layer of intramaps.

Group	Characteristics	Example Species	Score
1	• trees of short life span (less than 50 years)	*Prunus, Acacia, Virgillia, Laburnum, Malus, Crataegus, Eugenia, Waterhousia, Pyrus*	**0.5**
2	• trees of medium life span (50 -150 years)	*Populus, Liquidamber, Eucalyptus, Corymbia, Angophora, Grevillea, Melaleuca, Michelia, Salix, Casaurina, Hakea, Celtis, Acmena Brachychiton, Fraxinus, Gleditsia, Jacaranda, Shinus, Phoenix, Melia, Robinia, Lophostemon, Liriodendron, Agonis, Meterosideros, Syzygium*	**0.7**
3	• trees of long life span (more than 150 years)	*Cupressus, Platanus, Ficus, Pinus, Ulmus, Quercus, Sequoia, Ginko, Araucaria*	**0.9**
		Species Factor (S)	

Aesthetics (A)

The aesthetic value of a tree is determined by the impact on the landscape if the tree were removed. This category is closely tied to the locality factor (L).

Aesthetic Factor	Score
Contributes little to the landscape	**0.5**
One of a group of close plantings	**0.6**
Street or pathway plantings, regular spacing both sides	**0.9**
Solitary feature specimen tree	**1.0**
Aesthetics (A)	

Locality (L)

The locality factor is determined by the tree's geographical situation. Trees in a main street or boulevard score highest because of the stressful growing environment in which the tree has to survive. As the location becomes more rural, the significance of the tree diminishes.

Locality Factor	Score
In undeveloped bushland or open forest	**0.5**
In rural areas	**1.0**
In **outer** suburban areas and residential streets	**1.5**
In **inner** suburban areas and residential streets	**1.75**
In Park or Reserve; significant street near City Centre	**2.0**
In Park or Reserve; outer suburban or rural.	**2.25**
City Centre Main Street, Principal Boulevard	**2.5**
Locality (L)	

Tree Condition (C)

The tree condition value is determined by the latest inspection by Councils arborist. This information is generally available on the asset layer of intramaps.

TREE CONDITION	RATING
very poor	0.2
poor	0.4
fair	0.6
good	0.8
excellent	1.0
Tree Condition Rating (C)	

3 – REINSTATEMENT COSTS

Where a replacement tree is deemed necessary the costs of this shall be payable by the applicant at the rate of $250 per tree.

For further information please contact the City of Melton on:
03 9747 7200 or email csu@melton.vic.gov.au

QTRA Quantified Tree Risk Assessment

Simply Balancing Risks With Benefits

Quantified Tree Risk Assessment

PRACTICE NOTE

VERSION 5

Quantified Tree Risk Assessment Practice Note

"***When you can measure what you are speaking about, and express it in numbers, you know something about it; but when you cannot measure it, when you cannot express it in numbers, your knowledge is of a meagre and unsatisfactory kind"***

William Thomson, Lord Kelvin, Popular Lectures and Addresses [1891-1894]

1. INTRODUCTION

Every day we encounter risks in all of our activities, and the way we manage those risks is to make choices. We weigh up the costs and benefits of the risk to determine whether it is acceptable, unacceptable, or tolerable. For example, if you want to travel by car you must accept that even with all the extensive risk control measures, such as seat-belts, speed limits, airbags, and crash barriers, there is still a significant risk of death. This is an everyday risk that is taken for granted and tolerated by millions of people in return for the benefits of convenient travel. Managing trees should take a similarly balanced approach.

A risk from falling trees exists only if there is both potential for tree failure and potential for harm to result. The job of the risk assessor is to consider the likelihood and consequences of tree failure. The outcome of this assessment can then inform consideration of the risk by the tree manager, who may also be the owner.

Using a comprehensive range of values[1], Quantified Tree Risk Assessment (QTRA) enables the tree assessor to identify and analyse the risk from tree failure in three key stages. 1) to consider land-use in terms of vulnerability to impact and likelihood of occupation, 2) to consider the consequences of an impact, taking account of the size of the tree or branch concerned, and 3) to estimate the probability that the tree or branch will fail onto the land-use in question. Estimating the values of these components, the assessor can use the QTRA manual calculator or software application to calculate an annual Risk of Harm from a particular tree. To inform management decisions, the risks from different hazards can then be both ranked and compared, and considered against broadly acceptable and tolerable levels of risk.

A Proportionate Approach to Risks from Trees

The risks from falling trees are usually very low and high risks will usually be encountered only in areas with either high levels of human occupation or with valuable property. Where levels of human occupation and value of property are sufficiently low, the assessment of trees for structural weakness will not usually be necessary. Even when land-use indicates that the assessment of trees is appropriate, it is seldom proportionate to assess and evaluate the risk for each individual tree in a population. Often, all that is required is a brief consideration of the trees to identify gross signs of structural weakness or declining health. Doing all that is reasonably practicable does not mean that all trees have to be individually examined on a regular basis (HSE 2013).

The QTRA method enables a range of approaches from the broad assessment of large collections of trees to, where necessary, the detailed assessment of an individual tree.

Risk of Harm

The QTRA output is termed the Risk of Harm and is a combined measure of the likelihood and consequences of tree failure, considered against the baseline of a lost human life within the coming year.

ALARP (As Low As Reasonably Practicable)

Determining that risks have been reduced to As Low As Reasonably Practicable (HSE 2001) involves an evaluation of both the risk and the sacrifice or cost involved in reducing that risk. If it can be demonstrated that there is gross disproportion between them, the risk being insignificant in relation to the sacrifice or cost, then to reduce the risk further is not 'reasonably practicable'.

Costs and Benefits of Risk Control

Trees confer many benefits to people and the wider environment. When managing any risk, it is essential to maintain a balance between the costs and benefits of risk reduction, which should be considered in the determination of ALARP. It is not only the financial cost of controlling the risk that should be considered, but also the loss of tree-related benefits, and the risk to workers and the public from the risk control measure itself.

When considering risks from falling trees, the cost of risk control will usually be too high when it is clearly 'disproportionate' to the reduction in risk. In the

[1] See Tables 1, 2 & 3.

context of QTRA, the issue of 'gross disproportion'[2], where decisions are heavily biased in favour of safety, is only likely to be considered where there are risks of 1/10 000 or greater.

Acceptable and Tolerable Risks

The Tolerability of Risk framework (ToR) (HSE 2001) is a widely accepted approach to reaching decisions on whether risks are broadly acceptable, unacceptable, or tolerable. Graphically represented in Figure 1, ToR can be summarised as having a Broadly Acceptable Region where the upper limit is an annual risk of death 1/1 000 000, an Unacceptable Region for which the lower limit is 1/1 000, and between these a Tolerable Region within which the tolerability of a risk will be dependent upon the costs and benefits of risk reduction. In the Tolerable Region, we must ask whether the benefits of risk control are sufficient to justify their cost.

In respect of trees, some risks cross the Broadly Acceptable 1/1 000 000 boundary, but remain tolerable. This is because any further reduction would involve a disproportionate cost in terms of the lost environmental, visual, and other benefits, in addition to the financial cost of controlling the risk.

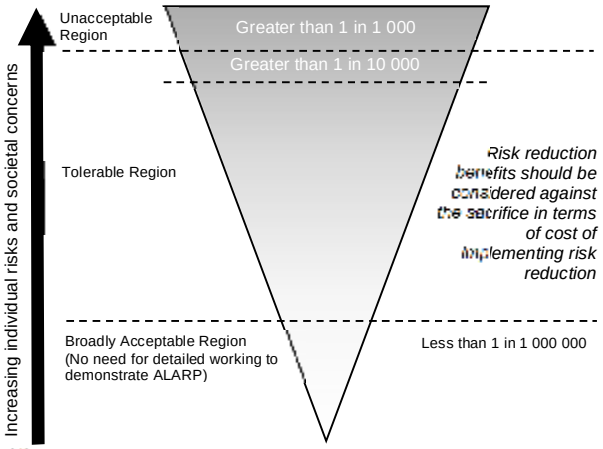


Figure 1. Adapted from the Tolerability of Risk framework (HSE 2001).

Value of Statistical Life

The Value of Statistical Life (VOSL), is a widely applied risk management device, which uses the value of a hypothetical life to guide the proportionate allocation of resources to risk reduction. In the UK, this value is currently in the region of £2 000 000, and this is the value adopted in the QTRA method.

In QTRA, placing a statistical value on a human life has two particular uses. Firstly, QTRA uses VOSL to enable damage to property to be compared with the loss of life, allowing the comparison of risks to people and property. Secondly, the proportionate allocation of financial resources to risk reduction can be informed by VOSL. "***A value of statistical life of £1 000 000 is just another way of saying that a reduction in risk of death of 1/100 000 per year has a value of £10 per year***" (HSE 1996).

Internationally, there is variation in VOSL, but to provide consistency in QTRA outputs, it is suggested that VOSL of £2 000 000 should be applied internationally. This is ultimately a decision for the tree manager.

2. OWNERSHIP OF RISK

Where many people are exposed to a risk, it is shared between them. Where only one person is exposed, that individual is the recipient of all of the risk and if they have control over it, they are also the owner of the risk. An individual may choose to accept or reject any particular risk to themselves, when that risk is under their control. When risks that are imposed upon others become elevated, societal concern will usually require risk controls, which ultimately are imposed by the courts or government regulators.

Although QTRA outputs might occasionally relate to an individual recipient, this is seldom the case. More often, calculation of the Risk of Harm is based on a cumulative occupation – i.e. the number of people per hour or vehicles per day, without attempting to identify the individuals who share the risk.

Where the risk of harm relates to a specific individual or a known group of people, the risk manager might consider the views of those who are exposed to the risk when making management decisions. Where a risk is imposed on the wider community, the principles set out in the ToR framework can be used as a reasonable approach to determine whether the risk is ALARP.

3. THE QTRA METHOD - VERSION 5

The input values for the three components of the QTRA calculation are set out in broad ranges[3] of Target, Size, and Probability of Failure. The assessor estimates values for these three components and inputs them on either the manual calculator or software application to calculate the Risk of Harm.

[2] Discussed further on page 5.

[3] See Tables 1, 2 & 3.

Assessing Land-use (Targets)

The nature of the land-use beneath or adjacent to a tree will usually inform the level and extent of risk assessment to be carried out. In the assessment of Targets, six ranges of value are available. Table 2 sets out these ranges for vehicular frequency, human occupation and the monetary value of damage to property.

Human Occupation

The probability of pedestrian occupation at a particular location is calculated on the basis that an average pedestrian will spend five seconds walking beneath an average tree. For example, an average occupation of ten pedestrians per day, each occupying the Target for five seconds is a daily occupation of fifty seconds, giving a likelihood of occupation 1/1,728. Where a longer occupation is likely, as with a habitable building, outdoor café, or park bench, the period of occupation can be measured, or estimated as a proportion of a given unit of time, e.g. six hours per day (1/4). The Target is recorded as a range (Table 2).

Weather Affected Targets

Often the nature of a structural weakness in a tree is such that the probability of failure is greatest during windy weather, while the probability of the site being occupied by people during such weather is often low. This applies particularly to outdoor recreational areas. When estimating human Targets, the risk assessor must answer the question 'in the weather conditions that I expect the likelihood of failure of the tree to be initiated, what is my estimate of human occupation?' Taking this approach, rather than using the average occupation, ensures that the assessor considers the relationship between weather, people, and trees, along with the nature of the average person with their ability to recognise and avoid unnecessary risks.

Vehicles on the Highway

In the case of vehicles, likelihood of occupation may relate to either the falling tree or branch striking the vehicle or the vehicle striking the fallen tree. Both types of impact are influenced by vehicle speed; the faster the vehicle travels the less likely it is to be struck by the falling tree, but the more likely it is to strike a fallen tree. The probability of a vehicle occupying any particular point in the road is the ratio of the time it is occupied - including a safe stopping distance - to the total time. The average vehicle on a UK road is occupied by 1.6 people (DfT 2010). To account for the substantial protection that the average vehicle provides against most tree impacts and in particular, frontal collisions, QTRA values the substantially protected 1.6 occupants in addition to the value of the vehicle as equivalent to one exposed human life.

Property

Table 1. Size

Size Range	Size of tree or branch	Range of Probability
1	> 450mm (>18") dia.	1/1 - >1/2
2	260mm (10½") dia. - 450mm (18") dia.	1/2 - >1/8.6
3	110mm (4½") dia. - 250mm (10") dia.	1/8.6 - >1/82
4	25mm (1") dia. - 100mm (4") dia.	1/82 - 1/2 500

* Range 1 is based on a diameter of 600mm.

Property can be anything that could be damaged by a falling tree, from a dwelling, to livestock, parked car, or fence. When evaluating the exposure of property to tree failure, the QTRA assessment considers the cost of repair or replacement that might result from failure of the tree. Ranges of value are presented in Table 2 and the assessor's estimate need only be sufficient to determine which of the six ranges the cost to select.

In Table 2, the ranges of property value are based on a VOSL of £2 000 000, e.g. where a building with a replacement cost of £20 000 would be valued at 0.01 (1/100) of a life (Target Range 2).

When assessing risks in relation to buildings, the Target to be considered might be the building, the occupants, or both. Occupants of a building could be protected from harm by the structure or substantially exposed to the impact from a falling tree if the structure is not sufficiently robust, and this will determine how the assessor categorises the Target.

Multiple Targets

A Target might be constantly occupied by more than one person and QTRA can account for this. For example, if it is projected that the average occupation will be constant by 10 people, the Risk of Harm is calculated in relation to one person constantly occupying the Target before going on to identify that the average occupation is 10 people. This is expressed as Target 1(10T)/1, where 10T represents the Multiple Targets. In respect of property, a Risk of Harm 1(10T)/1 would be equivalent to a risk of losing £20 000 000 as opposed to £2 000 000.

Tree or Branch Size

A small dead branch of less than 25mm diameter is not likely to cause significant harm even in the case of direct contact with a Target, while a falling branch with a diameter greater than 450mm is likely to cause some harm in the event of contact with all but the most robust Target. The QTRA method categorises

Size by the diameter of tree stems and branches (measured beyond any basal taper). An equation derived from weight measurements of trees of different stem diameters is used to produce a data set of comparative weights of trees and branches ranging from 25mm to 600mm diameter, from which Table 1 is compiled. The size of dead branches might be discounted where they have undergone a significant reduction in weight because of degradation and shedding of subordinate branches. This discounting, referred to as 'Reduced Mass', reflects an estimated reduction in the mass of a dead branch.

Table 2. Targets

Target Range	Property (repair or replacement cost)	Human (not in vehicles)		Vehicle Traffic (number per day)	Ranges of Value (probability of occupation or fraction of £2 000 000)
1	£2 000 000 – >£200 000	Occupation: Pedestrians & cyclists:	Constant – 2.5 hours/day 720/hour – 73/hour	26 000 – 2 700 @ 110kph (68mph) 32 000 – 3 300 @ 80kph (50mph) 47 000 – 4 800 @ 50kph (32mph)	1/1 – >1/10
2	£200 000 – >£20 000	Occupation: Pedestrians & cyclists:	2.4 hours/day – 15 min/day 72/hour – 8/hour	2 600 – 270 @ 110kph (68mph) 3 200 – 330 @ 80kph (50mph) 4 700 – 480 @ 50kph (32mph)	1/10 – >1/100
3	£20 000 – >£2 000	Occupation: Pedestrians & cyclists:	14 min/day – 2 min/day 7/hour – 2/hour	260 – 27 @ 110kph (68mph) 320 – 33 @ 80kph (50mph) 470 – 48 @ 50kph (32mph)	1/100 – >1/1 000
4	£2 000 – >£200	Occupation: Pedestrians & cyclists:	1 min/day – 2 min/week 1/hour – 3/day	26 – 4 @ 110kph (68mph) 32 – 4 @ 80kph (50mph) 47 – 6 @ 50kph (32mph)	1/1 000 – >1/10 000
5	£200 – >£20	Occupation: Pedestrians & cyclists:	1 min/week – 1 min/month 2/day – 2/week	3 – 1 @ 110kph (68mph) 3 – 1 @ 80kph (50mph) 5 – 1 @ 50kph (32mph)	1/10 000 – >1/100 000
6	£20 – £2	Occupation: Pedestrians & cyclists:	<1 min/month – 0.5 min/year 1/week – 6/year	None	1/100 000 – 1/1 000 000

Vehicle, pedestrian and property Targets are categorised by their frequency of use or their monetary value. The probability of a vehicle or pedestrian occupying a Target area in Target Range 4 is between the upper and lower limits of 1/1 000 and >1/10 000 (column 5). Using the VOSL £2 000 000, the property repair or replacement value for Target Range 4 is £2 000 - >200.

Probability of Failure

In the QTRA assessment, the probability of tree or branch failure within the coming year is estimated and recorded as a range of value (Ranges 1 – 7, Table 3).

Selecting a Probability of Failure (PoF) Range requires the assessor to compare their assessment of the tree or branch against a benchmark of either a non-compromised tree at Probability of Failure Range 7, or a tree or branch that we expect to fail within the year, which can be described as having a 1/1 probability of failure.

During QTRA training, Registered Users go through a number of field exercises in order to calibrate their estimates of Probability of Failure.

Table 3. Probability of Failure

Probability of Failure Range	Probability
1	1/1 - >1/10
2	1/10 - >1/100
3	1/100 - >1/1 000
4	1/1 000 - >1/10 000
5	1/10 000 – >1/100 000
6	1/100 000 – >1/1 000 000
7	1/1 000 000 – 1/10 000 000

The probability that the tree or branch will fail within the coming year.

The QTRA Calculation

The assessor selects a Range of values for each of the three input components of Target, Size and Probability of Failure. The Ranges are entered on either the manual calculator or software application to calculate a Risk of Harm.

The Risk of Harm is expressed as a probability and is rounded, to one significant figure. Any Risk of Harm

that is lower than 1/1 000 000 is represented as <1/1 000 000. As a visual aid, the Risk of Harm is colour coded using the traffic light system illustrated in Table 4 (page 7).

> Risk of Harm - Monte Carlo Simulations
>
> The Risk of Harm for all combinations of Target, Size and Probability of Failure Ranges has been calculated using Monte Carlo simulations[4]. The QTRA Risk of Harm is the mean value from each set of Monte Carlo results.
>
> In QTRA Version 5, the Risk of Harm should not be calculated without the manual calculator or software application.

Assessing Groups and Populations of Trees

When assessing populations or groups of trees, the highest risk in the group is quantified and if that risk is tolerable, it follows that risks from the remaining trees will also be tolerable, and further calculations are unnecessary. Where the risk is intolerable, the next highest risk will be quantified, and so on until a tolerable risk is established. This process requires prior knowledge of the tree manager's risk tolerance.

Accuracy of Outputs

The purpose of QTRA is not necessarily to provide high degrees of accuracy, but to provide for the quantification of risks from falling trees in a way that risks are categorised within broad ranges (Table 4).

4. INFORMING MANAGEMENT DECISIONS

Balancing Costs and Benefits of Risk Control

When controlling risks from falling trees, the benefit of reduced risk is obvious, but the costs of risk control are all too often neglected. For every risk reduced there will be costs, and the most obvious of these is the financial cost of implementing the control measure. Frequently overlooked is the transfer of risks to workers and the public who might be directly affected by the removal or pruning of trees. Perhaps more importantly, most trees confer benefits, the loss of which should be considered as a cost when balancing the costs and benefits of risk control.

When balancing risk management decisions using QTRA, consideration of the benefits from trees will usually be of a very general nature and not require detailed consideration. The tree manager can consider, in simple terms, whether the overall cost of risk control is a proportionate one. Where risks are approaching 1/10 000, this may be a straightforward balancing of cost and benefits. Where risks are 1/10 000 or greater, it will usually be appropriate to implement risk controls unless the costs are grossly disproportionate to the benefits rather than simply disproportionate. In other words, the balance being weighted more on the side of risk control with higher associated costs.

Considering the Value of Trees

It is necessary to consider the benefits provided by trees, but they cannot easily be monetised and it is often difficult to place a value on those attributes such as habitat, shading and visual amenity that might be lost to risk control.

A simple approach to considering the value of a tree asset is suggested here, using the concept of 'average benefits'. When considered against other similar trees, a tree providing 'average benefits' will usually present a range of benefits that are typical for the species, age and situation. Viewed in this way, a tree providing 'average benefits' might appear to be low when compared with particularly important trees – such as in Figure 2, but should nonetheless be sufficient to offset a Risk of Harm of less than 1/10 000. Without having to consider the benefits of risk controls, we might reasonably assume that below 1/10 000, the risk from a tree that provides 'average benefits' is ALARP.

In contrast, if it can be said that the tree provides lower than average benefits because, for example, it is declining and in poor physiological condition, it may be necessary to consider two further elements. Firstly, is the Risk of Harm in the upper part of the Tolerable Region, and secondly, is the Risk of Harm likely to increase before the next review because of an increased Probability of Failure. If both these conditions apply then it might be appropriate to consider the balance of costs and benefits of risk reduction in order to determine whether the risk is ALARP. This balance requires the tree manager to take a view of both the reduction in risk and the costs of that reduction.

[4] For further information on the Monte Carlo simulation method, refer to http://en.wikipedia.org/wiki/Monte_Carlo_method


Fig. 2

Lower Than Average Benefits from Trees

Usually, the benefits provided by a tree will only be significantly reduced below the 'average benefits' that are typical for the species, age and situation, if the life of the benefits is likely to be shortened, perhaps because the tree is declining or dead. That is not to say that a disbenefit, such as undesirable shading, lifting of a footpath, or restricting the growth of other trees, should not also be considered in the balance of costs and benefits.

The horse chestnut tree in Figure 3 has recently died, and over the next few years, may provide valuable habitats. However, for this tree species and the relatively fast rate at which its wood decays, the lifetime of these benefits is likely to be limited to only a few years. This tree has an already reduced value that will continue to reduce rapidly over the coming five to ten years at the same time as the Risk of Harm is expected to increase. There will be changes in the benefits provided by the tree as it degrades. Visual qualities are likely to reduce while the decaying wood provides habitats for a range of species, for a short while at least. There are no hard and fast measures of these benefits and it is for the tree manager to decide what is locally important and how it might be balanced with the risks.

Where a risk is within the Tolerable Region and the tree confers lower than average benefits, it might be appropriate to consider implementing risk control while taking account of the financial cost. Here, VOSL can be used to inform a decision on whether the cost of risk control is proportionate. Example 3 below puts this evaluation into a tree management context.

There will be occasions when a tree is of such minimal value and the monetary cost of risk reduction so low that it might be reasonable to further reduce an already relatively low risk. Conversely, a tree might be of such considerable value that an annual risk of death greater than 1/10 000 would be deemed tolerable.

Occasionally, decisions will be made to retain elevated risks because the benefits from the tree are particularly high or important to stakeholders, and in these situations, it might be appropriate to assess and document the benefits in some detail. If detailed assessment of benefits is required, there are several methodologies and sources of information (Forest Research 2010).

Delegating Risk Management Decisions


Fig. 3

Understanding of the costs with which risk reduction is balanced can be informed by the risk assessor's knowledge, experience and on-site observations, but the risk management decisions should be made by the tree manager. That is not to say that the tree manager should review and agree every risk control measure, but when delegating decisions to surveyors and other staff or advisors, tree managers should set out in a policy, statement or contract, the principles and perhaps thresholds to which trees and their associated risks will ordinarily be managed.

Based on the tree manager accepting the principles set out in the QTRA Practice Note and or any other specific instructions, the risk assessor can take account of the cost / benefit balance and for most situations will

be able to determine whether the risk is ALARP when providing management recommendations.

Table 4. QTRA Advisory Risk Thresholds

Thresholds	Description	Action
	Unacceptable Risks will not ordinarily be tolerated	• Control the risk
1/1,000		
	Unacceptable (where imposed on others) Risks will not ordinarily be tolerated	• Control the risk • Review the risk
	Tolerable (by agreement) Risks may be tolerated if those exposed to the risk accept it, or the tree has exceptional value	• Control the risk unless there is broad stakeholder agreement to tolerate it, or the tree has exceptional value • Review the risk
1/10 000		
	Tolerable (where imposed on others) Risks are tolerable if ALARP	• Assess costs and benefits of risk control • Control the risk only where a significant benefit might be achieved at reasonable cost • Review the risk
1/1 000 000		
	Broadly Acceptable Risk is already ALARP	• No action currently required • Review the risk

QTRA Informative Risk Thresholds

The QTRA advisory thresholds in Table 4 are proposed as a reasonable approach to balancing safety from falling trees with the costs of risk reduction. This approach takes account of the widely applied principles of ALARP and ToR, but does not dictate how these principles should be applied. While the thresholds can be the foundation of a robust policy for tree risk management, tree managers should make decisions based on their own situation, values and resources. Importantly, to enable tree assessors to provide appropriate management guidance, it is helpful for them to have some understanding of the tree owner's management preferences prior to assessing the trees.

A Risk of Harm that is less than 1/1 000 000 is Broadly Acceptable and is already ALARP. A Risk of Harm 1/1 000 or greater is unacceptable and will not ordinarily be tolerated. Between these two values, the Risk of Harm is in the Tolerable Region of ToR and will be tolerable if it is ALARP. In the Tolerable Region, management decisions are informed by consideration of the costs and benefits of risk control, including the nature and extent of those benefits provided by trees, which would be lost to risk control measures.

For the purpose of managing risks from falling trees, the Tolerable Region can be further broken down into two sections. From 1/1 000 000 to less than 1/10 000, the Risk of Harm will usually be tolerable providing that the tree confers 'average benefits' as discussed above. As the Risk of Harm approaches 1/10 000 it will be necessary for the tree manager to consider in more detail the benefits provided by the tree and the overall cost of mitigating the risk.

A Risk of Harm in the Tolerable Region but 1/10 000 or greater will not usually be tolerable where it is imposed on others, such as the public, and if retained, will require a more detailed consideration of ALARP. In exceptional circumstances a tree owner might choose to retain a Risk of Harm that is 1/10 000 or greater. Such a decision might be based on the agreement of those who are exposed to the risk, or perhaps that the tree is of great importance. In these circumstances, the prudent tree manager will consult with the appropriate stakeholders whenever possible.

5. EXAMPLE QTRA CALCULATIONS AND RISK MANAGEMENT DECISIONS

Below are three examples of QTRA calculations and application of the QTRA Advisory Thresholds.

Example 1.

	Target		Size		Probability of Failure		Risk of Harm
Range	6	x	1	x	3	=	<1/1 000 000

Example 1 is the assessment of a large (Size 1), unstable tree with a probability of failure of between 1/100 and >1/1 000 (PoF 3). The Target is a footpath with less than one pedestrian passing the tree each week (Target 6). The Risk of Harm is calculated as less than 1/1 000 000 (green). This is an example of where the Target is so low consideration of the structural condition of even a large tree would not usually be necessary.

Example 2.

	Target		Size		Probability of Failure		Risk of Harm
Range	1	x	4	x	3	=	1(2T) / 50 000

In Example 2, a recently dead branch (Size 4) overhangs a busy urban high street that is on average occupied constantly by two people, and here Multiple Target occupation is considered.

Having an average occupancy of two people, the Risk of Harm 1(2T) / 50 000 (yellow) represents a twofold increase in the magnitude of the consequence and is therefore equivalent to a Risk of Harm 1 / 20 000 (yellow). This risk does not exceed 1 / 10 000, but being a dead branch at the upper end of the Tolerable Region it is appropriate to consider the balance of costs and benefits of risk control. Dead branches can be expected to degrade over time with the probability of failure increasing as a result. Because it is dead, some of the usual benefits from the branch have been lost and it will be appropriate to consider whether the financial cost of risk control would be proportionate.

Example 3.

	Target		Size		Probability of Failure		Risk of Harm
Range	3	x	3	x	3	=	1 / 500 000

In Example 3, a 200mm diameter defective branch overhangs a country road along which travel between 470 and 48 vehicles each day at an average speed of 50kph (32mph) (Target Range 3). The branch is split and is assessed as having a probability of failure for the coming year of between 1 / 100 and 1 / 1 000 (PoF Range 3). The Risk of Harm is calculated as 1 / 500 000 (yellow) and it needs to be considered whether the risk is ALARP. The cost of removing the branch and reducing the risk to Broadly Acceptable (1 / 1 000 000) is estimated at £350. To establish whether this is a proportionate cost of risk control, the following equation is applied. £2 000 000 (VOSL) x 1 / 500 000 = £4 indicating that the projected cost of £350 would be disproportionate to the benefit. Taking account of the financial cost, risk transfer to arborists and passers-by, the cost could be described as being grossly disproportionate, even if accrued benefits over say ten years were taken into account.

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