ARBORICULTURAL IMPACT ASSESSMENT

3 Edward Street, Kingswood.

Prepared for: Signature Projects Australia Pty Ltd

Prepared by: Tom Hare
AQF Level 5 Consulting Arborist
Truth About Trees
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Date: July 6th 2020.

Version 3

Executive Summary

Truth about trees have been engaged by Signature Projects Australia Pty. Ltd. to provide an Arboricultural Impact Assessment (AIA) in relation to a proposed development at 3 Edward Street, Kingswood.

The existing property holds a single storey brick & fibro dwelling with a driveway along the western boundary leading to a brick garage.

Tree one (1) is a mature specimen of Lophostemon confertus located within the neighbours property. The tree is displaying good health and vigour and has been allocated a medium retention value. The tree will be encroached upon by the proposed driveway; however, the proposed driveway is to replace the existing driveway so the negative impacts are likely to be reduced. The existing driveway would need to be removed by hand and following this, if significant roots greater than 40mm in diameter are discovered within the footprint of the new driveway, the driveway must be constructed above grade with suspended slab located on individual piers. The tree is encroached upon by around 16%, however, as mentioned previously, much of this encroachment replaces existing structures. This species of tree is known to be very tolerant of root disturbance and no significant impacts are anticipated.

Tree two (2) is a Eucalyptus scoparia which is in advanced decline, the tree is encroached upon by the driveway and the proposed building footprint. This species is known to be relatively short-lived in the Sydney region and this tree has significant structural defects. This tree should be removed regardless of development.

Tree three (3) is a council street tree. The tree has been identified as a Callistemon viminalis-Bottle brush. The tree is displaying fair health and poor structure with co-dominant stems at 0.5m above grade. The tree suffers no encroachment of the TPZ and no significant impacts are anticipated.

Tree four (4) is an old Bottle brush stump that has been repeatedly lopped and managed to form a shrub. The tree has a calculated TPZ of 6 metres and is within the footprint of a proposed footpath/entranceway. The previous management of this tree raises long-term concerns over its structural condition and its should be considered for removal regardless of the development requirements.

There are no other trees in adjacent properties which stand to be affected by the proposed development.

Two trees (2 & 4) are recommended for removal regardless of the development requirements.

Trees one and three (1 & 3) must be isolated from construction activity with tree protection fencing in accordance with AS4970-2009 The Protection of Trees on Development Sites.

The existing driveway is to be used for site access/egress, with the section of driveway adjacent to tree one (1) to remain in situ to protect the tree roots beneath until such time as the site access for machinery is no longer required. Alternatively, the driveway removal and replacement may be carried out first and then used as the site access/egress. If neither of these options are feasible, the driveway may be removed by hand under supervision of the project Arborist who will then oversee the installation of ground protection measures. Ground protection measures will consist of geotextile fabric topped with 150mm depth of mulch or aggregate with hardwood rumble boards or steel road plates on top. Further detail may be found in the generic tree protection measures in appendix 2 of this report.

Tree protection fencing is to be installed and certified as per appendix 3 of this report.

Any other works within the TPZ of any prescribed tree to be retained must be supervised by the AQF level 5 Project Arborist.

The removal of trees two (2) and four (4) will result in the need for at least two replacement plantings. The replacement plantings should preferably be a tree species which is locally occurring within the Penrith Council LGA.

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Introduction

Truth about trees have been engaged by Signature Projects Australia Pty. Ltd. to provide an Arboricultural Impact Assessment (AIA) in relation to a proposed development at 3 Edward Street, Kingswood.

The existing property holds a single storey brick & fibro dwelling with a driveway along the western boundary leading to a brick garage.

The existing dwelling and ancillary structures are proposed for demolition to enable the construction of a new two storey multi-room boarding house. The proposed development will also incorporate off-street parking as shown in figure 1 below.

Figure 1-Plan showing the ground floor of the proposed development.

Methodology

A site visit was conducted on Friday 12th June 2020.

Assessment was undertaken of all trees within the subject property and properties directly adjacent, which had the potential to be impacted upon by the proposed development.

The site is located within the municipality of Penrith City Council and as such, the trees were assessed in accordance with the Penrith council DCP and the tree and vegetation fact sheet, an excerpt of which is shown below.

TREE & VEGETATION REMOVAL – PROTECTED & EXEMPT VEGETATION

FACT SHEET

Under the State Environmental Planning Policy (SEPP (Vegetation in Urban Areas)) and the Penrith Development Control Plan (DCP), it is illegal to cut down, fell, uproot, kill, poison, ringbark, burn or otherwise destroy vegetation, or lop or otherwise remove a substantial part of the vegetation as prescribed in Council's DCP without Council permission. Where the vegetation is native, clearing includes shrubs, ground covers or wetland plants.

PRESCRIBED VEGETATION Prescribed (protected) vegetation is outlined in the Penrith DCP as:

1) Any indigenous tree (both living and dead) or other vegetation that is on land zoned E2 Environmental Conservation in the Penrith LEP 2010 Land Zoning Map or natural resources sensitive land identified in the Penrith LEP 2010 Natural Resources Sensitivity Land Map.

2) In residential areas, any tree or other vegetation having a height of 3m or more or a trunk exceeding 100mm Diameter at Breast Height (DBH, measured at approx. 1400mm above ground level).

3) In business and industrial areas: a) Any tree or other vegetation having a height of 3m or more or a trunk diameter exceeding 100mm DBH.

4) In rural areas: a) Any tree or other vegetation, within 20m of a dwelling house, having a height of 3m or more or a trunk exceeding 100mm DBH. b) Any indigenous tree or vegetation, not within 20m of a dwelling house. Note: clearing of vegetation will only be considered where it is proposed in conjunction with a use permissible on that land. c) Any introduction vegetation, not within 20m of a dwelling house, having a height of 3m or more or a trunk exceeding 100mm DBH.

5) Any tree or other vegetation that is, or forms part of, a heritage item or is within a heritage conservation area.

EXEMPT VEGETATION You do not need approval for the following:

1) a tree or other vegetation that the Council is satisfied is dying or dead and is not required as the habitat for native fauna.

2) a tree or other vegetation that the Council is satisfied is a risk or imminent threat to human life or property.

3) a tree or other vegetation where the trunk is located within 2m of an existing dwelling, as measured from the main trunk of the tree or other vegetation to an external enclosing wall of the existing dwelling.

4) controlled weeds under the NSW Biosecurity Act 2015 and identified in the Greater Sydney Regional Strategic Weed Management Plan 2017 – 2022.

5) the removal of trees and other vegetation to maintain approved dams or bushfire asset protection zones.

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You can also carry out the following works without permission:

1. Remove or prune edible fruit trees (excluding Australian natives), eg. Citrus, apple, mulberry, etc. Note: Ornamental fruit trees are not exempt.
2. Remove fruit and dead leaves (fronds) from palm trees.
3. Prune branches up to 50mm diameter, prune to remove deadwood and mistletoe, remove or prune any exempt species (see below)

Exempt Species

African Olive (Olea europaea subsp. africana), Cassia (Senna pendula), Cocos palm (Syagrus romanzoffianum) , Cotoneaster , Hackberry (Celtis sinensis), Norfolk Island Hibiscus (Lagunaria patersonia), Oleander (Nerium oleander), Privet (Ligustrum spp.), Rubber Tree (Ficus elastica), Tree of Heaven (Ailanthus altissima), Umbrella Tree (Schefflera actinophylla).[1]

Work must be undertaken in accordance with the WorkCover NSW Code of Practice for the Amenity Tree Industry and the guidelines in Australian Standard AS 4373 Pruning of Amenity Trees.

Assessment of the trees was undertaken using the framework of the visual tree assessment procedure (VTA) as prescribed by Mattheck & Broeler 1994.[2]

Tree Protection Zones and Structural Root Zones were calculated in accordance with AS4970-2009- The Protection of Trees on Development Sites [3](see Section 1.2). Tree Retention Values were determined using the IACA 'Significance of a Tree, Assessment Rating System [4](STARS – see Section 1.3). This report will discuss the current structural condition and health of the trees and will provide recommendations regarding their viability relative to proposed works.

- No internal diagnostic testing has been completed.
- No sub surface root testing or soil testing has been completed.
- All observations were made from the ground only.
- Tree heights have been estimated and diameters have been measured with a diameter tape where access allowed.

The following drawings and resources were considered when completing the assessment:

Document name	Provided by	Document name	Provided by
SK-02-Ground level plan-Issue K	Signature Projects	AS4970-2009- The Protection of Trees on Development Sites	Standards Australia
SK-03- First Floor plan- Issue H	Signature Projects		
20075-DET- Site Survey (Revision 1)	Geo Point Surveyors		

Table 1- Resources considered during assessment.

[1] Penrith City Council Vegetation Fact Sheet-Accessed 14-6-20- Penrith City Council Website.
[2] Mattheck & Broeler 1994- The Body Language of Trees.
[3] Standards Australia- AS4970-2009- The Protection of Trees on Development Sites
[4] IACA- Significance of a Tree Assessment Rating System- STARS

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Site Details

The site is at 3 Edward Street, Kingswood.

Figure 2- The subject site. Image taken from Near Maps[5]

[5] Near Maps 2020, *The location of 3 Edward Street, Kingswood*. Near Maps 2020.

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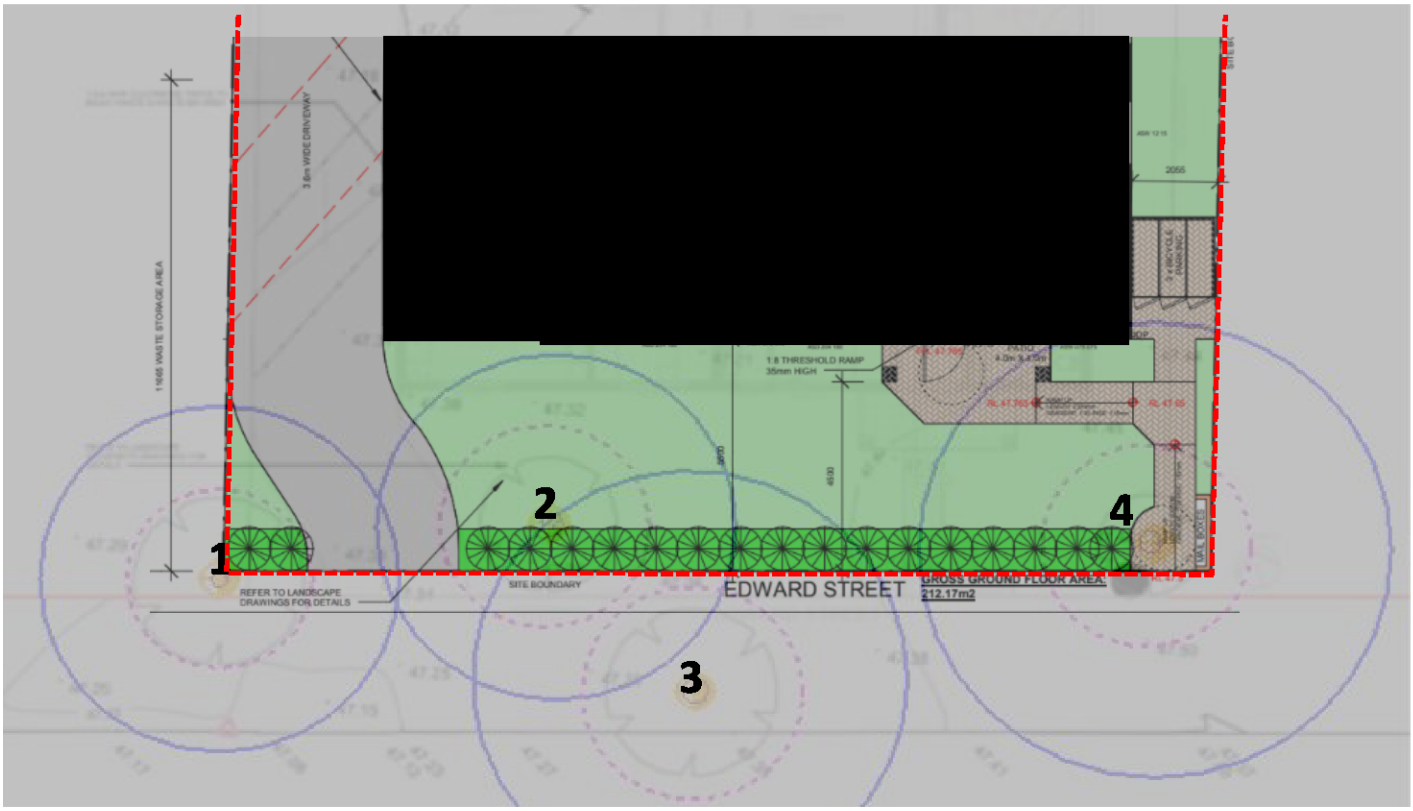

Figure 3- The locations of the trees with TPZs and SRZs overlaid in ArborCad.

Tree schedule

Tree #	Species	Height	spread	TPZ/ SRZ	Health & vigour	Structure	Sig.	E.L. E	Retention value	Comments
1	*Lophostemon confertus- Brush Box*	9m	8m	4.6m 2.4m	Good	Fair	Medium	Medium	Medium	Neighbours tree
2	*Eucalyptus scoparia- Wallangarra white gum*	14m	8m	4.6m 2.7m	Poor	Poor	Low	Short	Low	Advanced decline and structural defects.
3	*Callistemon viminalis-* Weeping Bottle Brush	6m	9m	5.5m 2.8m	Fair	Poor	Low	Medium	Low	Council Street tree
4	*Callistemon viminalis-* Weeping Bottle Brush	3m	3m	6.0m 2.7m	Good	Poor	Low	Medium	Low	Poorly formed lopped specimen

Table 2-Tree schedule

There are a number of other trees and shrubs throughout the property which are exempt due to size and/or species, with a number of them being commercially grown fruit tree species.

Retention values

Retention value	
High	N/A
Medium	1
Low	2-3-4
Very low	N/A

Table 3- Retention values calculated using the STARS system.

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Discussion

Tree one (1) is a mature specimen of Lophostemon confertus located within the neighbours property. The tree is displaying good health and vigour and has been allocated a medium retention value. The tree will be encroached upon by the proposed driveway; however, the proposed driveway is to replace the existing driveway so the negative impacts are likely to be reduced. The existing driveway would need to be removed by hand and following this, if significant roots greater than 40mm in diameter are discovered within the footprint of the new driveway, the driveway must be constructed above grade with suspended slab located on individual piers. The tree is encroached upon by around 16%, however, as mentioned previously, much of this encroachment replaces existing structures. This species of tree is known to be very tolerant of root disturbance and no significant impacts are anticipated.

Tree two (2) is a Eucalyptus scoparia which is in advanced decline, the tree is encroached upon by the driveway and the proposed building footprint. This species is known to be relatively short-lived in the Sydney region and this tree has significant structural defects. This tree should be removed regardless of development.

Tree three (3) is a council street tree. The tree has been identified as a Callistemon viminalis-Bottle brush. The tree is displaying fair health and poor structure with co-dominant stems at 0.5m above grade. The tree suffers no encroachment of the TPZ and no significant impacts are anticipated.

Tree four (4) is an old Bottle brush stump that has been repeatedly lopped and managed to form a shrub. The tree has a calculated TPZ of 6 metres and is within the footprint of a proposed footpath/entranceway. The previous management of this tree raises long-term concerns over its structural condition and its should be considered for removal regardless of the development requirements.

There are no other trees in adjacent properties which stand to be affected by the proposed development.

Trees recommended for removal/retention

Proposed for	Tree number
Trees proposed for removal	2-4
Trees proposed for retention	1-3

Table 4- Trees proposed for removal/retention

Conclusions

Two trees (2 & 4) are recommended for removal regardless of the development requirements. Tree two (2) is in advanced decline and has significant structural defects. Tree four (4) is an old stump that has been repeatedly lopped to form a shrub. Unless this management is continued, the tree is likely to become hazardous and its removal is recommended.

The only other tree which stands to be affected is tree one (1). Tree one (1) is impacted upon by the removal of the existing driveway and construction of a new driveway.

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Recommendations

1. Trees 2, 4 should be removed regardless of the development requirements.
2. Tree 3 is a council street tree and is to be retained and protected throughout development
3. Tree one (1) is impacted upon by removal of the existing driveway and construction of a new driveway. The existing driveway is to be carefully removed by hand. Once the driveway is removed, if tree roots greater than 40mm in diameter are discovered within the footprint of the new driveway, the new driveway must be installed as a suspended slab on individual pier footings.
4. Trees one and three (1 & 3) must be isolated from construction activity with tree protection fencing in accordance with AS4970-2009 The Protection of Trees on Development Sites.
5. The existing driveway is to be used for site access/egress, with the section of driveway adjacent to tree one (1) to remain in situ to protect the tree roots beneath until such time as the site access for machinery is no longer required. Alternatively, the driveway removal and replacement may be carried out first and then used as the site access/egress. If neither of these options are feasible, the driveway may be removed by hand under supervision of the project Arborist who will then oversee the installation of ground protection measures. Ground protection measures will consist of geotextile fabric topped with 150mm depth of mulch or aggregate with hardwood rumble boards or steel road plates on top. Further detail may be found in the generic tree protection measures in appendix 2 of this report.
6. Any other works within the TPZ of any prescribed tree to be retained must be supervised by the AQF level 5 Project Arborist.
7. The removal of trees two (2) and four (4) will result in the need for at least two replacement plantings. The replacement plantings should preferably be a tree species which is locally occurring within the Penrith Council LGA.

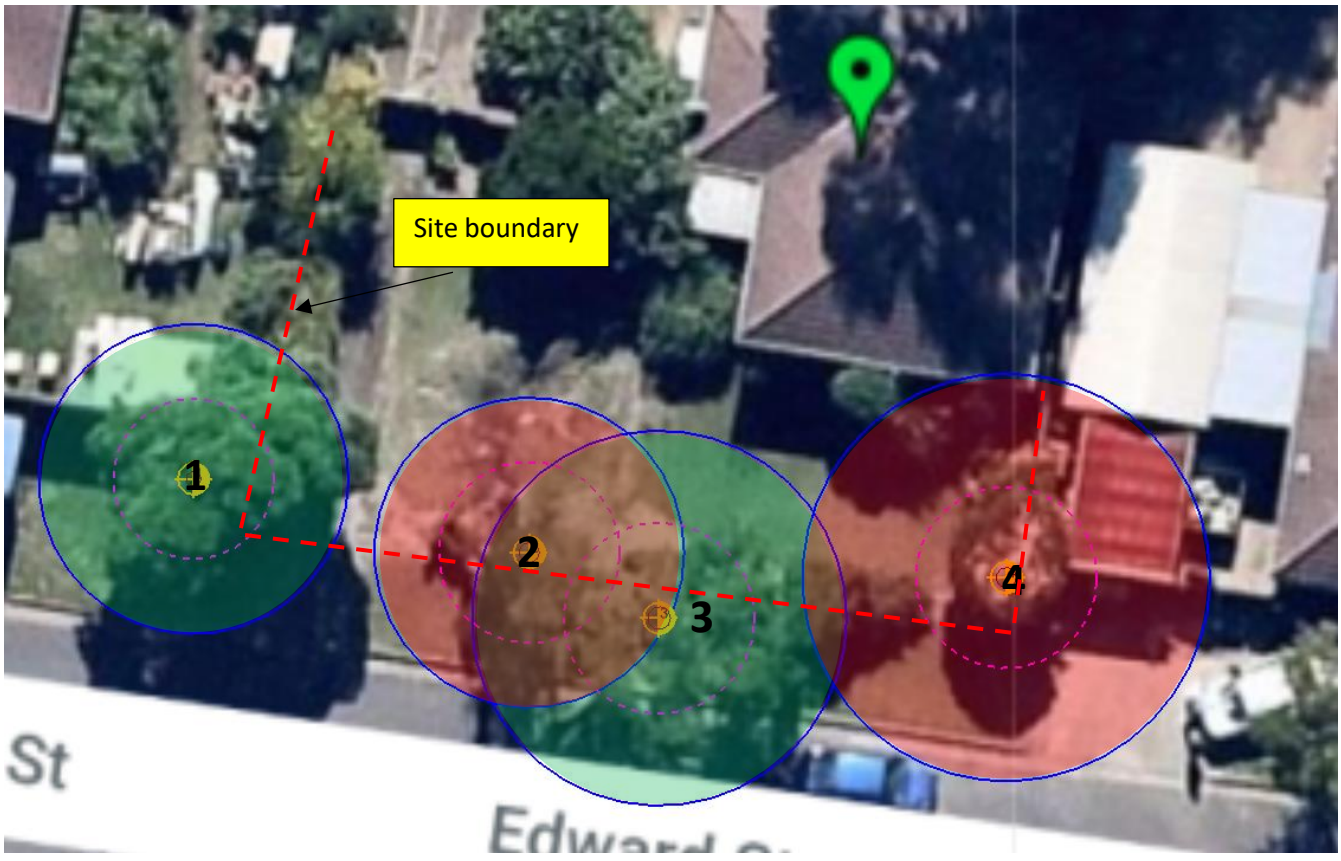

Figure 4- Proposed removal and retention plan.

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References

Mattheck, C. & Broeler, H. 1994, *The Body Language of Trees*.
The Stationery Office. London.

Matheny, N. & Clark, J. 1994. *A Photographic Guide to the Evaluation of Hazard Trees in Urban Areas.*
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Institute of Australian Consulting Arboriculturists. Australia. **www.iaca.org.au**

Near Maps. 2020. *The location of 3 Edward Street, Kingswood*
Accessed 14-6-20.

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Disclaimer:

The information contained within this report is to be used solely for the purposes that were specified at the time of engagement.

All attempts have been made to ensure the legitimacy of any information which has been gathered in the process of compiling this report, however Truth About Trees cannot be held liable for inaccurate or misguiding information which has been provided by others.

Any tree inspections or assessments which have been carried out for the purposes of this report are valid only at the time of inspection and are based on what could reasonably be seen or diagnosed from a visual inspection carried out from ground level.

All inspections, unless otherwise stated, are based upon Visual Tree Assessment (VTA) techniques, industry best practice and applied knowledge. No internal diagnostic testing or below ground investigation has been carried out, unless otherwise stated.

Trees are a dynamic living organism and as such they have a finite lifespan the end of which cannot always be predicted or understood, even apparently healthy trees can die suddenly or fall without warning. As such there is no warranty or guarantee provided, or implied, regarding the future risks associated with any tree.

Please feel free to contact me either via telephone or email if you have any questions regarding this report.

Kind regards

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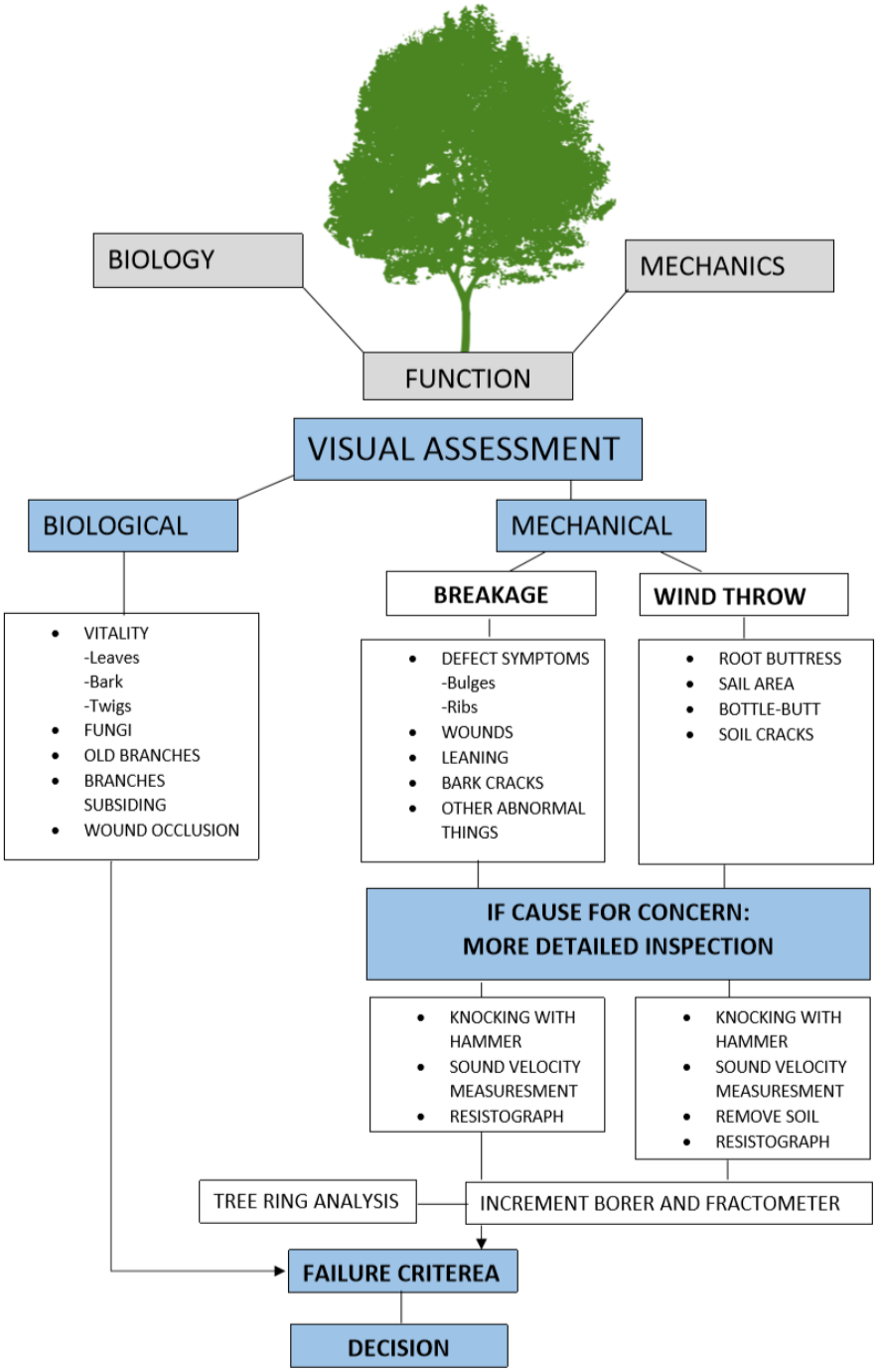
Appendix 1: Tree assessment methodology

1.1 Visual Tree Assessment (VTA)

The VTA system is based on the theory of tree biology and physiology, as well as tree architecture and structure. This method is used by arborists to identify visible signs on trees that indicate good health, or potential problems. Symptoms of decay, growth patterns and defects are identified and assessed as to their potential to cause whole-tree, part-tree and/or branch failure. This system (represented by the image below) is based around methods discussed in `*The Body Language of Trees*'[6].



For the purpose of this report, elements of the VTA system will be used, along with industry standard literature, and other relevant studies that provide an insight into potential hazards in trees. This assessment is a snapshot of what could be reasonably seen or determined from a basic visual inspection. The VTA system is generally used as a means to identify hazardous trees; however it is important to realize that for a tree to be hazardous there must be a target; a hazard poses no risk if there is no exposure to the hazard.

[6] Mattheck, C. & Broeler, H. 1994. *The Body Language of Trees*.

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1.1.1 Health and Vigour Assessment

The health and vigour of a tree are assessed by looking at the tree canopy and how it is performing. Certain indicators provide information on which to base the assessment. Abnormally small leaves, chlorosis (yellowing), sparse crown, wilting, and die-back can be signs of ill-health or decline but may also be related to a temporary imbalance due to drought or pest infestations. Epicormic growth can be a sign of stress and low energy reserves but can also be related to increased light levels through the removal or pruning of adjacent trees. Extension growth can be a good indicator of vigour, but this can vary greatly between species and under differing climatic conditions. For these reasons, each individual symptom or observation needs to be assessed with objectivity and consideration of all available information.

1.1.2 Structural Assessment

The structural assessment of trees is carried out using the basic framework of Visual Tree Assessment. Signs and symptoms of defects are assessed to gauge the likelihood of failure, because not every defect constitutes a hazard e.g. *"…co-dominant stems are a structural defect. The severity of the defect is increased by included bark, large crowns and strong wind."*[7] If trees were removed purely on the basis that there were defects present without assessing the likelihood of failure or whether practical mitigation measures are available, the urban forest would cease to exist. A basic visual tree assessment is undertaken from ground level, if defects are suspected further investigation may be required and recommended. "*[When using] the Visual Tree Assessment (VTA) procedure for assessing trees, as the suspicion increases that defects are present, the examination becomes more thorough and searching."*[1]

"Some defects, especially some forms of decay, do not give rise to external signs and therefore tend to escape detection in a purely visual survey. If there is no reason for suspecting a hidden defect to occur within a particular part of the tree, there is no reasonable basis for carrying out a detailed internal assessment. Although in theory an unsuspected defect might be detectable by the use of specialized diagnostic devices, this would be impracticable in the absence of some external sign to indicate the place which should be probed. Also, internal examination without good reason is undesirable, as it usually causes injury to the tree and is unreasonably time consuming and costly."[8]

[7] Matheny, N. & Clark, J. 1994. *A Photographic Guide to the Evaluation of Hazard Trees in Urban Areas.*

[8] Lonsdale. 1999. *Principles of Tree Hazard Assessment and Management.*

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1.2 Tree Protection Zone (TPZ) & Structural Root Zone (SRZ) Calculations

In accordance with Australian Standard *AS4970-2009 Protection of trees on development sites*[9], Tree Protection Zone (TPZ) radius is calculated using the following procedure. Diameter of the trunk is measured at approximately 1.4m above ground level; this measurement is referred to as DBH (Diameter at Breast Height). $R_{TPZ} = DBH \times 12$. For multi-stemmed trees the formula used is $R_{TPZ} = \sqrt{[(DBH1)^2 + (DBH2)^2 + (DBH3)^2]}$. The TPZ is measured radially from the centre of the stem and must be protected on all sides.

The Structural Root Zone (SRZ) radius is calculated by measuring the diameter of the stem close to ground level, just above the basal flare. This measurement is taken as ***D*** and then used in the following formula: $R_{SRZ} = (Dx50)^{0.42} \times 0.64$ and becomes the Structural Root Zone, measured radially from the centre of the stem.

It is important to realize that these calculations provide a notional figure only and tree dynamics, form and site conditions will greatly affect these zones, and it is the job of the arborist to interpret the information correctly.

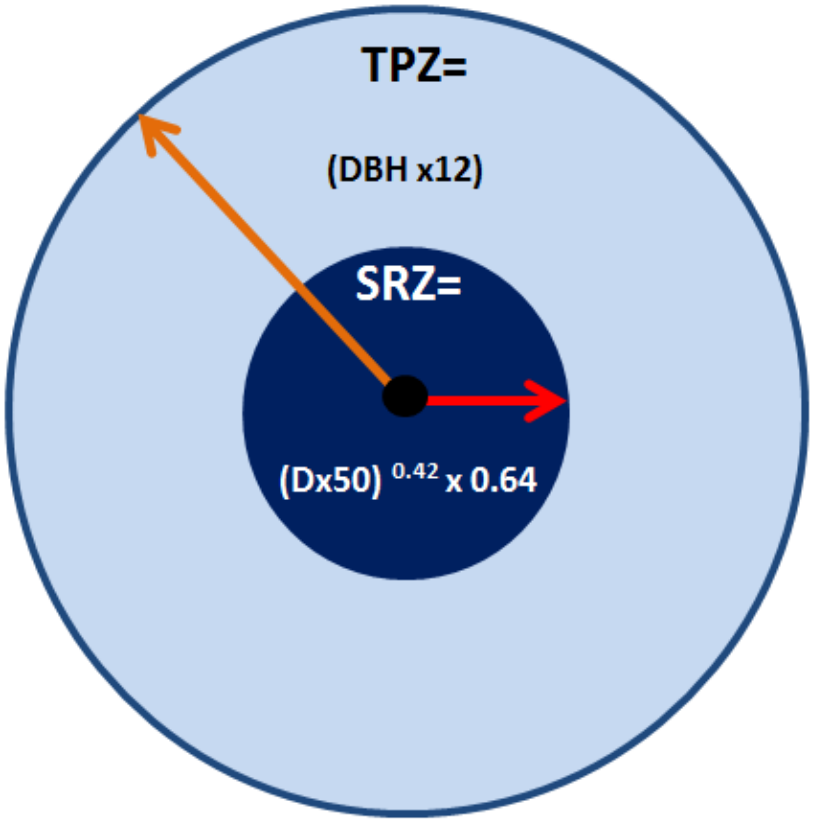

Figure 2 – A representation of TPZ & SRZ calculations.

For palms, cycads, tree ferns, and similar monocots, the TPZ is positioned at least 1m outside the crown projection. SRZs are not applicable to these plant types.

AS4970-2009[3] states "*a TPZ should not be less than 2m nor greater than 15m (except where crown protection is required*" and the minimum radius for an SRZ is 1.5m.

[9] Standards Australia. 2009. *AS4970-2009 Protection of trees on development sites.*

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1.3 Significance of a Tree, Assessment Rating System (STARS)

IACA Significance of a Tree, Assessment Rating System (STARS)© (IACA 2010)©

In the development of this document IACA acknowledges the contribution and original concept of the Footprint Green Tree Significance & Retention Value Matrix, developed by Footprint Green Pty Ltd in June 2001.

The landscape significance of a tree is an essential criterion to establish the importance that a particular tree may have on a site. However, rating the significance of a tree becomes subjective and difficult to ascertain in a consistent and repetitive fashion due to assessor bias. It is therefore necessary to have a rating system utilising structured qualitative criteria to assist in determining the retention value for a tree. To assist this process all definitions for terms used in the *Tree Significance - Assessment Criteria* and *Tree Retention Value - Priority Matrix*, are taken from the IACA Dictionary for Managing Trees in Urban Environments 2009.

This rating system will assist in the planning processes for proposed works, above and below ground where trees are to be retained on or adjacent a development site. The system uses a scale of *High*, *Medium* and *Low* significance in the landscape. Once the landscape significance of an individual tree has been defined, the retention value can be determined. An example of its use in an Arboricultural report is shown as Appendix A.

Tree Significance - Assessment Criteria

1. High Significance in landscape

- The tree is in good condition and good vigour;
- The tree has a form typical for the species;
- The tree is a remnant or is a planted locally indigenous specimen and/or is rare or uncommon in the local area or of botanical interest or of substantial age;
- The tree is listed as a Heritage Item, Threatened Species or part of an Endangered ecological community or listed on Councils significant Tree Register;
- The tree is visually prominent and visible from a considerable distance when viewed from most directions within the landscape due to its size and scale and makes a positive contribution to the local amenity;
- The tree supports social and cultural sentiments or spiritual associations, reflected by the broader population or community group or has commemorative values;
- The tree's growth is unrestricted by above and below ground influences, supporting its ability to reach dimensions typical for the taxa *in situ* - tree is appropriate to the site conditions.

2. Medium Significance in landscape

- The tree is in fair-good condition and good or low vigour;
- The tree has form typical or atypical of the species;
- The tree is a planted locally indigenous or a common species with its taxa commonly planted in the local area
- The tree is visible from surrounding properties, although not visually prominent as partially obstructed by other vegetation or buildings when viewed from the street,
- The tree provides a fair contribution to the visual character and amenity of the local area,
- The tree's growth is moderately restricted by above or below ground influences, reducing its ability to reach dimensions typical for the taxa *in situ*.

3. Low Significance in landscape

- The tree is in fair-poor condition and good or low vigour;
- The tree has form atypical of the species;
- The tree is not visible or is partly visible from surrounding properties as obstructed by other vegetation or buildings,
- The tree provides a minor contribution or has a negative impact on the visual character and amenity of the local area,
- The tree is a young specimen which may or may not have reached dimension to be protected by local Tree Preservation orders or similar protection mechanisms and can easily be replaced with a suitable specimen,
- The tree's growth is severely restricted by above or below ground influences, unlikely to reach dimensions typical for the taxa *in situ* - tree is inappropriate to the site conditions,
- The tree is listed as exempt under the provisions of the local Council Tree Preservation Order or similar protection mechanisms,
- The tree has a wound or defect that has potential to become structurally unsound.

Environmental Pest / Noxious Weed Species

- The tree is an Environmental Pest Species due to its invasiveness or poisonous/ allergenic properties,
- The tree is a declared noxious weed by legislation.

Hazardous/Irreversible Decline

- The tree is structurally unsound and/or unstable and is considered potentially dangerous,
- The tree is dead, or is in irreversible decline, or has the potential to fail or collapse in full or part in the immediate to short term.

The tree is to have a minimum of three (3) criteria in a category to be classified in that group.

Note: The assessment criteria are for individual trees only, however, can be applied to a monocultural stand in its entirety e.g. hedge.

IACA 2010, *IACA Significance of a Tree, Assessment Rating System (STARS)*, Institute of Australian Consulting Arboriculturists, www.iaca.org.au

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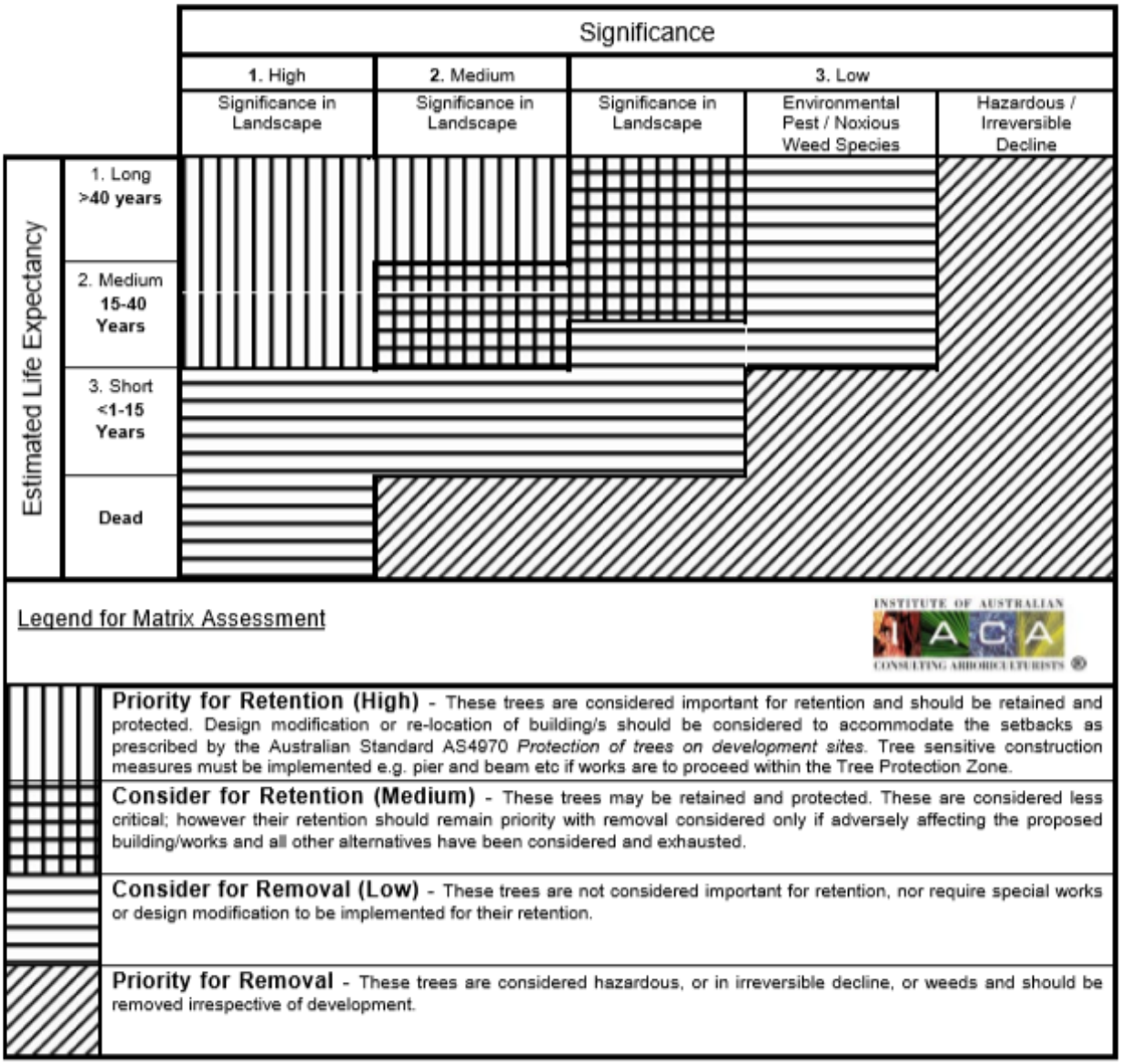
Table 1.0 Tree Retention Value - Priority Matrix.



USE OF THIS DOCUMENT AND REFERENCING

The IACA Significance of a Tree, Assessment Rating System (STARS) is free to use, but only in its entirety and must be cited as follows:

IACA, 2010, *IACA Significance of a Tree, Assessment Rating System (STARS)*, Institute of Australian Consulting Arboriculturists, Australia, www.iaca.org.au

REFERENCES

Australia ICOMOS Inc. 1999, *The Burra Charter – The Australian ICOMOS Charter for Places of Cultural Significance*, International Council of Monuments and Sites, www.icomos.org/australia

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Appendix 2- Generic Tree Protection Measures.

Tree protection measures are used to isolate the calculated tree protection zone from the impacts of construction activities. Tree protection measures come in many different forms and types depending on the type of protection required for the situation. The protection measures can be broadly considered as tree root protection, canopy protection or trunk and branch protection.

Tree root protection: TPZ Fencing- Figure 1

Tree root protection is generally achieved with the allocation and delineation of a tree protection zone (TPZ) in accordance with AS4970-2009- The Protection of Trees on Development Sites. Temporary fencing is used to isolate the area from construction activity and restrict unauthorized access. Where access into the TPZ is required and unavoidable, ground protection measures may be recommended to ensure that the tree roots which are to be protected remain undamaged during works within the TPZ. Any works within the allocated tree protection zones must be directly supervised by a project Arborist with a minimum AQF level 5 qualification. In situations where there are low lying tree branches to be protected, the TPZ may be extended beyond the calculated TPZ in order to incorporate canopy protection as shown below.

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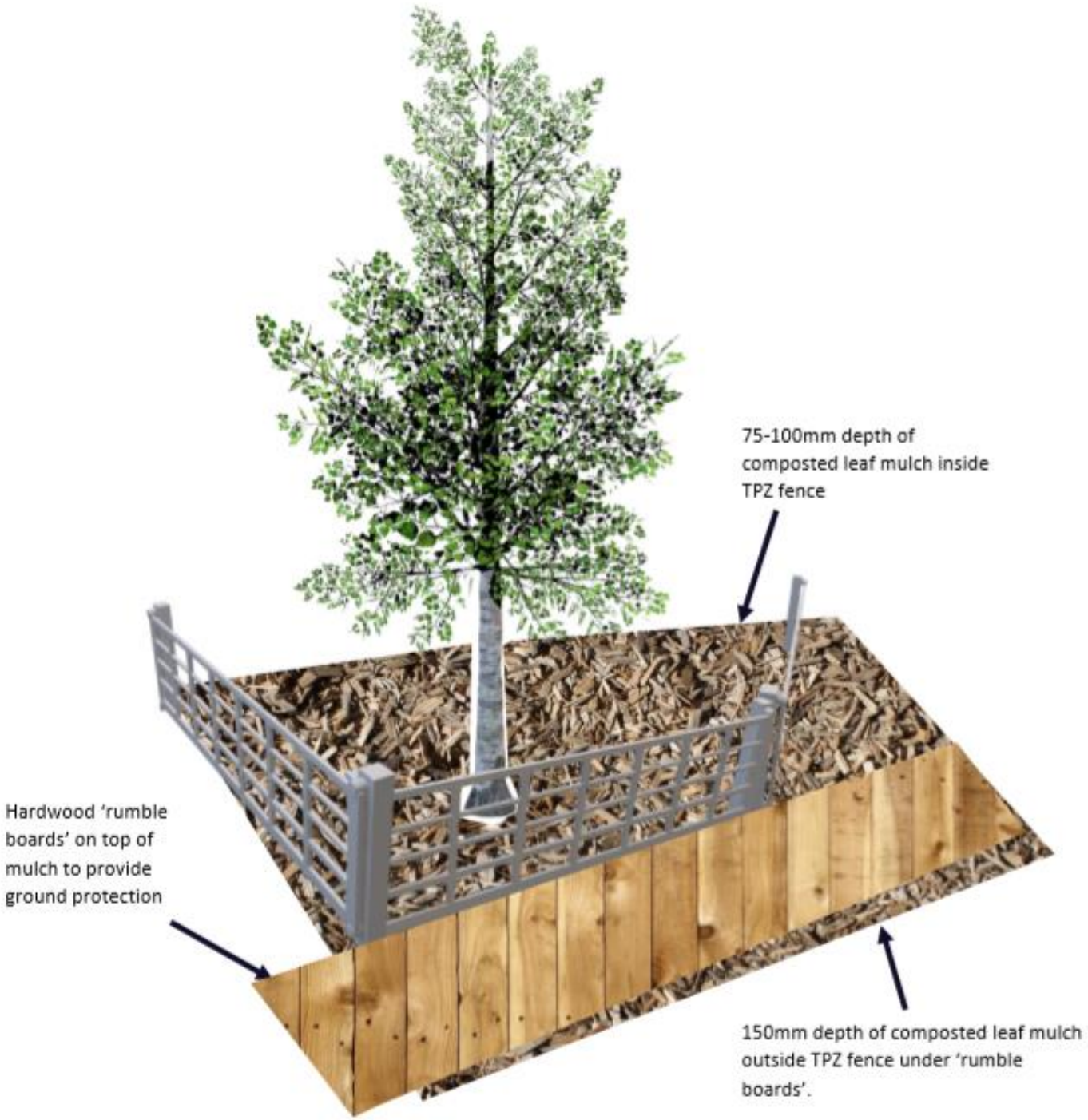
Ground protection: Access road within TPZ- Figure 2.



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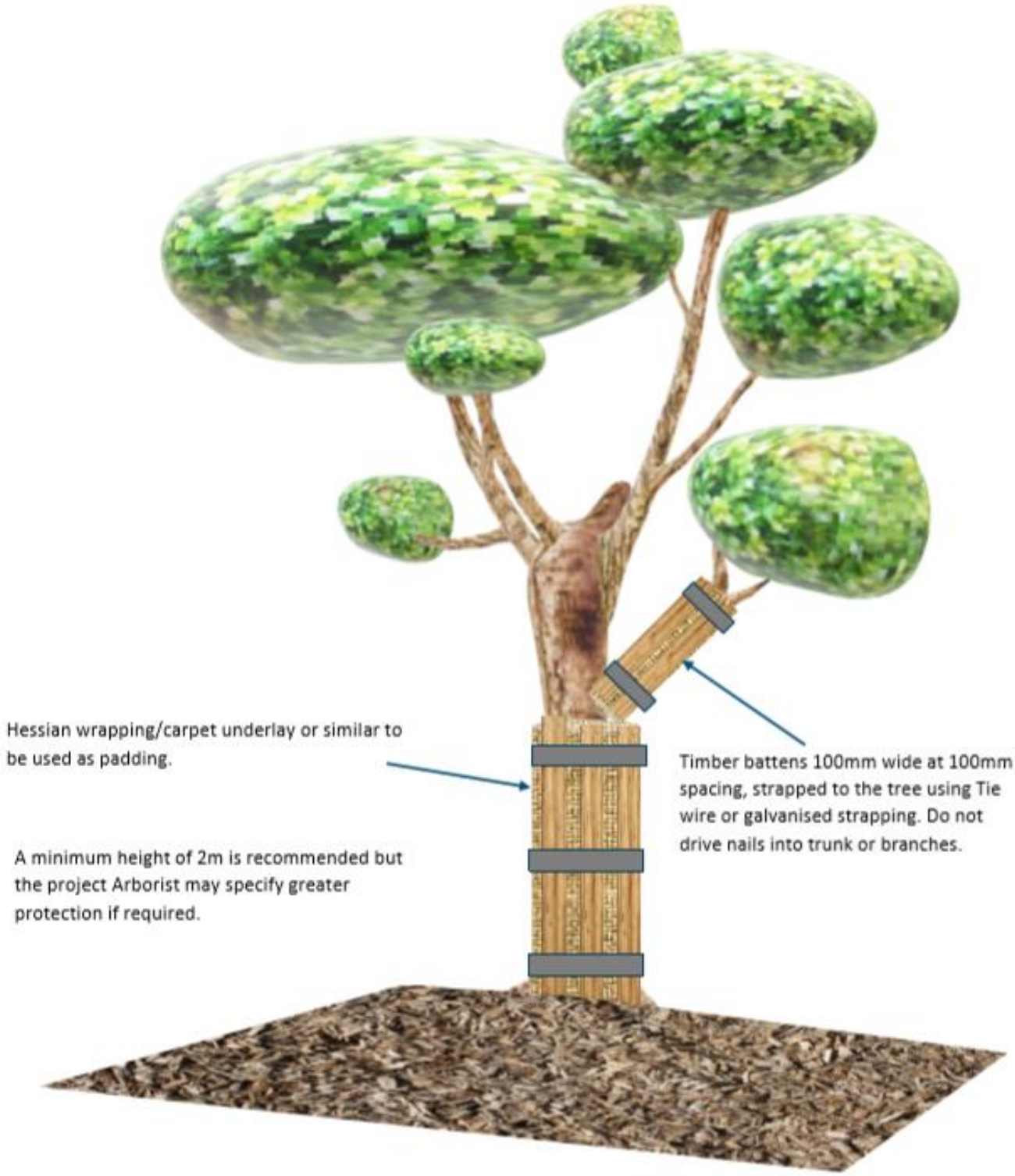
Trunk and branch protection- Figure 3.



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Tree protection specifications:

In accordance with AS4970-2009- The Protection of Trees on Development Sites, activities restricted within the TPZ include but are not limited to:

a) Machine excavation including trenching.
b) Excavation for silt fencing.
c) Cultivation.
d) Storage of materials or machinery.
e) Preparation of chemicals, including cement products.
f) Parking of vehicles and plant.
g) Refueling of machinery.
h) Dumping of waste.
i) Wash down and cleaning of equipment.
j) Placement of fill.
k) Lighting fires.
l) Soil level changes.
m) Temporary or permanent installation of utilities and signs.
n) Physical damage to the tree.

Tree protection fencing:

Tree protection fencing is to be installed prior to site establishment, demolition or commencement of any works on site.
All fencing must be chainmesh fencing 1.8m in height, secured with concrete 'feet' and in accordance with AS4678-Temporary Fencing and Hoardings. Depending on the type of development, shade cloth or similar may be recommended to reduce the spread of dust, particulate matter and liquids into the protected area. Silt fencing may also be required and may be incorporated into the TPZ fencing if required. Once the TPZ fencing has been installed the site Arborist must provide a letter of certification of tree protection measures to the client which may be forwarded on to the private certifier or council. Tree protection fencing is not to me moved, realigned, dismantled or tampered with in any way and shall only be relocated under instruction of the project Arborist. (See Figure 1)
If the protective fencing requires temporary removal, trunk, branch and ground protection must be installed and must comply with AS 4970-2009 - Protection of trees on development sites. Existing fencing and site hoarding may be used as tree protection fencing, providing the TPZ remains isolated from construction activities. The purpose of ground protection is to prevent root damage and soil compaction within the TPZ. Ground protection may include a permeable membrane such as geotextile fabric beneath a layer of mulch, crushed rock or rumble boards.
Any additional construction activities within the TPZ of the subject trees must be assessed and approved by the project arborist, and must comply with AS 4970- 2009 - Protection of trees on development sites.

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Tree protection signage:

Tree protection zone signage must be installed and clearly visible from all angles within the site stating "NO ENTRY TREE PROTECTION ZONE" and phone numbers for the site Arborist and site supervisor/foreman must be provided. TPZ signage must be laminated or otherwise protected to ensure that it remains legible for the duration of the project. (See Figure 1)

Ground protection:

Where access into the TPZ of a tree is necessary and unavoidable, the project Arborist must specify the methods of additional protection required. This may be ground protection in the form of 150mm depth of composted mulch beneath hardwood 'rumble boards' alternatively track mats or road plates may be used (See figure 2). Tree roots are essential for the uptake/absorption of water, oxygen and mineral ions (solutes). It is essential to prevent the disturbance of the soil beneath the dripline and within the TPZ of trees that are to be retained. Soil compaction within the TPZ will adversely affect the ability of roots to function correctly.

Generally, soil level changes within the TPZ of a tree is not recommended and is contrary to AS4970-2009 The Protection of Trees on Development Sites. Certain circumstances can arise where this may be necessary and the requirements must be carefully considered by the project Arborist. If the grade is to be raised within the TPZ, the material should be coarser or more porous than the underlying material and the suitability of this action must be assessed by the project Arborist.

Trunk and branch protection:

Where there is the risk of accidental mechanical damage due to narrow access paths or large machinery movements, trunk and branch protection may also be recommended (see figure 3). The removal of bark or branches allows the potential ingress of micro-organisms which may cause decay. Furthermore, the removal of bark restricts the trees' ability to distribute water, mineral ions (solutes), and glucose.

Trunk protection shall consist of a layer of either Hessian wrapping, carpet underlay, geotextile fabric or similar wrapped around the trunk, followed by softwood timbers approximately 100mm wide, aligned vertically and spaced evenly around the trunk (with an approx. 100 mm gap between the timbers).

The timbers must be secured using galvanized hoop strapping or tie wire. The timbers shall be wrapped around the trunk but not fixed to the tree with nails, screws or other means, as this will cause injury/damage to the tree.

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Crown protection:

Tree crowns/canopy may be injured or damaged by machinery such as; excavators, drilling rigs, trucks, cranes, plant and vehicles. Where crown protection is required, it will usually be located at least one meter outside the perimeter of the crown.

Crown protection may include the installation of a physical barrier, pruning selected branches to establish clearance, or the tying/bracing of branches.

Supervision of works within the TPZ:

If incursion/excavation amounting to greater than 10% of the TPZ is unavoidable, exploratory excavation (under the supervision of the Project Arborist) using non-destructive methods may be considered to evaluate the extent of the root system affected, and determine if the tree can remain viable.

If the project arborist identifies conflicting roots that require pruning, they must be pruned with a sharp implement such as; secateurs, pruners, handsaws or a chainsaw back to undamaged tissue. All works within the TPZ of any tree to be retained must be completed under the direct supervision of the project Arborist. This may include non-destructive excavation or hand digging to locate individual piers or fence posts.

The project Arborist is to recommend measures to protect and preserve any roots uncovered during these activities, this may include wrapping the tree roots in hessian or similar and keeping them moist to prevent desiccation.

Any tree roots which are damaged are to be assessed by the supervising Arborist who is to determine the best course of action. If root pruning is recommended, the project Arborist should sever the damaged roots cleanly back to undamaged tissue and cover the exposed portion of root to prevent desiccation.

Where significant roots have been pruned, the project Arborist should complete a letter of certification including a root mapping report explaining the number and diameter of roots which were severed, what impacts are likely and provide recommendations for mitigation of such impacts if required.

All supervision works must be completed by an Arborist with a minimum AQF level 5 in Arboriculture.

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Hold points/ certification:

Arborist involvement will be required throughout the development process at key milestones, at a minimum these are:

1. Certification of tree protection installation prior to site establishment
2. Monthly inspection of trees to ensure tree protection measures are effective.
3. Supervision and certification of any works within tree protection zones.
4. Removal of tree protection measures and final certification.

The approved tree protection plan must be available onsite prior to the commencement of works, and throughout the entirety of the project. To ensure the tree protection plan is implemented, hold points have been specified in the schedule of works for Arborist involvement. It is the responsibility of the principal contractor to complete each of the tasks. Once each stage is reached, the work will be inspected and certified by the project arborist and the next stage may commence. Alterations to this schedule may be required due to necessity. However, this shall be through consultation with the project arborist only.

A recommended schedule of works for Arborist involvement is as follows:

Pre-construction:	Prior to demolition and site establishment indicate clearly (with spray paint on trunks) trees marked for removal only. Tree protection (for trees that will be retained) shall be installed prior to demolition and site establishment, this will include mulching of areas within the TPZ. Scheduled inspection of trees by the project arborist should be undertaken monthly during the construction period.
During Construction:	Inspection of trees by project arborist after all major construction has ceased, following the removal of tree protection measures.
Post Construction:	Final inspection of trees by project arborist to confirm tree condition and provide final letter of certification.

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Appendix 3- Tree protection plan