



Arboricultural Assessment

510 Swan Street, Richmond

Prepared for:
Geoffrey Mills | Victorian School Building Authority

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treelogic

Tree management for the urban forest

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Title Page Images

Left: Tree 2, River She-oak (*Allocasuarina cunninghamiana*), viewing east.

Above right: Tree 5, Lemon Scented Gum (*Corymbia citriodora*), viewing west.

Below right: Group 2 of shrubs, view from across the street of Group 2 consisting of large shrubs.

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1. Objectives

Tree Logic was engaged by Geoffrey Mills of the Victorian School Building Authority to undertake an arboricultural assessment and prepare an arboricultural report for trees at 510 Swan Street, Richmond. The requirements of the arboricultural report include;

- 1.1. To provide information on the species, origin, dimensions, health and structure of the trees and their appropriateness for retention.
- 1.2. To offer recommendations regarding the management of the trees, including any tree protection measures for retained trees.
- 1.3. Determine the Tree Protection Zones (TPZ) for assessed trees compliant with AS4970 'Protection of trees on development sites'.

2. Method

- 2.1. A site inspection was carried out on Thursday 23rd June 2016.
- 2.2. The trees were inspected from the ground and observations were made of the growing environment and surrounding area. The trees were not climbed and no samples of the tree or site soil were taken.
- 2.3. Assessment details of individual trees are listed in the Tree Assessment Table in Appendix 1. A copy of the tree plan can be seen in Appendix 2.
- 2.4. Observations were made of the assessed trees to determine species, origin, age category, useful life expectancy and condition. Measurements were taken to establish tree crown height (measured with a height meter), crown width (paced) and trunk dimensions (measured 1.4 m up the trunk with a diameter tape unless otherwise stated). Descriptors used in the tree assessment can be seen in Appendix 3.
- 2.5. Some photographs of the trees and the environs were taken for further reference and inclusion in the report.
- 2.6. Only trees with a single stem diameter greater than 150 mm at a height of 1.4 m above ground level were assessed. Several smaller trees and larger shrubs were observed and were categorised into groups for this report.
- 2.7. Each of the assessed trees was attributed an 'Arboricultural Rating'. The arboricultural rating correlates the combination of tree condition factors (health and structure) with tree amenity value. Definitions of arboricultural ratings can be seen in Appendix 3.
- 2.8. The assessed trees have been allocated tree protection zones (TPZ). The Australian Standard, AS 4970-2009, has been used as a guide in the allocation of TPZs for the assessed trees. This method provides a TPZ that addresses both the stability and growing requirements of a tree. TPZ distances are measured as a radius, from the centre of the trunk at (or near) ground level. All TPZ measurements are provided in Appendix 1.
- 2.9. Documents reviewed include:
 - City of Yarra Street Tree Policy – City of Yarra
 - The City of Yarra Street Tree Policy states that trees are to be retained whenever possible and removal is subject to the appropriate authority of the City of Yarra.

- Environmental Local Law No.3 of 2012 – City of Yarra
 - According to the Environmental Local Law No.3, a significant tree must not be removed without a permit. A significant tree is defined as a tree that is single trunked with a trunk diameter 400mm or greater measured at 1500mm (1.5m) above the ground; or is listed in the City of Yarra Significant Tree Register.
- Planning Property Report for 510 Swan St – Department of Environment, Land, Water and Planning. The site is zoned as Public Park and Recreation Zone (PPRZ).
- Detailed Site Investigation plan – Senversa Pty Ltd.

3. Observations

3.1 The subject site was located on the corner of Swan Street and Stawell Street in Richmond. The tree study area comprised a diverse group of planted and self-seeded trees within the subject site, neighbouring properties and surrounding streets.

The site is currently utilised as a fenced sporting facility which is comprised of hard court surfaces, clubrooms and general recreation space.

The site was landscaped with various small trees and large shrubs, primarily concentrated within the southern boundary.

3.2 Tree population

3.3 Seventeen (17) trees were inspected in total.

- Six (6) trees located within the subject site
- Nine (9) street trees
- Two (2) trees in a neighbouring property south-west of the subject site.
- A range of larger smaller trees and larger shrubs were observed and categorized into two (2) groups based on location and species.

Refer to Appendix 1 for individual tree details and Appendix 2 for tree locations and numbering.

The tree population consisted of various species. Most trees were identified as exotic deciduous or evergreen species with a smaller number of trees identified as an Australian native. There were no indigenous or trees on the City of Yarra Significant Tree Register located within the subject site.

The species are listed below in Table 1.

Table 1: Common Name (<i>Botanic name</i>)	Origin	No. of Trees
London Plane (<i>Platanus xacerifolia</i>)	Exotic deciduous	6
Crepe Myrtle (<i>Lagerstroemia indica</i>)	Exotic deciduous	3
River She-oak (<i>Casuarina cunninghamiana</i>)	Australian native	2
Desert Ash (<i>Fraxinus angustifolia</i> subsp. <i>angustifolia</i>)	Exotic deciduous	2
Lemon Scented Gum (<i>Corymbia citriodora</i>)	Australian native	2
Chinese Elm (<i>Ulmus parvifolia</i>)	Exotic deciduous	1
Peppercorn (<i>Schinus areira</i>)	Exotic evergreen	1
Total		17

Table 1. Species list

3.4 **Tree health** was assessed based on foliage colour, size and density as well as shoot initiation and elongation.

- Six (6) trees were within the subject site.
Trees within the site displayed characteristics considered typical or better with the exception of the Desert Ash which displayed reduced foliage density and minor tip dieback.
- Nine (9) trees were street trees within the surrounds of the subject site.
Of the six (6) London Plane trees, five (5) were in Fair to poor health displayed low vigour and signs of decline
Three (3) Crepe Myrtles displayed characteristics typical of young and newly planted trees.
- Two (2) trees located in neighbouring property displayed characteristics typical or better within the current growing conditions.

A summary of tree health is listed below in Table 2.

Health rating	Number
Fair	10
Fair to poor	6
Poor	1
Total	17

Table 2. Tree health.

3.5 **Tree structure** was assessed for structural defects and deficiencies, likelihood of failures and risk to potential targets.

- Trees within the subject site generally displayed Fair structure with the exception of a Tree 6, a Lemon Scented Gum, with a codominant fork and slightly suppressed canopy and Tree 4, a Desert Ash, that has been lopped numerous times.
- Street trees generally displayed Fair-poor structure with all trees having been pruned for power line clearance or had evidence of previous failures.
- Trees in neighbouring properties displayed Fair-poor structure with Tree 17, a Peppercorn, displaying slight asymmetric canopy and over-extended limbs and Tree 16, a self-seeded Desert Ash that has been suppressed by the adjacent Peppercorn.

A summary of tree structure is listed below in Table 3.

Health rating	Number
Fair	6
Fair to poor	10
Poor	1
Total	17

Table 3. Tree structure

3.6 The assessed trees were given an **arboricultural rating**. This rating relates to the combination of tree condition factors, including health and structure (arboricultural merit), and also conveys an amenity value. Amenity relates to the trees biological, functional and aesthetic characteristics within an urban landscape context. It should be noted that the arboricultural rating is different to the conservation/ecological values placed on trees by other professions. Definitions of arboricultural ratings can be seen in Appendix 3.

A summary of arboricultural ratings is listed below in Table 3.

Arboricultural Rating	No. of trees	Tree numbers
Moderate	7	1, 2, 3, 5, 6, 15, 17
Low	7	4, 7, 8, 9, 10, 11, 16
Low (size)	3	12, 13, 14 and Groups 1, 2
Total	17	

Table 3. Arboricultural ratings for subject site

- 3.6..1 Moderate rated trees are desirable and suitable to be retained within the site redevelopment if they can be incorporated into the design and can be appropriately protected throughout the planning, design and construction stages of any redevelopment.
- 3.6..2 Trees with a Low arboricultural rating displayed general health and/or structural deficiencies or were considered as functionally inappropriate to retain in conjunction with occurring development within the site. Low rated trees are generally not considered worthy of being a constraint on reasonable design intent and outcomes. Retention of Low rated trees may be considered if not requiring a disproportionate expenditure of resources to successfully incorporate them into the design or manage their condition.
- 3.6..3 Trees 12, 13 and 14 were attributed a Low (size) value as they were newly planted trees. Groups 1 and 2 were attributed a Low (size) value. Trees with a Low (size) arboricultural rating are not canopy tree species or were fair specimens of small size that could be easily replaced within the landscape.

4. Tree permit requirements

- 4.1. The site is zoned as Public Park and Recreation Zone (PPRZ). There are no overlays applying to the site that confer any specific tree controls. However, the City of Yarra Local Law No.3 (2012) states that: "A person must not, without a permit, remove, damage, destroy or lop a significant tree."

The City of Yarra defines a Significant Tree as:

- A tree that is single trunked with a trunk diameter 400mm or greater measured at 1500mm (1.5m) above the ground; or
- A tree that is multi-trunked with a combined trunk diameter 400mm or greater at 1500mm (1.5m) above the ground.

Table below lists the trees on site, in surrounding streets and neighbouring properties that trigger a permit:

Tree No.	Common Name (<i>Botanic name</i>)	DBH
1	River She-oak (<i>Casuarina cunninghamiana</i>)	49
2	River She-oak (<i>Casuarina cunninghamiana</i>)	52
4	Desert Ash (<i>Fraxinus angustifolia</i> subsp. <i>angustifolia</i>)	72
5	Lemon Scented Gum (<i>Corymbia citriodora</i>)	53
15	London Plane (<i>Platanus xacerifolia</i>)	45
17	Peppercorn (<i>Schinus areira</i>)	121

- 4.2. All trees on neighbouring properties and council managed trees, regardless of Arboricultural Rating, must be afforded appropriate protection to sustain them in conjunction with any proposed development of the site, unless otherwise negotiated with their respective owners.

5. Tree Protection Zones

- 5.1. The arboricultural assessment report provides planners and designers with information on the measures required to protect trees suitable for retention.
- 5.2. The most important consideration for the successful retention of trees is to allow appropriate above and below ground space for the trees to continue to grow. This requires the allocation of tree protection zones (TPZ) for all retained trees.
- 5.3. The Australian Standard for Protection of Trees on Development Sites (*AS4970 – 2009*) has been used as the method for calculating a TPZ. The TPZ defines an area in which construction activity is either avoided, or at least controlled, in order to successfully sustain a tree. The TPZ measurements are provided in the tree assessment data in Appendix 1.
- 5.4. Minor encroachment, up to 10% of the TPZ, is generally permissible provided encroachment is compensated for the recruitment and protection of an equivalent area contiguous with the TPZ. No construction should be proposed in the Reduced TPZ unless based the results of non-destructive root investigation, utilising root sensitive design & construction methods. Refer to Figure 1 for examples of minor encroachment.

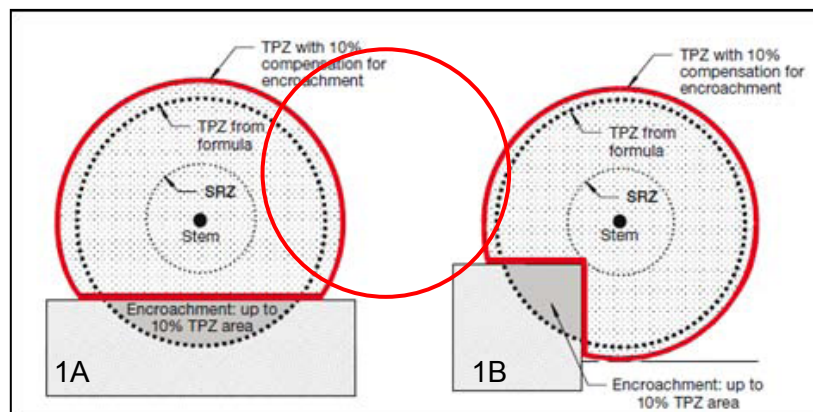


Figure 1: 1A & 1B - Examples of minor encroachment into a TPZ.

Extract from: AS4970-2009, Appendix D, pg. 30 of 32

- 5.5. The Structural Root Zone (SRZ) represents the minimum area required to maintain tree stability without consideration to the ongoing health of the tree. No works are recommended within the SRZ.
- 5.6. All TPZ measurements are provided in the tree assessment data in Appendix 1.

6. Design review

- 6.1. At the time of preparing the report no plans were available to be reviewed. Given the site is likely to be redeveloped it is clear that some trees within the middle of the site may need to be removed and others may have some disturbance close to or within the recommended TPZ to provide access and allow other essential infrastructure to be installed.
- 6.2. In the absence of site design plans, it is not appropriate to speculate on which trees are considered sustainable apart from the general guide provided by the arboricultural ratings attributed to each tree. Retention suitability is dependent on the proposed landscape setting in which trees are intended to be retained. The following recommendations are provided for consideration in the design process.

- 6.3. On the basis of tree quality, safety and potential amenity, preference should be given to retaining trees of Moderate arboricultural value in areas of built form or areas of increased target potential.
- 6.3.1. Trees 1 and 2, both River She-oaks located in the south-west corner of the site, were in Fair health and structure. These trees display typical vigour, growth extension and balanced canopy with typical foliage density. These trees are expected to grow unhindered with the exception of minor pruning for nearby power cable.
- 6.3.2. Tree 3, a Chinese Elm, was in Fair health and structure and is capable of developing into a medium-sized shade canopy tree. The tree requires weight reduction on some westerly branches and can develop a balanced canopy.
- 6.3.3. Tree 5, a Lemon Scented Gum located centre of the subject site, was in Fair health and structure. This tree has the potential to become a moderate to long term feature of the landscape, displaying a rounded canopy, fair taper and sound branch unions with no evidence of previous failures. The lower branches of this tree are becoming overextended and may require weight reduction.
- 6.3.4. Tree 6, a Lemon Scented Gum located centre and north adjacent of Tree 5, was in Fair health and Fair-poor structure. This tree has been slightly suppressed by the canopy of Tree 5, as a result the canopy is slightly asymmetrical to the north-east with the majority of the foliage held by codominant stems. Reduction of the lesser codominant stem is recommended.
- 6.4. One tree within the subject site was attributed a Low arboricultural rating (Tree 4) and trees of small trees or large shrubs were attributed a Low rating due to low significance in size (Groups 1 and 2). These trees are easily replaceable and retention should not be a constraint on reasonable redevelopment of the site.
- Small trees of Low arboricultural value that are otherwise in reasonable condition (Fair-poor or better Health and /or Structure) may offer a potential established tree resource, even if only as an interim measure.
- 6.5. Eleven (11) trees were located outside the subject site. These trees must be considered for retention within any design concept proposed on site.
- 6.5.1. Trees 7, 8, 9, 10, 11, 12, 13, 14 and 15 (London Plane trees) were council street trees located south of the subject site on Swan Street and Stawell Street.
- 6.5.2. Trees 16 and 17 (Desert Ash and Peppercorn) were located in neighbouring property north-west of the site.
- 6.5.3. Each of these trees require minimum tree protection comprising the reduced TPZ extending into the subject site.
- 6.6. Tree protection zones have been allocated in Appendix 2 to the three moderate rated trees to indicate the area required were they to be retained in any future redevelopment plans.
- 6.7. Appropriate tree protection management will be required when designing building foot prints, benching requirements, paths of access and location of underground services.
- 6.8. All trees that are to be retained will require tree protection zone fences to be established prior to commencing any works onsite including demolition, bulk earthworks, construction, landscaping activity, delivery and storage of materials or placement of site sheds.

- 6.8.1. Where TPZ fencing is impractical, ground protection measures in accordance with AS4970 will be required in order to prevent root damage and soil compaction. Appendix 4 provides tree protection and tree and ground buffering guidelines that should be incorporated into the design and management plans for retained trees.
- 6.9. Existing soil levels within the TPZ's must not be altered during construction activities, including landscape design
- 6.10. It is imperative that no open cut excavation occurs within the recommended TPZ area of any retained trees for installation of underground services such as water, drainage, electricity, gas, telecommunications, security or any other landscape feature.
- 6.11. Reduction of up to 10% of the TPZ area is acceptable if a commensurate area contiguous with the TPZ is protected from further encroachment. This would be applicable to all trees located in adjoining properties and the street tree.
- 6.12. Any encroachment of a TPZ in excess of 10% must be based on the results of non-destructive root investigation using either Air-spade® or Hydro-excavation and approved by the consulting arborist and/or relevant authority.
- 6.13. Any recommended pruning must be undertaken by a qualified arborist and comply with Australian Standard AS 4373-2007 - Pruning of Amenity trees. All TPZ and reduced TPZ radius distances are provided in Appendix 1. Pruning recommendations have been provided for Trees 3, 4, 5 and 6.

7. Photographic examples



- 1 Moderate rated Tree 5, Lemon Scented Gum, within site viewing west.
- 2 Moderate rated Tree 1 and Tree 2, River She-Oaks, within site viewing south.



- 3 Low rated Tree 4, Desert Ash, within site viewing north.

- 4 Group 2, Kohuhu and variegated Pittosporum species, within site viewing south-west.



- 5 Moderate rated Trees 4 and 5, Lemon Scented Gums, within site viewing west.

- 6 Group 1, Kohuhu and variegated Pittosporum species, within site viewing south.



- 7 Moderate rated Tree 3, Chinese Elm, within site viewing south.

- 8 Street Tree 15, London Plane, with power line pruned canopy, viewing south.



- 9 Street Trees 7, 8, 9, 10 and 11, London Planes, viewing south-east.

- 10 Neighbouring Trees 16 and 17, Desert Ash and Peppercorn, viewing south.

8. Conclusion and Recommendations

- 8.1. Seventeen (17) trees were inspected within the subject site and neighbouring properties.
- 8.2. The most important consideration for the successful retention of suitable trees is to allow appropriate above and below ground space for the trees to continue to grow. This requires the allocation of tree protection zones for all trees to be retained. All TPZ measurements are provided in the tree assessment data in Appendix 1.

- 8.3. In the absence of a design proposal it is recommended Moderate rated trees be considered as suitable for retention in conjunction with increased development of the site. Such trees have been allocated TPZs, the distance of the recommended TPZs has been provided. Refer to Appendix 1 for individual tree details.
- 8.4. Five (5) moderate rated trees: 1, 2, 3, 5 and 6 represent the best options for tree retention in conjunction with site redevelopment.
- 8.5. Trees 3, 4, 5 and 6 have pruning recommendations.
- 8.6. Trees attributed an arboricultural rating of Low or Low (size) are small specimens that are readily replaceable if required or trees that are in poor health or structure. Retention should not be a constraint on reasonable redevelopment of the site.
- 8.7. Provision must be provided for trees located within neighbouring properties or on the street (Trees 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17 and Groups 1 and 2). These trees are to be protected during redevelopment. The TPZs of these trees can be referred to in Appendix 1 and Appendix 2.
- 8.8. To successfully sustain those trees deemed to be most suitable for retention in conjunction with any re-development, tree protection zones must be incorporated into the design and appropriate construction controls, fencing and management practices must be implemented prior to commencing any construction related activity including demolition and bulk earthworks. Where TPZ fencing is impractical, ground protection measures will be required.
- Refer to Appendix 4 for TPZ establishment and management guidelines.

I am available to answer any questions arising from this report.

No part of this report is to be reproduced unless in full.

Signed



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References:

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Standards Australia (2007), Australian Standard (4373-2007) - Pruning of Amenity trees, Standards Australia, Homebush, NSW.

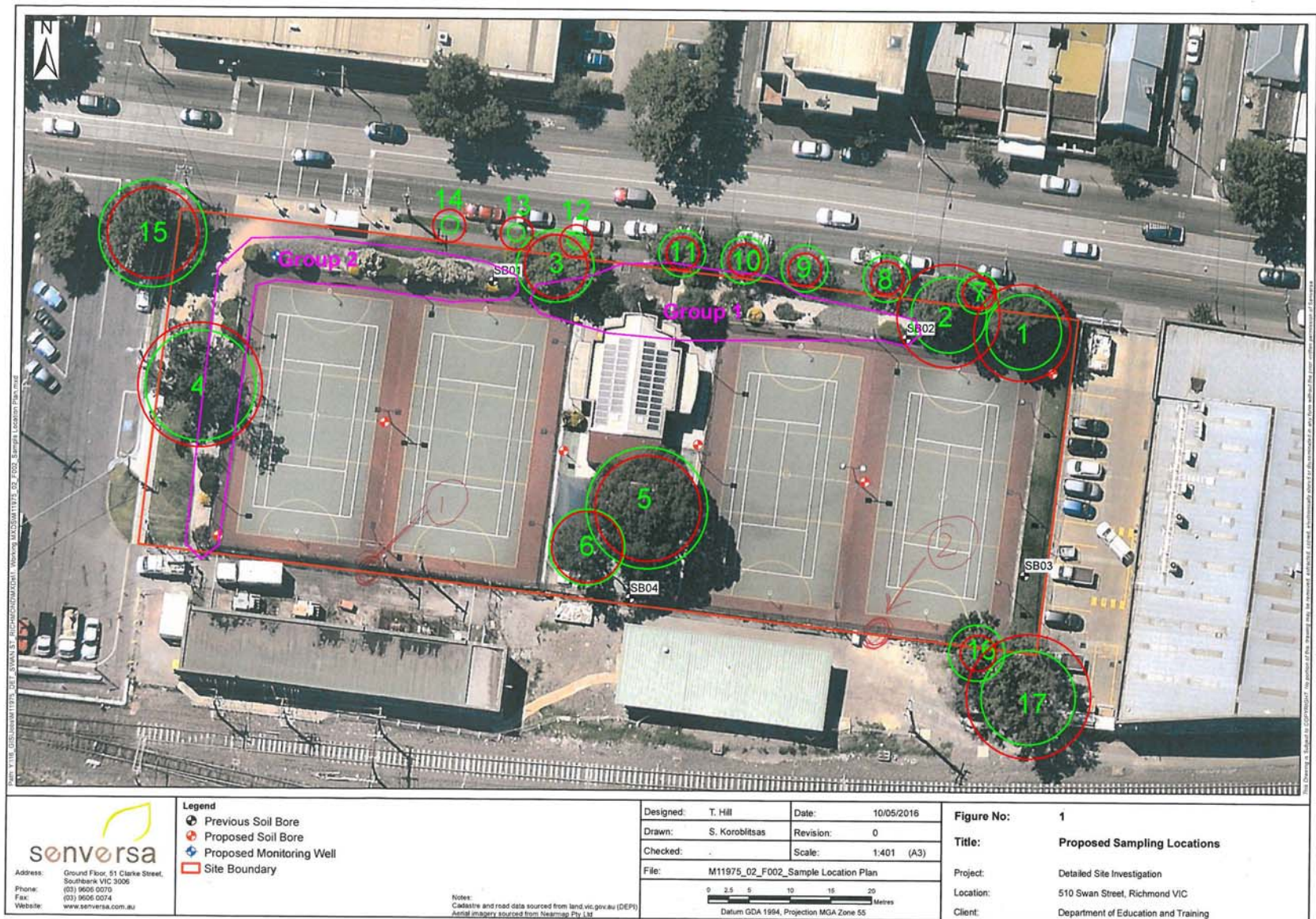
Appendix 1: Tree details: 510 Swan Street, Richmond

DBH = Diameter at Breast Height (measured in centimetres at 1.4m above ground unless otherwise stated). TPZ = Tree Protection Zone (metre radius).
Radius distances measured in metres from the centre of trunk. For tree location and numbering refer Appendix 2. See Appendix 3 for Tree descriptors

No.	Species	Common Name	Type	DBH (cm)	Basal (cm)	HxW	Age	Health	Structure	Arb. rating	TPZ (radius m)	SRZ (radius m)	Comments	Recommended works
1	<i>Casuarina cunninghamiana</i>	River She-oak	Australian native	49	58	9x9	Early mature	Fair	Fair	Moderate	5.9	2.6	Powerline pruned, codominant fork at 4 m	
2	<i>Casuarina cunninghamiana</i>	River She-oak	Australian native	52	58	10x9	Early mature	Fair	Fair	Moderate	6.2	2.6	Powerline pruned.	
3	<i>Ulmus parvifolia</i>	Chinese Elm	Exotic deciduous	31	38	6x11	Semi-mature	Fair	Fair	Moderate	3.7	2.2	Powerline pruned.	Weight reduction on westerly overextending limbs.
4	<i>Fraxinus angustifolia</i> subsp. <i>angustifolia</i>	Desert Ash	Exotic deciduous	72	80	10x15	Mature	Fair-poor	Poor	Low	8.6	3	Lopped, Epicormic end shoots, Previous branch failures.	Deadwood removal.
5	<i>Corymbia citriodora</i>	Lemon-scented Gum	Australian native	53	65	11 x 15	Early mature	Fair	Fair	Moderate	6.4	2.8	Round balanced canopy, Minor deadwood, Overextended limbs	Weight reduction on overextending limbs.
6	<i>Corymbia citriodora</i>	Lemon-scented Gum	Australian native	36	44	12 x 8	Semi-mature	Fair	Fair-poor	Moderate	4.3	2.3	Codominant fork with Included bark @ 4m, Minor deadwood,	Reduce lesser south-easterly codominant stem
7	<i>Platanus Xacerifolia</i>	London Plane	Exotic deciduous	7	18	4x4	Semi-mature	Poor	Fair-poor	Low	2.0	1.6	Street tree, Lopped, Poor vigour, Union decay	
8	<i>Platanus Xacerifolia</i>	London Plane	Exotic deciduous	24	35	4x5	Semi-mature	Fair-poor	Fair-poor	Low	2.9	2.1	Street tree, Lopped, Poor vigour, Codominant fork.	
9	<i>Platanus Xacerifolia</i>	London Plane	Exotic deciduous	25	31	4x4	Semi-mature	Fair-poor	Fair-poor	Low	3.0	2	Street tree, Lopped, Poor vigour.	
10	<i>Platanus Xacerifolia</i>	London Plane	Exotic deciduous	25	31	4x8	Semi-mature	Fair-poor	Fair-poor	Low	3.0	2	Street tree, Lopped, Powerline pruned.	
11	<i>Platanus Xacerifolia</i>	London Plane	Exotic deciduous	25	31	4x8	Semi-mature	Fair-poor	Fair-poor	Low	3.0	2	Street tree, Lopped, Powerline pruned, Epicormics	
12	<i>Lagerstroemia indica</i>	Crepe Myrtle	Exotic deciduous	3	3	2x1	Young	Fair	Fair	Low (size)	2.0	2	Street tree.	
13	<i>Lagerstroemia indica</i>	Crepe Myrtle	Exotic deciduous	3	3	2x1	Young	Fair	Fair	Low (size)	2.0	2	Street tree.	
14	<i>Lagerstroemia indica</i>	Crepe Myrtle	Exotic deciduous	3	3	2x1	Young	Fair	Fair	Low (size)	2.0	2	Street tree.	
15	<i>Platanus Xacerifolia</i>	London Plane	Exotic deciduous	45	53	14x10	Early mature	Fair	Fair-poor	Moderate	5.4	2.5	Street tree, Powerline pruned, Overextended limb, Unbalanced canopy.	
16	<i>Fraxinus angustifolia</i> subsp. <i>angustifolia</i>	Desert Ash	Exotic deciduous	20	36	5x5	Semi-mature	Fair-poor	Fair-poor	Low	2.4	2.2	Neighbouring tree, Self seeded, Suppressed canopy.	
17	<i>Schinus areira</i>	Peppercorn Tree	Exotic evergreen	121	150	12x16	Mature	Fair	Fair-poor	Moderate	14.5	3.9	Neighbouring tree, Minor deadwood, Western lean	
Grp 1	<i>Pittosporum eugenioides</i> 'Variegatum'	Variegated Tarata	Exotic evergreen	10	15	3x3	Semi-mature	Fair	Fair	Low (size)	1.2	1.5	Group of <i>Pittosporum eugenioides</i> 'Variegatum', <i>Pittosporum tenuifolium</i> and <i>Photonia serratafolia</i>	
Grp 2	<i>Pittosporum tenuifolium</i>	Kohuhu	Exotic evergreen	10	31	5x4	Early mature	Fair-poor	Fair	Low (size)	1.2	2	Group of Hedge shrubs x4 with variegated species intermingled	

Appendix 2: Tree numbers and locations: 510 Swan Street, Richmond.

Refer to following page.
Green circle: Tree with tree
number. Red circle: Tree
Protection Zone



Appendix 3: Arboricultural Descriptors (April 2015)

Note that not all of the described tree descriptors may be used in a tree assessment and report. The assessment is undertaken with regard to contemporary arboricultural practices and consists of a visual inspection of external and above-ground tree parts.

1. Tree Condition

The assessment of tree condition evaluates factors of health and structure. The descriptors of health and structure attributed to a tree evaluate the individual specimen to what could be considered typical for that species growing in its location under current climatic conditions. For example, some species can display inherently poor branching architecture, such as multiple acute branch attachments with included bark. Whilst these structural defects may technically be considered arboriculturally poor, they are typical for the species and may not constitute an increased risk of failure. These trees may be assigned a structural rating of fair-poor (rather than poor) at the discretion of the assessor.

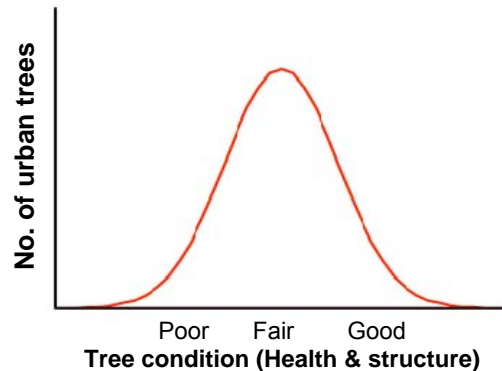


Diagram 1: Indicative normal distribution curve for tree condition

Diagram 1, provides an indicative distribution curve for tree condition to illustrate that within a normal tree population the majority of specimens are centrally located within the condition range (normal distribution curve). Furthermore, that those individual trees with an assessed condition approaching the outer ends of the spectrum occur less often.

2. Tree Name

Provides botanical name, (genus, species, variety and cultivar) according to accepted international code of taxonomic classification, and common name.

3. Tree Type

Describes the general geographic origin of the species and its type e.g. deciduous or evergreen.

Category	Description
Indigenous	Occurs naturally in the area or region of the subject site. Remnant.
Victorian native	Occurs naturally within some part of the State of Victoria (not exclusively) but is not indigenous (component of EVC benchmark). Could be planted indigenous trees.
Australian native	Occurs naturally within Australia but is not a Victorian native or indigenous
Exotic deciduous	Occurs outside of Australia and typically sheds its leaves during winter
Exotic evergreen	Occurs outside of Australia and typically holds its leaves all year round
Exotic conifer	Occurs outside of Australia and is classified as a gymnosperm
Native conifer	Occurs naturally within Australia and is classified as a gymnosperm
Native Palm	Occurs naturally within Australia. Woody monocotyledon
Exotic Palm	Occurs outside of Australia. Woody monocotyledon

4. Height and Width

Indicates height and width of the individual tree; dimensions are expressed in metres. Crown heights are measured with a height meter where possible. Due to the topography of some sites and/or the density of vegetation it may not be possible to do this for every tree. Tree heights may be estimated in line with previous height meter readings in conjunction with assessor's experience. Crown widths are generally paced (estimated) at the widest axis or can be measured on two axes and averaged. In some instances the crown width can be measured on the four cardinal direction points (North, South, East and West).

Crown height, crown spread are generally recorded to the nearest half metre (crown spread would be rounded up) for dimensions up to 10 m and the nearest whole metre for dimensions over 10 m. Estimated dimensions (e.g. for off-site or otherwise inaccessible trees where accurate data cannot be recovered) shall be clearly identified in the assessment data.

5. Trunk diameters

The position where trunk diameters are captured may vary dependent on the requirements of the specific assessment and an individual trees specific characteristics. DBH is the typical trunk diameter captured as it relates to the allocation of tree protection distances. The basal trunk diameter assists in the allocation of a structural root zone. Some municipalities require trunk diameters be captured at different heights, with 1.0 m above grade being a common requirement. The specific planning schemes will be checked to ascertain requirements.

Stem diameters shall be recorded in centimetres, rounded to the nearest 1 cm (0.01 m).

Diameter at Breast Height (DBH)

Indicates the trunk diameter (expressed in centimetres) of an individual tree measured at 1.4m above the existing ground level or where otherwise indicated, multiple leaders are measured individually. Plants with multiple leader habit may be measured at the base. The range of methods to suit particular trunk shapes, configurations and site conditions can be seen in Appendix A of Australian Standard *AS 4970-2009 Protection of trees on development sites*. Measurements undertaken using foresters tape or builders tape.

Basal trunk diameter

The basal dimension is the trunk diameter measured at the base of the trunk or main stem(s) immediately above the root buttress. Used to ascertain the Structural Root Zone (SRZ) as outlined in AS4970.

6. Health

Assesses various attributes to describe the overall health and vigour of the tree.

Category	Vigour, Extension growth	Decline symptoms, Deadwood, Dieback	Foliage density, colour, size, intactness	Pests and or disease
Good	Above typical. Excellent. Full canopy density	Negligible	Better than typical	Negligible
Fair	Typical. 90-100% canopy density	Minor or expected. Little or no dead wood	Typical. Minor deficiencies or defects could be present.	Minor, within damage thresholds
Fair to Poor	Below typical - low vigour	More than typical. Small sub-branch dieback	Exhibiting deficiencies. Could be thinning, or smaller	Exceeds damage thresholds
Poor	Minimal - declining	Excessive, large and/or prominent amount & size of dead wood	Exhibiting severe deficiencies. Thinning foliage, generally smaller or deformed	Extreme and contributing to decline
Dead	N/A	N/A	N/A	N/A

7. Structure

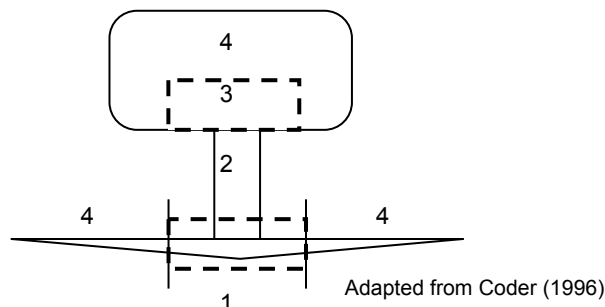
Assesses principal components of tree structure (Diagram 2).

Descriptor	Zone 1 - Root plate & lower stem	Zone 2 - Trunk	Zone 3 - Primary branch support	Zone 4 - Outer crown and roots
Good	No obvious damage, disease or decay; obvious basal flare / stable in ground	No obvious damage, disease or decay; well tapered	Well formed, attached, spaced and tapered. No history of failure.	No obvious damage, disease, decay or structural defect. No history of failure.
Fair	Minor damage or decay. Basal flare present.	Minor damage or decay	Generally well attached, spaced and tapered branches. Minor structural deficiencies may be present or developing. No history of branch failure.	Minor damage, disease or decay; minor branch end-weight or over-extension. No history of branch failure.
Fair to Poor	Moderate damage or decay; minimal basal flare.	Moderate damage or decay; approaching recognised thresholds	Weak, decayed or with acute branch attachments; previous branch failure evidence	Moderate damage, disease or decay; moderate branch end-weight or over-extension. Minor branch failure evident.
Poor	Major damage, disease or decay; fungal fruiting bodies present. Excessive lean placing pressure on root plate	Major damage, disease or decay; exceeds recognised thresholds; fungal fruiting bodies present. Acute lean. Stump re-sprout	Decayed, cavities or has acute branch attachments with included bark; excessive compression flaring; failure likely. Evidence of major branch failure.	Major damage, disease or decay; fungal fruiting bodies present; major branch end-weight or over-extension. Branch failure evident.
Very Poor	Excessive damage, disease or decay; unstable / loose in ground; altered exposure; failure probable	Excessive damage, disease or decay; cavities. Excessive lean. Stump re-sprout	Decayed, cavities or branch attachments with active split; failure imminent. History of major branch failure.	Excessive damage, disease or decay; excessive branch end-weight or over-extension. History of branch failure.

Structure ratings will also take into account general branching architecture, stem taper, live crown ratio, crown symmetry (bias or lean) and crown position such as tree being suppressed amongst more dominant trees.

Diagram 2: Tree structure zones

Root plate & lower stem
Trunk
Primary branch support
Outer crown & roots



The lowest or worst descriptor assigned to the tree in any column could generally be the overall rating assigned to the tree. The assessment for structure is limited to observations of external and above ground tree parts. It does not include any exploratory assessment of underground or internal tree parts unless this is requested as part of the investigation. Trees are assessed and then given a rating for a point in time. Generally, trees with a poor or very poor structure are beyond the benefit of practical arboricultural treatments.

The management of trees in the urban environment requires appropriate arboricultural input and consideration of risk. Risk potential will take into account the combination of likelihood of failure and impact, including the perceived importance of the target(s).

8. Age class

Relates to the physiological stage of the tree's life cycle.

Category	Description
Young	Sapling tree and/or recently planted. Approximately 5 or less years in location.
Semi-mature	Tree increasing in size and yet to achieve expected size in situation. Primary developmental stage.
Early-mature	Tree established, generally growing vigorously. 50% of attainable age/size.
Mature	Specimen approaching expected size in situation, with reduced incremental growth.
Over-mature	Mature full-size with a retrenching crown. Tree is senescent and in decline. Significant decay generally present.

9. Arboricultural Rating

Relates to the combination of tree condition factors, including health and structure (arboricultural merit), and also conveys an amenity value. Amenity relates to the trees biological, functional and aesthetic characteristics (Hitchmough 1994) within an urban landscape context. The presence of any serious disease or tree-related hazards that would impact risk potential are taken into account.

Category	Description
High	Tree of high quality in good to fair condition. Generally a prominent arboricultural/landscape feature. These trees have the potential to be a medium- to long-term component of the landscape if managed appropriately. Retention of these trees is highly desirable.
Moderate	Tree of moderate quality, in fair or better condition. Tree may have a condition, and or structural problem that will respond to arboricultural treatment. These trees have the potential to be a medium- to long-term component of the landscape if managed appropriately. Retention of these trees is generally desirable.
Low	Unremarkable tree of low quality or little amenity value. Tree in either poor health or with poor structure or a combination. Tree is not significant because of either its size or age, such as young trees with a stem diameter below 15 cm. These trees are easily replaceable. Tree (species) is functionally inappropriate to specific location and would be expected to be problematic if retained. Retention of such trees may be considered if not requiring a disproportionate expenditure of resources for a tree in its condition and location.
None	Trees of low quality with an estimated remaining life expectancy of less than 5 years. Tree has either a severe structural defect or health problem or combination that cannot be sustained with practical arboricultural techniques and the loss of the tree would be expected in the short term. Trees that are dead or are showing signs of significant, immediate, and irreversible overall decline. Tree infected with pathogens of significance to either the health or safety of the tree or other adjacent trees. Tree whose retention would not be viable after the removal of adjacent trees (includes trees that have developed in close spaced groups and would not be expected to acclimatise to severe alterations to surrounding environment – removal of adjacent shelter trees). Tree has a detrimental effect on the environment, for example, the tree is a recognised environmental woody weed with potential to spread into waterways or natural areas. Unremarkable tree of no material landscape, conservation or other cultural value.

Trees have many values, not all of which are considered when an arboricultural assessment is undertaken. However, individual trees or tree group features may be considered important community resources because of unique or noteworthy characteristics or values other than their age, dimensions, health or structural condition. Recognition of one or more of the following criterion is designed to highlight other considerations that may influence the future management of such trees.

Significance	Description
Horticultural Value/ Rarity	Outstanding horticultural or genetic value; could be an important source of propagating stock, including specimens that are particularly resistant to disease or exposure. Any tree of a species or variety that is rare.
Historic, Aboriginal Cultural or Heritage Value	Tree could have value as a remnant of a particular important historical period or a remnant of a site or activity no longer in action. Tree has a recognised association with historic aboriginal activities, including scar trees. Tree commemorates a particular occasion, including plantings by notable people, or having associations with an important event in local history.
Ecological Value	Tree could have value as habitat for indigenous wildlife, including providing breeding, foraging or roosting habitat, or is a component of a wildlife reserve. Remnant Indigenous vegetation that contribute to biological diversity

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Appendix 4: Tree protection zones.

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Introduction

In order to sustain trees on a development site consideration must be given to the establishment of tree protection zones.

The physical dimensions of tree protection zones can sometimes be difficult to define. The projection of a tree's crown can provide a guide but is by no means the definitive measure. The unpredictable nature of roots and their growth, differences between species and their tolerances, and observable and hidden changes to the trees growing environment, as a result of development, are variables that must be considered.

Most vigorous, broad canopied trees survive well if the area within the drip-line of the canopy is protected. Fine root density is usually greater beneath the canopy than beyond (Gilman, 1997). If few to no roots over 3cm in diameter are encountered and severed during excavation the tree will probably tolerate the impact and root loss. A healthy tree can sustain a loss of between 30% and 50% of absorbing roots (Harris, Clark, Matheny, 1999), however encroachment into the structural root system of a tree may be problematic.

The structural root system of a tree is responsible for ensuring the stability of the entire tree structure in the ground. A tree could not sustain loss of structural root system and be expected to survive let alone stand up to average annual wind loads upon the crown.

Allocation of tree protection zone (TPZ)

The method of allocating a TPZ to a particular tree will be influenced by site factors, the tree species, its age and developed form.

Once it has been established, through an arboricultural assessment, which trees and tree groups are to be retained, the next step will require careful management through the development process to minimise any impacts on the designated trees. The successful retention of trees on any particular site will require the commitment and understanding of all parties involved in the development process. The most important activity, after determining the trees that will be retained is the implementation of a TPZ.

The intention of tree protection zones is to:

- mitigate tree hazards;
- provide adequate root space to sustain the health and aesthetics of the tree into the future;
- minimise changes to the trees growing environment, which is particularly important for mature specimens;
- minimise physical damage to the root system, canopy and trunk; and
- define the physical alignment of the tree protection fencing

Tree protection

The most important consideration for the successful retention of trees is to allow appropriate above and below ground space for the trees to continue to grow. This requires the allocation of tree protection zones for retained trees.

The Australian Standard AS 4970-2009 Protection of trees on development sites has been used as a guide in the allocation of TPZs for the assessed trees.

The TPZ for individual trees is calculated based on trunk (stem) diameter (DBH), measured at 1.4 metres up from ground level. The radius of the TPZ is calculated by multiplying the trees DBH by 12. The method provides a TPZ that addresses both the stability and growing requirements of a tree. TPZ distances are measured as a radius from the centre of the trunk at (or near) ground level. The minimum TPZ should be no less than 2m and the maximum no more than 15m radius. The TPZ of palms should be not less than 1.0m outside the crown projection.

Encroachment into the TPZ is permissible under certain circumstances though is dependent on both site conditions and tree characteristics. Minor encroachment, up to 10% of the TPZ, is generally permissible provided encroachment is compensated for by recruitment of an equal area contiguous with the TPZ. Examples are provided in Diagram 1. Encroachment greater than 10% is considered major encroachment under AS4970-2009 and is only permissible if it can be demonstrated that after such encroachment the tree would remain viable.

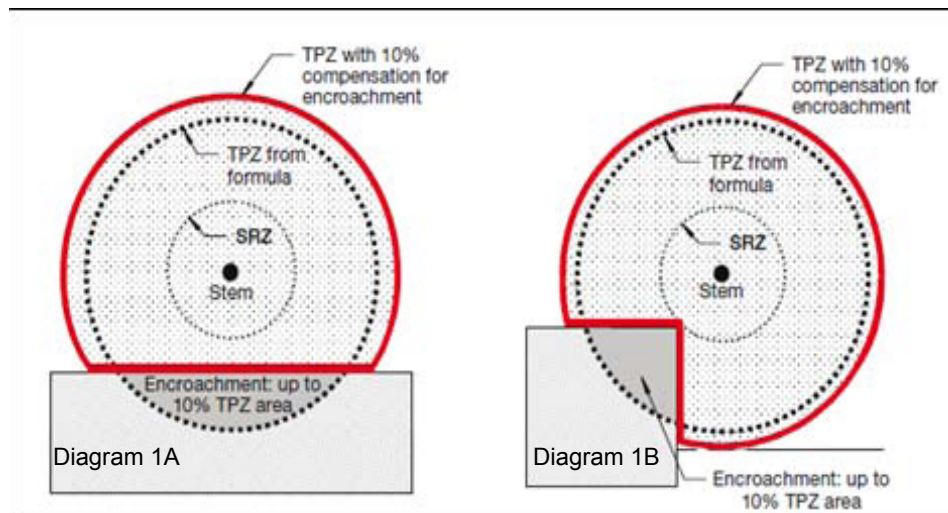


Diagram 1: Examples of minor encroachment into a TPZ.

(Extract from: AS4970-2009, Appendix D, p30 of 32)

The 10% encroachment on one side equates to approximately $\frac{1}{3}$ radial distance. Tree root growth is opportunistic and occurs where the essentials to life (primarily air and water) are present. Heterogeneous soil conditions, existing barriers, hard surfaces and buildings may have inhibited the development of a symmetrically radiating root system.

Existing infrastructure around some trees may be within the TPZ or root plate radius. The roots of some trees may have grown in response to the site conditions and therefore if existing hard surfaces and building alignments are utilised in new designs the impacts on the trees should be minimal. The most reliable way to estimate root disturbance is to find out where the roots are in relation to the demolition, excavation or construction works that will take place (Matheny & Clark, 1998). Exploratory excavation prior to commencement of construction can help establish the extent of the root system and where it may be appropriate to excavate or build.

The TPZ should also give consideration to the canopy and overall form of the tree. If the canopy requires severe pruning in order to accommodate a building and in the process the form of the tree is diminished it may be worthwhile considering altering the design or removing the tree.

General tree protection guidelines

The most important factors are:

- Prior to construction works the trees nominated for tree works should be pruned to remove larger dead wood. Pruning works may also identify other tree hazards that require remedial works.
- Installation of tree protection fencing. Once the tree protection zones have been determined the next step is to mulch the zone with woodchip and erect tree protection fencing. This must be completed prior to any materials being brought on-site, erection of temporary site facilities or demolition/earth works. The protection fencing must be sturdy and withstand winds and construction impacts. The protection fence should only be moved with approval of the site supervisor. Other root zone protection methods can be incorporated if the TPZ area needs to be traversed.
- Appropriate signage is to be fixed to the fencing to alert people as to importance of the tree protection zone.
- The importance of tree preservation must be communicated to all relevant parties involved with the site.
- Inspection of trees during excavation works.

Exploratory excavation

The most reliable way to estimate root disturbance is to find out where the roots are in relation to the demolition, excavation or construction works that will take place (Matheny & Clark, 1998).

Exploratory excavation prior to commencement of construction can help establish the extent of the root system and where it may be appropriate to excavate or build. This also allows management decisions to be made and allows time for redesign works if required.

Any exploratory excavation within the allocated TPZ is to be undertaken with due care of the roots. Minor exploration is possible with hand tools. More extensive exploration may require the use of high pressure water or air excavation techniques. Either hydraulic or pneumatic excavation techniques will safely expose tree roots; both have specific benefits dependent on the situation and soil type. An arborist is to be consulted on which system is best suited for the site conditions.

Substantial roots are to be exposed and left intact.

Once roots are exposed decisions can be made regarding the management of the tree. Decisions will be dependent on the tree species, its condition, its age, its relative tolerance to root loss, and the amount of root system exposed and requiring pruning.

Other alternative measures to encroaching the TPZ may include boring or tunnelling.

How to determine the diameter of a substantial root

The size of a substantial root will vary according to the distance of the exposed root to the trunk of the tree. The further away from the trunk of a tree that a root is, the less significant the root is likely to be to the tree's health and stability.

The determination of what is a substantial root is often difficult because the form, depth and spread of roots will vary between species and sites. However, because smaller roots are connected to larger roots in a framework, there can be no doubt that if larger roots are severed, the smaller roots attached to them will die. Therefore, the larger the root, the more significant it may be.

Gilman (1997) suggests that trees may contain 4-11 major lateral roots and that the five largest lateral roots account (act as a conduit) for 75% of the total root system.

These large lateral roots quickly taper within a distance to the tree, this distance is identified as the Structural Root Zone (SRZ). Within the SRZ distance, all roots and the soil surrounding the roots are deemed significant.

No root or soil disturbance is permitted within the SRZ.

In the area outside the SRZ the tree may tolerate the loss of one or a number of roots. The table below indicates the size of tree roots, outside the SRZ that would be deemed substantial for various tree heights. The assessment of combined root loss within the TPZ would need to be undertaken by an arborist on an individual basis because the location of the tree, its condition and environment would need to be assessed.

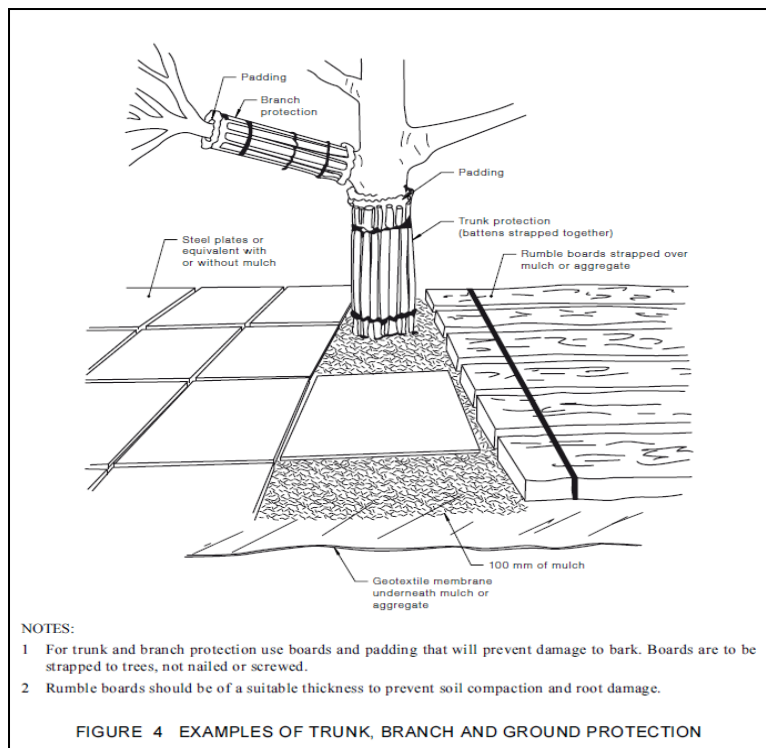
Table 1: Estimated significant root sizes outside SRZ

Height of tree	Diameter of root
Less than 5m	≥ 30mm
Between 5m - 15m	≥ 50mm
More than 15m	≥ 70mm

Ground buffering

Where works are required to be undertaken within the Tree root zone without penetration of the surface, ground buffering and trunk and limb protection must be provided to minimise the potential for soil to become compacted and avoid potential for impact wounds to occur to surface roots, trunk or limbs. Refer below.

Diagram 2: Examples of ground buffering and trunk and limb protection.



(Extract from: AS4970-2009, Appendix D, pg17)

Construction Guidelines

The following are guidelines that must be implemented to minimise the impact of the proposed construction works on the retained trees.

- The Tree Protection Zone (TPZ) is fenced and clearly marked at all times. The actual fence specifications should be a minimum of 1.2 - 1.5 metres of chain mesh or like fence with 1.8 meter posts (e.g. treated pine or star pickets) or like support every 3-4 metres and a top line of high visibility plastic hazard tape. The posts should be strong enough to sustain knocks from on site excavation equipment. This fence will deter the placement of building materials, entry of heavy equipment and vehicles and also the entry of workers and/or the public into the TPZ. Note: There are many different variations on the construction type and material used for TPZ fences, suffice to say that the fence should satisfy the responsible authority.
- Contractors and site workers should receive written and verbal instruction as to the importance of tree protection and preservation within the site. Successful tree preservation occurs when there is a commitment from all relevant parties involved in designing, constructing and managing a development project. Members of the project team need to interact with each other to minimise the impacts to the trees, either through design decisions or construction practices. The importance of tree preservation must be communicated to all relevant parties involved with the site.
- The consultant arborist is on-site to supervise excavation works around the existing trees where the TPZ will be encroached.
- A layer of organic mulch (woodchips) to a depth of no more than 100mm should be placed over the root systems within the TPZ of trees, which are to be retained so as to assist with moisture retention and to reduce the impact of compaction.
- No persons, vehicles or machinery to enter the TPZ without the consent of the consulting arborist or site manager.
- Where machinery is required to operate inside the TPZ it must be a small skid drive machine (i.e. Dingo or similar) operating only forwards and backwards in a radial direction facing the tree trunk and not altering direction whilst inside the TPZ to avoid damaging, compacting or scuffing the roots.
- Any underground service installations within the allocated TPZ should be bored and utility authorities should common trench where possible.
- No fuel, oil dumps or chemicals shall be allowed in or stored on the TPZ and the servicing and re-fuelling of equipment and vehicles should be carried out away from the root zones.
- No storage of material, equipment or temporary building should take place over the root zone of any tree.
- Nothing whatsoever should be attached to any tree including temporary services wires, nails, screws or any other fixing device.
- Supplementary watering should be provided to all trees through any dry periods during and after the construction process. Proper watering is the most important maintenance task in terms of successfully retaining the designated trees. The areas under the canopy drip lines should be mulched with woodchip to a depth of no more than 100mm. The mulch will help maintain soil moisture levels. Testing with a soil probe in a number of locations around the tree will help ascertain soil moisture levels and requirements to irrigate. Water needs to be applied slowly to avoid runoff. A daily watering with 5 litres of water for every 30 mm of trunk calliper may provide the most even soil moisture level for roots (Watson & Himelick, 1997), however light frequent irrigations should be avoided. Irrigation should wet the entire root zone and be allowed to dry out prior to another application. Watering should continue from October until April.

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