REDGUM Horticultural
Arboriculture & Horticulture Consultants

REPORT:

ARBORICULTURAL IMPACT ASSESSMENT

157 Church Street, Ryde, NSW

Prepared 30 November 2015
Our Ref: 1684

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PREFACE

Redgum Horticultural has prepared this report for Brain Mann, Robertson & Marks *(the architect)* on behalf of Christina Boumelhem, Assistant Project Manager, Holdmark Property Group (*the client),* Suite 2, 2- Giffnock Avenue, Macquarie Park. Mr. Neville Shields (*the author*) attended 157 Church Street, Ryde, NSW (*the site*), on 19 November 2015, all the trees and their growing environment were examined. The site is subject to a Development Application and this report and any works recommended herein, that require approval from the consenting authority, forms part of that development application.

INTRODUCTION

The land is located in the Ryde Council (*the Council)* Local Government Area (*LGA*) and the trees are protected under Councils Development Control Plan 2010. The Council is the consenting authority for development works on the site. This report involves 17 trees (*the trees*), as indicated on Site Plan A - Survey of Subject Trees (Appendix E) and considers the removal of thirteen (13) trees within the property and adjacent on the road reserve and the retention of four (4) trees within the adjacent Council reserve. The trees will be considered as 1 stand to encompass all trees within and immediately adjacent to the site, where appropriate, as marked on Appendix E, Site Plan A – Survey of Subject Trees. ***Tree Protection Zone*** fencing or works are marked on the Appendix F, Site Plan B - Trees to be Retained and Tree Protection Zones.

The site is comprised of four parcels of land where the existing structures are to be demolished and are to be replaced with a proposed mixed use development, requiring the removal of thirteen (13) existing trees within the site. As part of the Landscape Plan where appropriate, the tree cover on the site will be enhanced by planting with advanced specimens/s of appropriate tree species for the space available above and below ground being soil volumes available and to prevent future conflict between trees and built structures.

The proposed building design and its configuration and infrastructure were arrived at following the undertaking of an arboricultural assessment of the trees on the site to determine their significance by Redgum Horticultural. The plans provided do not show the location of sewer, water or electricity supply to the proposed development.

Setbacks for the new works and associated infrastructure should provide sufficient space to protect the existing growing environments both above and below ground for trees to be retained, and so that trees within the property and on adjoining properties will not be adversely affected.

The proposed design has considered the spatial requirements for the trees to be retained based on the information available or provided at the time of compiling this report, and those areas to be protected will be discussed further. The Summary lists the general condition of trees and a summary of works in Table 1.0. In section 5.0 each individual tree is described in greater detail including protective or remedial works. Tree maintenance works including pruning, removal or transplantation are detailed in section 4.0.

SUMMARY

This report considers 17 trees, 1 tree within the site, 1 in the Council reserve and 15 trees within the road reserve / property boundary. The trees to be retained and protected are Trees 1, 2, 3 & 4 and Trees 5, 6, 7, 8, 9, 10, 11, 12, 13, 14^{x3} & 15 are recommended to be removed. For Tree 1; the alignment of the development is sufficiently setback to not affect this specimen. Tree 2; will be subject to a major encroachment, the basement within the Tree Protection Zone of this specimen is to be constructed using a vertical cut with shotcrete and contiguous pilings to reduce any impact on its stability. If associated infrastructure (*pipe works*) is to be installed within this area, it also has to be installed by hand with non-motorised machinery. If structural roots are found within the trench, they are to be left intact and dug around retaining this specimen's structural integrity. Minor crown raising of this specimen may be required to clear access over the proposed development. Works are to be undertaken by a qualified arborist and supervised by the project arborist if required by Council. Tree 3 & 4; the alignment of the basement is sufficiently setback to not affect these specimens.

The impact will be that of minor encroachment for Tree 1, 3 & 4 while Tree 2 will be subject to major encroachment which are to be retained and protected as per AS 4970 (2009) Section 3, 3.3.3 Major Encroachments from development works within >10% of the area of the Tree Protection Zone. These excavations must be supervised and certified by the Project Arborist in accordance with AS4970 (2009).

Table 1.0 General condition of trees and Schedule of works. Trees described in greater detail in section 5.0.

Tree No.	*Genus and species*	Common name	Condition G = Good, F = Fair P = Poor, D = Dead	Description of work to be done
1	*Ficus rubiginosa*	Port Jackson Fig	G	Retain and protect within a Tree Protection Zone (TPZ) as per the Tree Protection Plan - *Council Reserve Specimen*
2	*Jacaranda mimosifolia*	Jacaranda	F	Retain and protect within a Tree Protection Zone (TPZ) as per the Tree Protection Plan – *Street Tree Specimen*
3	*Allocasuarina littoralis*	Black She Oak	F	Retain and protect within a Tree Protection Zone (TPZ) as per the Tree Protection Plan – *Street Tree Specimen*
4	*Allocasuarina littoralis*	Black She Oak	F	Retain and protect within a Tree Protection Zone (TPZ) as per the Tree Protection Plan – *Street Tree Specimen*
5	*Melaleuca bracteata 'Revolution Green'*	Revolution Green Paperbark	F	Remove and replace with by new plantings as per Landscape Plan – *Street Tree Specimen*
6	*Melaleuca bracteata 'Revolution Green'*	Revolution Green Paperbark	F	Remove and replace with by new plantings as per Landscape Plan – *Street Tree Specimen*
7	*Melaleuca bracteata 'Revolution Green'*	Revolution Green Paperbark	F	Remove and replace with by new plantings as per Landscape Plan – *Street Tree Specimen*
8	*Melaleuca bracteata 'Revolution Green'*	Revolution Green Paperbark	F	Remove and replace with by new plantings as per Landscape Plan – *Street Tree Specimen*
9	*Melaleuca bracteata 'Revolution Green'*	Revolution Green Paperbark	F	Remove and replace with by new plantings as per Landscape Plan – *Street Tree Specimen*
10	*Melaleuca bracteata 'Revolution Green'*	Revolution Green Paperbark	F	Remove and replace with by new plantings as per Landscape Plan – *Street Tree Specimen*
11	*Melaleuca bracteata 'Revolution Green'*	Revolution Green Paperbark	F	Remove and replace with by new plantings as per Landscape Plan – *Street Tree Specimen*
12	*Melaleuca bracteata 'Revolution Green'*	Revolution Green Paperbark	F	Remove and replace with by new plantings as per Landscape Plan – *Street Tree Specimen*
13	*Melaleuca bracteata 'Revolution Green'*	Revolution Green Paperbark	F	Remove and replace with by new plantings as per Landscape Plan – *Street Tree Specimen*
14/2	*Melaleuca bracteata 'Revolution Green' x3*	Revolution Green Paperbark	F	Remove and replace with by new plantings as per Landscape Plan – *Street Tree Specimen*
15	*Gleditsia triacanthos sunburst*	Honey Locust	F	Remove and replace with by new plantings as per Landscape Plan

Table 2.0

This table only applies to trees being retained. Tree Protection Zone fencing locations as measured from the centre of each tree and the recommended distances for the side closest to the building construction works e.g. excavation (see explanatory notes below). Tree Protection Zone fences and setbacks where applicable are indicated in Appendix F and are to be measured on site.

1. Redgum Tree No. / Redgum Stand No.	2. **S**tructural **R**oot **Z**one **SRZ (DARB)** From centre of trunk (COT) **D**iameter **A**bove **R**oot **B**uttress AS4970 2009 Section 3, 3.3.5 (see Appendix C) where applicable (Minimum 1.5 metres)	3. **T**runk **D**iameter at **B**reast **H**eight **DBH** 1.4m above ground, AS4970 2009, or mm or m above ground where indicated. # = average. g = ground	4. **T**ree **P**rotection **Z**one (**TPZ**) = **12 x DBH** From centre of trunk (COT) in metres AS4970 2009Section 3 (see Appendix C) (Minimum 2.0 metres)	5. Distance of fence with TPZ setback **(reduced by 10% of area of TPZ)** in metres as per AS4970 2009 Section 3, 3.3 (Minimum 2.0 metres)	6. Estimated distance of tree protection fence/works on the side closest to building construction[2], in metres by Redgum Horticultural.
1	4.0	1600	15 [23]	15 [23]	10[1,2]
2	2.5	490	5.9	5.3	4.0[1,2]
3	2.2	370	4.4	4.0	3.5[1,2]
4	2.2	390	4.7	4.2	3.5[1,2]

Descriptors for modified setbacks in Column 6.

1 Special conditions apply to protect the roots of trees generally, see discussion points.
2 Additional protective fencing information is detailed in discussion points.
3 Acceptable due to the good relative tolerance of the species to development impacts.
4 Range of setbacks for the trees at each end of a linear stand, see discussion points.
5 Acceptable as fence located at a substantial distance beyond dripline, or may also include the location of a smaller tree in proximity to a larger tree to be retained and the smaller tree being protected well within the protective fencing for that larger tree.
6 Acceptable due to additional special protection works, see Section 5.0 for this tree.
7 Acceptable as pre-existing site conditions were conducive to having restricted the development of root growth in this direction.
8 Street tree with protective fencing of minimal width to allow for pedestrian access along road reserve.
9 Acceptable as tree transplanted reducing the area of the root zone.
10 Acceptable as not effected by development works.
11 Young tree not expected to have established a substantially expansive root system and able to re-establish or modify growth to be sustainable due to age and good vigour.
12 Set back prescribed by the consent authority.
13 Acceptable as tree growing on a lean and encroachment on compression wood side where root growth is of reduced structural importance.
14 Acceptable as root mapping has indicated extent of structural woody roots with a diameter of 20 mm or more.
15 Acceptable as a specimen of palm taxa tolerant of encroachment.
16 Acceptable as excavation on down slope or across slope side of tree.
17 Acceptable as encroachment into growing area below ground minor, with one corner of building or excavation works extending to within the radius of the dripline.
18 Acceptable as encroachment by pier, including screw piles, with minimal disturbance.
19 Acceptable as encroachment above grade without excavation or sub-base compaction.
20 Acceptable as located within 0.5 m from edge of dripline.
21 Acceptable as encroachment with gap graded fill that can accommodate gaseous exchange between roots/soil and the atmosphere and ongoing root growth.
22 Minimum setback 2 m, AS4970 (2009) section 3, 3.2.
23 Maximum setback 15 m, AS4970 (2009) section 3, 3.2.
24 Tree is a palm, other monocot, cycad or tree fern TPZ is to be 1 m outside crown projection AS4970 (2009) section 3, 3.2.
25 Minimum Structural Root Zone (SRZ) for trees less than 0.15 m diameter is 1.5 m, AS4970 (2009) section 3, 3.5.

Explanatory notes for Table 2.0.

This table is based upon Australian Standard AS4970 2009 *Protection of trees on development sites*, Section 3 Determining the protection zone of the selected trees (see Appendix B), where the approved building works should be no closer, including excavation, than the dimensions stated above.

"3.3 Variations to the TPZ
3.3.2 Minor Encroachment
If the proposed encroachment is less than 10% of the area of the TPZ and is outside the SRZ, detailed root investigations should not be required. The area lost to this encroachment should be compensated for elsewhere and contiguous with the TPZ.

3.3.3 Major Encroachment - *If the proposed encroachment is greater than 10% of the area of the TPZ or inside the SRZ the project arborist must demonstrate that the tree(s) would remain viable. The area lost to this encroachment should be compensated for elsewhere and contiguous with the TPZ."*

1.0 AIMS

1.1 Detail the condition of the trees on the site, adjoining properties or adjacent road reserve where such trees may be affected by the proposed works, by assessment of individual trees or stands of trees, and indicate protection measures or remedial works for their retention and protection pre, during and post construction. Consider the location and condition of the trees in relation to the proposed building works and recommend retention and protection or removal and replacement where appropriate. The retained specimens are to remain in a safe and healthy condition, not less than at the time of initial inspection for this report, or in a reduced but sustainable condition due to the impact of the development but ameliorated through tree protection measures recommended to be applied.

1.2 Provide as an outcome of the assessment, the following: a description of the trees, observations made, discussion of the effects the location of the proposed building works may have on the trees, and make recommendations required for remedial or other works to the trees, if and where appropriate. *(See section 5 - Tree Assessment.)*

1.3 Determine from the assessment as detailed in 1.2 a description of the works or measures required to ameliorate the impact upon the trees to be retained, by the proposed building works or future impacts the trees may have upon the new building works if and where appropriate, or the benefits of removal and replacement if appropriate for the medium to long term safety and amenity of the site.

2.0 OBJECTIVES

2.1 Assess the condition of the subject trees.

2.2 Determine impact of development on the subject trees.

2.3 Provide recommendations for retention or removal of the subject trees.

3.0 METHODOLOGY
Note: Individual methodologies applied as applicable.

3.1 The method of assessment of tree/s applied is adapted from the principles of visual tree assessment undertaken from the ground, which considers:

1. Tree health and subsequent stability, both long and short term
2. Sustainable Retention Index Value (SRIV) Version 4 (IACA 2010)©
3. Hazard potential to people and property
4. Amenity values
5. Habitat values
6. Significance

3.2 This assessment is undertaken using standard tree assessment criteria for each tree based on the values above and is implemented as a result of at least one comprehensive and detailed site inspection to undertake a visual tree assessment from the ground of each individual tree, or stand of trees, or a representative population sample. Any dimensions recorded as averages, or by approximation are noted accordingly.

3.3 This report adopts Australian Standard AS4970 2009 *Protection of trees on development sites* as a point of reference and guide for the recommended minimum setbacks (Appendix C) from the centre of a tree's trunk to development works and the distances may be increased or decreased by the author in accordance with AS4970 – Section 3.3.4 as a result of other factors providing mitigating circumstances or constraints as indicated by but not restricted to the following:

1. Condition of individual trees,
2. Tolerance of individual species to disturbance,
3. Geology e.g. physical barriers in soil, rock floaters, bedrock to surface
4. Topography e.g. slope, drainage,
5. Soil e.g. depth, drainage, fertility, structure,
6. Microclimate e.g. due to landform, exposure to dominant wind,
7. Engineering e.g. techniques to ameliorate impact on trees such as structural soil, gap graded fill, lateral boring,
8. Construction e.g. techniques to ameliorate impact on trees such as pier and beam, bridge footings, suspended slabs,
9. Root mapping,
10. Physical limitations - existing modifications to the environment and any impact to tree/s by development e.g. property boundaries, built structures, houses, swimming pools, road reserves, utility services easements, previous impact by excavation, or construction in other directions, soil level changes by cutting or filling, existing landscaping works within close proximity, modified drainage patterns,
11. Extraneous factors e.g. potential future impacts from development on adjoining land when the tree is located on or near to a property boundary.

3.4 Trees in groups may be referred to as stands and a stand may exclusively contain specimens to be either retained or removed or a combination of both. A stand may be used to discuss all the trees on a given site to expedite their assessment, or refer to trees growing proximate to one another or within a defined space. Stands may be comprised by mass boundary or screen plantings, to form a group of the same or a mixture of taxa. Each stand is considered as a single unit with each component tree assessed and expressed in tabular form, or indicated by a given percentage as a population sample of each stand. Where it is appropriate for a stand of trees to be retained in full or part, the location and setback of Tree Protection Zone fences or works, are prescribed to provide for the preservation of the stand or selected component trees, in a condition not less than that at the time of initial inspection for its incorporation into the landscape works for the site, or in a reduced but sustainable condition due to the impact of the development but ameliorated through tree protection measures.

3.5 The meanings for terminology used herein are taken from the IACA Dictionary for Managing Trees in Urban Environments 2009. An extract from the IACA Dictionary forms a glossary of terms included as Appendix D.

4.0 PRUNING STANDARDS

4.1 Any pruning recommended in this report is to be to the Australian Standard® AS4373 *Pruning of amenity trees*, and conducted in accordance with the NSW Work Cover Authority Code of Practice, Tree Work, 2007.

4.2 All pruning or removal works are to be in accordance with the appropriate Tree Management Policy where applicable, or Tree Management Order (TMO), or Tree Preservation Order (TPO).

4.3 Tree maintenance work is specialised and in order to be undertaken safely to ensure the works carried out are not detrimental to the survival of a tree being retained, and to assist in the safe removal of any tree, should be undertaken by a qualified arboriculturist with appropriate competencies recognised within the Australian Qualification Framework, with a minimum of 5 years of continual experience within the industry of operational amenity arboriculture, and covered by appropriate and current types of insurance to undertake such works.

5.0 TREE ASSESSMENT – 5.1 - Assessment of a stand of Trees

Tree / Stand No.	*Genus & Species* Common Name	Age Y = Young M = Mature O = Overmature	Vigour GV = Good Vigour LV = Low Vigour	Condition G = Good F = Fair P = Poor D = Dead	1. SRIV Age, Vigour, Condition / Index Rating www.iaca.org.au / 2. Estimated Life Expectancy 1. Long 2. Medium 3. Short	Crown Form D = Dominant C = Co-dominant I = Intermediate S = Suppressed F = Forest E = Emergent	Ht. Approx. metres	Crown Spread approx. metres / Orientation R = Radial, or other	Crown Symmetry 1 = symmetrical 2 = asymmetrical / Orientation	Crown Cover % / Crown Density % / D = dormant	DBH in mm @ 1.4m, or other, as indicated / Trunk Orientation other than R = radial, e.g. N/S g = ground	Trunk Lean 1 = Upright-Slight 2 = Moderate 3 = Severe 4 = Critical. 5 = Acaulescent / Orientation / ST = Static P = Progressive Sc = Self-correcting	Roots Evident at Root Crown 1. = None 2. = Adventitious 3. = Basal Flare 4. = Buttresses 5. = First Order Roots (FOR), No. & distribution e.g. R = radial, or one each to N, S, E and W	Pests, Diseases & Damage No or Yes If Yes see comments	Branch Bark Included No or Yes or N/A	Form G = Good Form P = Poor Form	Significance scale 1=High 2=Medium 3=Low / Retention Value 1=High 2=Medium 3=Low 4=Remove
1	*Ficus rubiginosa*	M	GV	G	MGVG - 10 2	D	15	20x20 R	1	90 90	1600 R	1/R ST	4 10-R	NO	NO	G	1 1
	Port Jackson Fig	Comment: Trunk to 1.5 metres, crown deliquescent, orientation radial, symmetrical.															
2	*Jacaranda mimosifolia*	M	GV	F	MGVF - 9 2	D	7	7x7 R	1	N/A D	490 @g R	5/R ST	1	NO	NO	G	1 2
	Jacaranda	Comment: Comment: Acaulescent or short trunk @ or near ground, crown deliquescent, orientation radial, symmetrical.															
3	*Allocasuarina littoralis*	M	GV	F	MGVF - 9 2	D	7	2x2 R	1	70 70	370 @g R	5/R ST	1	NO	NO	G	2 2
	Black She Oak	Comment: Acaulescent or short trunk @ or near ground, crown deliquescent, orientation radial, symmetrical.															
4	*Allocasuarina littoralis*	M	GV	F	MGVF - 9 2	D	7	4x3 E/W	2/E	70 70	390 @g R	5/R ST	1	NO	NO	G	2 2
	Black She Oak	Comment: Acaulescent or short trunk @ or near ground, crown deliquescent, orientation E / W, asymmetrical bias to east.															
5	*Melaleuca bracteata 'Revolution Green'*	M	GV	F	MGVF - 9 2	C	5	2x2 R	1	70 70	170 @g R	5/R ST	1	NO	NO	P	3 3
	Revolution Green Paperbark	Comment: Acaulescent or short trunk @ or near ground, crown deliquescent, orientation radial, symmetrical.															
6	*Melaleuca bracteata 'Revolution Green'*	M	GV	F	MGVF - 9 2	C	5	2x2 R	1	60 60	190 @g R	5/R ST	1	NO	NO	G	3 3
	Revolution Green Paperbark	Comment: Acaulescent or short trunk @ or near ground, crown deliquescent, orientation radial, symmetrical.															
7	*Melaleuca bracteata 'Revolution Green'*	M	GV	F	MGVF - 9 2	C	5	3x2 N/S	2/W	60 60	310 @g R	5/R ST	1	NO	NO	G	3 3
	Revolution Green Paperbark	Comment: Acaulescent or short trunk @ or near ground, crown deliquescent, orientation N / S, asymmetrical bias to west.															
8	*Melaleuca bracteata 'Revolution Green'*	M	GV	F	MGVF - 9 2	C	5	3x2 E/W	2/W	60 60	170 @g R	5/R ST	1	NO	NO	G	3 3
	Revolution Green Paperbark	Comment: Acaulescent or short trunk @ or near ground, crown deliquescent, orientation E / W, asymmetrical bias to west.															
9	*Melaleuca bracteata 'Revolution Green'*	M	GV	F	MGVF - 9 2	C	5	3x2 E/W	2/W	60 60	300 @g R	5/R ST	1	NO	NO	G	3 3
	Revolution Green Paperbark	Comment: Acaulescent or short trunk @ or near ground, crown deliquescent, orientation E / W, asymmetrical bias to west.															
10	*Melaleuca bracteata 'Revolution Green'*	M	GV	F	MGVF - 9 2	C	5	3x2 N/S	2/W	60 60	170 @g R	5/R ST	1	NO	NO	G	3 3
	Revolution Green Paperbark	Comment: Acaulescent or short trunk @ or near ground, crown deliquescent, orientation N / S, asymmetrical bias to north.															

Tree No.	*Genus & Species* Common Name	Age Y = Young M = Mature O = Overmature	Vigour GV = Good Vigour LV = Low Vigour	Condition G = Good F = Fair P = Poor D = Dead	1. SRIV Age, Vigour, Condition / Index Rating www.iaca.org.au / 2. Estimated Life Expectancy 1. Long 2. Medium 3. Short	Crown Form D = Dominant C = Co-dominant I = Intermediate S = Suppressed F = Forest E = Emergent	Ht. Approx. metres	Crown Spread approx. metres / Orientation R = Radial, or other	Crown Symmetry 1 = symmetrical 2 = asymmetrical / Orientation	Crown Cover % / Crown Density % / D = dormant	DBH in mm @ 1.4m, or other, as indicated / Trunk Orientation other than R = radial, e.g. N/S g = ground	Trunk Lean 1 = Upright-Slight 2 = Moderate 3 = Severe 4 = Critical. 5 = Acaulescent / Orientation / ST = Static P = Progressive Sc = Self-correcting	Roots Evident at Root Crown 1. = None 2. = Adventitious 3. = Basal Flare 4. = Buttresses 5. = First Order Roots (FOR), No. & distribution e.g. R = radial, or one each to N, S, E and W	Pests, Diseases & Damage No or Yes If Yes see comments	Branch Bark Included No or Yes or N/A	Form G = Good Form P = Poor Form	Significance scale 1=High 2=Medium 3=Low / Retention Value 1=High 2=Medium 3=Low 4=Remove
11	*Melaleuca bracteata 'Revolution Green'*	M	GV	F	MGVF - 9 2	C	5	3x2 E/W	2/E	60 60	210 @g R	5/R ST	1	NO	NO	G	3 3
	Revolution Green Paperbark	Comment: Acaulescent or short trunk @ or near ground, crown deliquescent, orientation E/W, asymmetrical bias to east.															
12	*Melaleuca bracteata 'Revolution Green'*	M	GV	F	MGVF - 9 2	C	5	3x2 E/W	2/E	60 60	220 @g R	5/R ST	1	NO	NO	G	3 3
	Revolution Green Paperbark	Comment: Acaulescent or short trunk @ or near ground, crown deliquescent, orientation E/W, asymmetrical bias to east.															
13	*Melaleuca bracteata 'Revolution Green'*	M	GV	F	MGVF - 9 2	C	5	3x2 N/S	2/N	60 60	210 @g R	5/R ST	1	NO	NO	G	3 3
	Revolution Green Paperbark	Comment: Acaulescent or short trunk @ or near ground, crown deliquescent, orientation N/S, asymmetrical bias to north.															
14/2	*Melaleuca bracteata 'Revolution Green' x3*	M	GV	F	MGVF - 9 2	C	5	3x2 N/S	2/N	60 60	210 @g R	1/R ST	1	NO	NO	G	3 3
	Revolution Green Paperbark	Comment: Acaulescent or short trunk @ or near ground, crown deliquescent, orientation N/S, asymmetrical bias to north.															
15	*Gleditsia triacanthos sunburst*	M	GV	F	MGVF - 9 2	C	5	3x3 R	1	70 70		1/R ST	1	NO	NO	G	2 3
	Honey Locust	Comment:															

Observation/Discussion

5.2 The site has a stand of mature, planted, non-locally indigenous or exotic deciduous taxa within the current proposal. The proposed design requires the retention and protection of four (4) specimens within the road and Council reserves as they are considered significant for their contribution as landscape elements to the property and the retention of these trees allows them as components of the current curtilage to be transferred to the new proposal, maintaining elements of a continuous landscape, providing a more harmonious integration and transition of the use of the land. The other specimens located within the site, property or on the property boundary were within the proposed building envelope and are not able to be retained. They are recommended for removal and replacement with super advanced specimens in 75 or 100 litre bags size stock within more appropriate positions within the development. Replacement of these specimens needs to be mindful of their spatial requirements to allow them to grow to maturity and not be impeded by the built structure.

Tree Significance

5.3 Significant Trees as established by the Rating System for Tree Significance – IACA Stars (2010), Appendix A.

Significance Scale
1 – High
2 – Medium
3 – Low

Significance Scale	1	2	3
Redgum Tree No.	1, 2	3, 4, 14, 15	5, 6, 7, 8, 9, 10, 11, 12, 13

Tree Retention Value

5.4 See Appendix A for Retention Value Matrix.

Retention Value
High – Priority for Retention
Medium – Consider for Retention
Low – Consider for Removal
Remove - Priority for Removal

Retention Value	High Priority for Retention	Medium Consider for Retention	Low Consider for Removal	Remove Priority for Removal
Redgum Tree No.	1	2, 3, 4	5, 6, 7, 8, 9, 10, 11, 12, 13, 14x3, 15	

5.5 AS4970 (2009) section 3, 3.3.3 requires the Project Arborist to demonstrate that where a retained tree is subject to a major encroachment (>10% of area of TPZ) it can be protected to remain viable

5.6 Tree 1 *Ficus rubiginosa* - Port Jackson Fig, this specimen was found in good health & vigour at time of assessment.

- *Trees viability to development; this specimen is not impacted by the proposed development. The project arborist is to certify that installation of protection measures have been installed as per D/A conditions prior to commencement and works are to be monitored throughout the project at approx. 3 mthly intervals depending on the length of the development. This specimen should remain viable beyond completion of development provided recommended installation & protection measures are adhered too.*

- *Development Impacts: AS4970 (2009) section 3 requires a Tree Protection Zone (TPZ) setback of 15.0 metres (m) from centre of trunk (COT), the setback for the proposed development adjacent to this specimen is estimated at17.0m from COT, which is a minor encroachment. This specimen is sufficiently setback from the development to not be affected.*

5.7 Tree 2 *Jacaranda mimosifolia* - Jacaranda, this specimen was found in fair health & good vigour at time of assessment.

- *Trees viability to development; this specimen is impacted by the proposed development. The project arborist is to certify that installation of protection measures have been installed as per D/A conditions prior to commencement and works are to be monitored throughout the project at approx. 3 mthly intervals depending on the length of the development. This specimen should remain viable beyond completion of development provided recommended installation & protection measures are adhered too.*

- *Development Impacts: AS4970 (2009) section 3 requires a TPZ setback of 5.9m from COT, the setback for the proposed basement adjacent to this specimen is estimated at 4.0m from COT, which is a major encroachment by the proposed development.*

The alignment of the basement will be a major encroachment to this specimen. The section of the basement within the TPZ of this specimen is to be constructed using a vertical cut with shotcrete and contiguous pilings to reduce any impact on its stability. If associated infrastructure (pipe works) is to be installed within this area, it also has to be installed by hand with non-motorised machinery. If structural roots are found within the trench, they are to be left intact and dug around retaining this specimen's structural integrity. Minor crown raising of this specimen may be required to clear access over the proposed development. Works are to be undertaken by a qualified arborist and supervised by the project arborist if required by Council.

5.8 Tree 3 & 4 *Allocasuarina littoralis* - Black She Oak, these specimens were found in fair health & good vigour at time of assessment.

- *Trees viability to development; these specimens are not impacted by the proposed development. The project arborist is to certify that installation of protection measures have been installed as per D/A conditions prior to commencement and works are to be monitored throughout the project at approx. 3 mthly intervals depending on the length of the development. These specimens should remain viable beyond completion of development provided recommended installation & protection measures are adhered too.*

- *Development Impacts: AS4970 (2009) section 3 requires a TPZ setback of 4.4m for Tree (T)3 & 4.7m for T4m from COT, the setback for the proposed development adjacent to these specimens is estimated at 3.5m from COT, which is a minor encroachment. These specimens are sufficiently setback from the development to not be affected.*

If associated infrastructure (pipe works) are to be installed within this area, they are to be installed by hand with non-motorised machinery. If structural roots are found within the trench, they are to be left intact and dug around retaining this specimen's structural integrity. Works are to be undertaken in consultation with the project arborist.

The impact will be that of minor encroachment for Tree 1, 3 & 4 while Tree 2 will be subject to major encroachment which are to be retained and protected as per AS 4970 (2009) Section 3, 3.3.3 Major Encroachments from development works within >10% of the area of the Tree Protection Zone. These excavations must be supervised and certified by the Project Arborist in accordance with AS4970 (2009).

General – Tree Protection works – Prior to Demolition

5.9 *Tree Management Plan* – Prior to demolition works, a site arborist shall be appointed to supervise all tree protection procedures detailed in this specification. The Site Arborist shall have a minimum level 5 AQF qualification in Arboriculture. Milestones are to be adhered to throughout the duration of this development and all relevant documentation is to be submitted to the local authority.

5.10 The Tree Protection Zone for each tree/s is to be incorporated into the construction works for the site and the protection fencing or works to be located as indicated on the Appendix F – Tree Protection Plan. The setbacks from building works on the side closest to each tree are to be carried out as indicated in Table 2.0, and Tree Protection Zones be constructed as described here and detailed in Appendix C. The trees will be sustained within the constraints of the modifications to the site by the proposed development works.

5.11 Trees 1, 2, 3 & 4 are to be retained and protected and incorporated into the landscape works for the site, and Tree Protection Zone fencing to be marked accordingly on the Landscape Plan, where appropriate and installed prior to any demolition or construction.

5.12 Ground protection - If temporary access for machinery is required within the TPZ ground protection measures will be required. The purpose of ground protection is to prevent root damage and soil compaction within the TPZ. Measures may include a permeable membrane such as geotextile fabric beneath a layer of mulch or crushed rock below rumble boards. These measures may be applied to root zones beyond the TPZ.

5.13 Where applicable, any excavation for the establishment of a batter slope or benching for reasons of safety and to comply with Work Cover Authority safety regulations should be restricted as far as is safely possible near to trees to be retained to prevent root damage. If the excavations cannot be undertaken near to vertical the stability of these trees and their long-term viability may be compromised and their retention in a safe and healthy condition jeopardized and they may need to be revised and possibly removed.

Specific - Tree Protection Works - Prior to Demolition and Tree Removal

5.14 All other trees/shrubs; prior to demolition and tree removal works these tree/s are to be placed within a Tree Protection Zone with protective fencing and maintained and retained until the completion of all building works. Protective fencing is to be installed as shown in Appendix F - Tree Protection Plan.

- *The Protective fencing where required may delineate the **Tree Protection Zone (TPZ)** and should be located as determined by the project arborist in accordance with AS4970 Protection of trees on development sites, Section 4, 4.3. "Fencing should be erected before any machinery or materials are brought onto the site and before the commencement of works including demolition. Once erected, protective fencing must not be removed or altered without approval by the project arborist. The TPZ must be secured to restrict access. AS4687 Temporary fencing and hoardings specifies applicable fencing requirements. Shade cloth or similar should be attached to reduce the transport of dust, other particulate matter and liquids into the protected area. Fence posts and supports should have a diameter greater than 20 mm and be located clear of roots. Existing perimeter fencing and other structures may be suitable as part of the protective fencing" or similar.*
- *Tree Protection signage is to be attached to each **TPZ** and displayed from within the development site in accordance with AS4970 2009 Protection of trees on development sites*
- *The area of the Tree Protection Zone to be mulched to a depth of 100 mm with organic material being 75% leaf litter and 25% wood, and this being composted material preferably from the same genus and species of tree as that to where the mulch is to be applied, i.e. species specific mulch. The depth of mulch and type as indicated, to be maintained for the duration of the project. Where deep excavation will expose the soil profile to drying out the root plate is to be protected by pegging jute matting across the ground surface 2 m back from the edge of the profile and 2 m down the face of the profile and is to be in one continuous sheet or layers up to 5 mm thick and overlapped 300 mm and pegged. Pegs are to be a minimum length of 200 mm and spaced at 500 mm increments in a grid pattern. Once installed mulch is to be placed on top of the jute matting previously described.*

5.15 There is to be no storage of materials, rubbish, soil, equipment, structures or goods of any type to be kept or placed within 5 metres from the trunk or within the dripline of any tree for the duration of the development. This will ensure protection of the tree/s to be retained on or adjacent to site.

5.16 *Milestone* - Project/Site arborist is to inspect/assess all retained specimens prior to demolition to inspect tree protection measures have been carried out as per the approved D/A conditions for the site. Documentation is to be submitted to the consenting authority after each inspection.

Demolition and Tree Removal/s

5.17 Trees 5, 6, 7, 8, 9, 10, 11, 12, 13, 14^{x3} & 15 are to be removed as they are located within the site in a position where they cannot be retained due to the proposed building envelopes and associated infrastructure such as excavation of the basement where encroachment will have an adverse impact on its roots and crown for viability and stability. They are recommended for removal and replacement with super advanced specimens in 75 or 100 litre bags size stock within more appropriate positions within the development. Replacement of these specimens needs to be mindful of their spatial requirements to allow them to grow to maturity and not be impeded by the built structure.

- Tree 5 to 13 & 14^{x3}: *Melaleuca bracteata 'Revolution Green'* - Revolution Green Paperbark; located within the road reserve and on the property boundary and positioned within the proposed building envelope. These specimens are recommended to be removed and replaced as they are unable to be retained due to the proposed development.
- Tree 15: *Gleditsia triacanthos sunburst* - Honey Locust; located within the sit and positioned within the building envelope. This specimen is recommended to be removed and replaced as it is unable to be retained due to the proposed development.

5.18 Removal of a tree within 6 m of a tree to be retained should be undertaken only by cutting down such a tree without damaging the trees to be retained, and by grinding out its stump. Where possible the structural roots of 20 mm diameter or greater of the tree to be cut down should not be removed, to minimise soil disturbance and to reduce the impact on the roots of any tree to be retained nearby. Where structural roots are to be removed this should be undertaken manually by the use of non-motorized hand tools after the stump has been ground out when such roots are often easier to locate from the site of the stump from which they have been severed.

5.19 Ground protection in accordance with AS4970 section 4, 4.5.3 may require steel plates to protect the ground surface from compaction to protect roots between the stages of demolition and construction of the new pavement.

Specific - Tree Protection works – Post Demolition and Prior to Construction

5.20 *Milestone* - Project/Site arborist is to inspect/assess all retained specimens prior to construction in relation to tree protection measures have been carried out as per the approved D/A conditions for the site. Documentation is to be submitted to the consenting authority after each inspection.

5.21 Location of underground utilities within a Tree Protection Zone of a retained specimen.
Any utility services to be located underground within the TPZ are to be undertaken utilising excavation techniques that prevent or minimise damage to structural roots (roots greater than >20 mm diameter). To prevent soil compaction and root damage these works should be conducted with non-motorised hand tools, air knife or directional drilling.

5.22 Re-grading of site near retained trees; Grading &/or re-grading of sites/slopes within Tree Protection Zones or near retained specimens is to be undertaken **only** if at all, after consultation with the Project Arborist. This is to protect all structural roots systems from damage or compaction from machinery.

5.23 Placement of relocatable buildings; consideration should be given to tree sensitivity such as the buildings being placed on pier and beam or skids construction as they are to be positioned now on the eastern side of their driplines within the Tree Protection Zone (TPZ). The area of the Tree Protection Zone under the buildings is to be mulched to a depth of 200 mm (*if installed on skids*) with organic material to further reduce compaction. The mulch is to be composted material, i.e. species specific mulch. Alternatively, if installed on a pier & beam construction, piers are to be undertaken manually by using non-motorized hand tools to determine the location of first order and lower order structural roots with a diameter of 20 mm (*structural woody roots*) or greater, without damaging them.

Specific - Tree Protection works – During Construction

5.24 *Milestone* - Project/Site arborist is to inspect/assess all retained specimens during construction in relation to tree protection measures have been carried out as per the approved D/A conditions for the site. Documentation is to be submitted to the consenting authority after each inspection.

5.25 Where any structural roots (roots with a diameter of greater than >20 mm) encountered by excavation are to be pruned and it is to be undertaken with clean sharp pruning tools, with a final cut to undamaged wood to prevent infestation by pathogens and assist continued root growth and undertaken in consultation with the Consulting Arboriculturist. Tree Protection Zone fences are to be maintained during these works. Ground protection in accordance with AS4970 section 4, 4.5.3 may require steel plates to protect the ground surface from compaction to protect roots between the stages of demolition and construction of the new pavement.

5.26 All Tree Protection Zones of retained trees are to be monitored for the duration of the construction phase of the development. The three main areas requiring monitoring are; *mulching* - mulch must be maintained to a depth of 50–100 mm using material that complies with AS 4454. Where the existing landscape within the TPZ is to remain unaltered (e.g. garden beds or turf) mulch may not be required, *Watering* - soil moisture levels should be regularly monitored by the project arborist. Temporary irrigation or watering may be required within the TPZ. An above-ground irrigation system could be installed and maintained by a competent individual and *weeding* - weeds should be removed by hand without disturbing soil or should be controlled with weedicide.

5.27 Trees to be removed are to be replaced with advanced specimens being mindful of the space limitations of the new use of the site. The advanced trees should be located in areas along the boundaries of the site. The planting in these locations will provide the maximum benefit to the surrounding properties by screening views to and from the site and the plantings included in the proposed landscape plan. The replacement trees will be located in positions where they may grow to maturity unhindered and will not conflict with built structures or utility services and in greater numbers than the trees removed should provide a net increase in the local amenity.

Specific - Tree Protection works – Post Construction

5.28 At completion of construction work the Site/Project Arborist should carry out an assessment of all trees retained &/or affected by works. This assessment is to document and any required on-going remedial care needed to ensure viable retention of trees affected. Documentation is to be submitted to the consenting authority.

6.0 CONCLUSION

Thirteen (13) trees are nominated for removal and replacement with species in accordance with the associated Landscape documentation for the development. The four (4) trees to be preserved will be retained and protected through the implementation of adequate measures for their integration into the development by the application of appropriate technology as detailed in this report. Where appropriate, the Landscape Plan will include planting with new trees including street tree/s.

It is often a consequence of redevelopment, and subject to the nature of the proposed land use that some or all of the trees present on the site prior to that redevelopment may be required to be removed and replaced with new tree plantings in different locations. This may be dependent upon the type of development and its design constraints and the requirements of the local planning instruments and any Landscape Design Codes if existing. Where tree removal is required for this development, it is considered that those trees identified within this report are not sustainable within the context of the proposed development. Where tree retention has been considered, those trees are expected to survive the redevelopment process and remain stable and viable. The retention and protection of existing trees on site is a significant aspect of the development process, allowing those trees as components of the current curtilage to be transferred to the new development for incorporation into the landscaping works for the site. The retention of some or all of the existing trees contributes to: the preservation of local amenity, screening of views to and from the site, and a balance to the scale and bulk of buildings, while maintaining elements of a continuous landscape, providing a more harmonious integration and transition of the use of the land.

If all the recommendations and procedures detailed herein are adhered to, some or all of the trees the subject of this report will continue, or will be replaced with more appropriate plantings in suitable locations, or enhanced by additional new plantings, and will grow to develop as important landscape components providing elements of long term amenity for the property and its owners or occupants, and the local community.

The recommendations made in this report are subject to approval by the consent authority.

As a renewable and dynamic natural resource the urban tree and the growing environment essential for its survival must be understood and carefully managed to balance its needs with those of people. It is crucial that as required: this resource be planned for, planted, nurtured, protected, maintained and replaced, to ensure appropriateness and suitability of new plantings and trees retained, for safety and viability, so that it remains vital, and is sustainable in continuity.

7.0 RECOMMENDATIONS

7.1 Trees 1, 2, 3 & 4 are to be retained in situ within the site and are to be protected as detailed in 5.6 - 5.16 & 5.19 - 5.28. Tree protection fences, or works, to be located in accordance with *Site Plan B - Trees To Be Retained And Tree Protection Zones* (Appendix F).

7.2 Where Tree Protection Zone fences are to be moved or relocated this must be undertaken in consultation with the Consultant Arboriculturist for the project to ensure that tree protection is maintained. If the fences are relocated areas are to be mulched in accordance with 5.14 of this report to reduce compaction to the root system of the retained specimens.

7.3 To minimise damage to retained crowns, all Tree Protection Zones are to be adhered to. This must be undertaken in consultation with the Consultant Arboriculturist for the project to ensure that tree protection is maintained. Minor pruning may be required if damage occurs, work is to be undertaken in accordance with section 4 of this report.

7.4 *Milestones* - Project/Site arborist is to inspect/assess all retained specimens prior to Demolition and Tree Removal, Post Demolition, Prior to Construction during Construction and on completion in relation to trees protected and the protection measures have been carried out as per the approved D/A conditions for the site. Documentation is to be submitted to the consenting authority after each inspection.

7.5 Trees 5, 6, 7, 8, 9, 10, 11, 12, 13, 14^{x3} & 15 are to be removed which is to be undertaken in accordance with section 4.0, parts 4.1 - 4.3.

7.6 Tree removal near retained specimens is to be undertaken in accordance with 5.18 of this report.

7.7 Any work to be undertaken within Tree Protection Zones is to be undertaken in accordance 7.2 of this report.

7.8 There is to be no storage of materials, rubbish, soil, equipment, structures or goods of any type to be kept or placed within 5 metres from the trunk or within the dripline of any tree for the duration of the development. This will ensure protection of the tree/s to be retained on or adjacent to site.

7.9 Each of the replacement are to be a vigorous specimen with a straight trunk, gradually tapering and continuous, crown excurrent, symmetrical, with roots established but not pot bound in a volume container or approved similar and be maintained by an appropriately qualified and experienced landscape contractor for up to one (1) year after planting, or as appropriate.

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3. Standards Australia 2007, *Australian Standard 4373 Pruning of amenity trees*, Standards Australia, Sydney, Australia.
4. Standards Australia 2009, *Australian Standard 4970 Protection of trees on development sites*, Standards Australia, Sydney, Australia.
5. Work Cover NSW 2007, *Code of Practice Tree Work*, New South Wales Government, Australia.

Appendix A

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.

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.

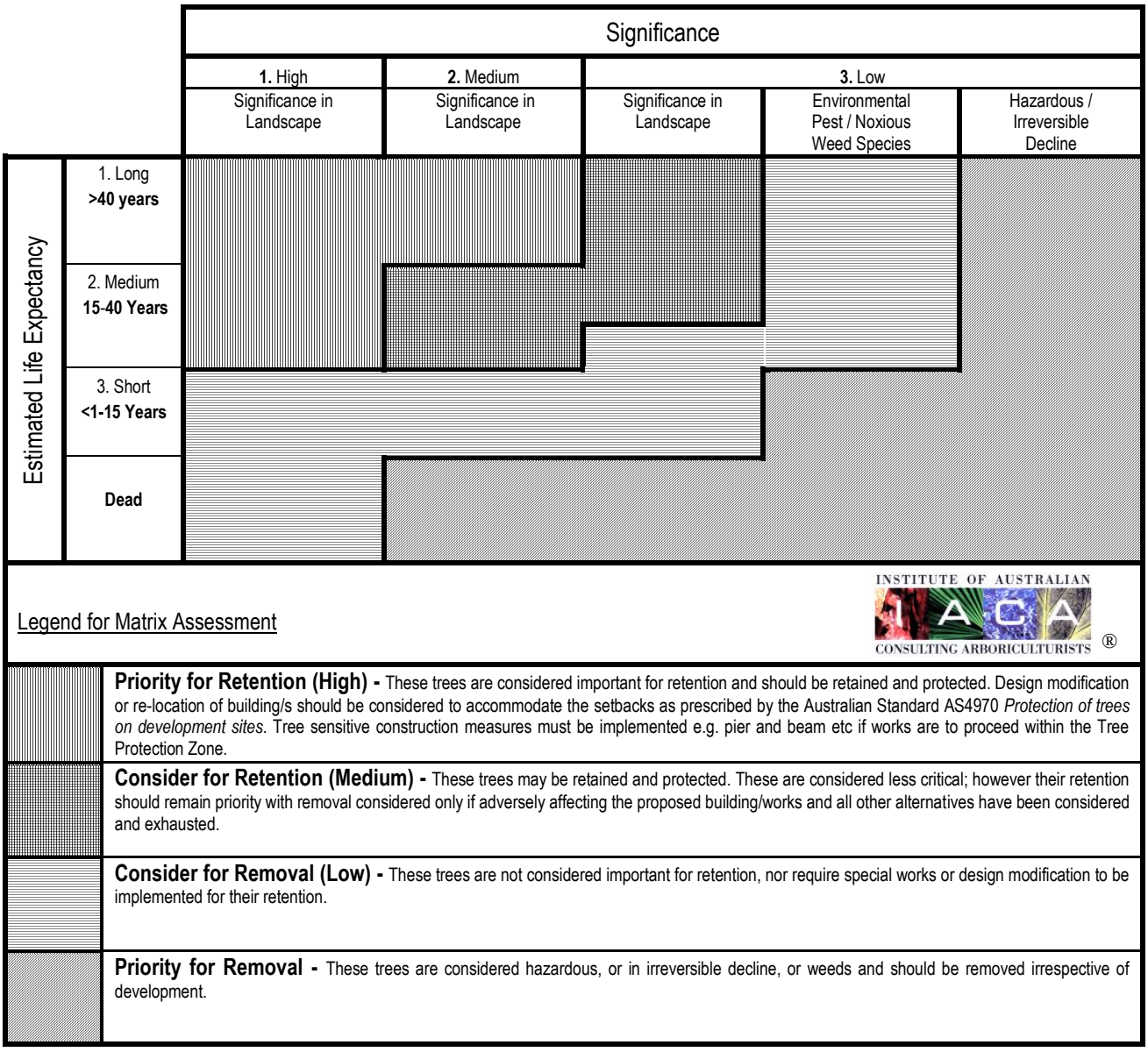
Hazardous/Irreversible Decline

- 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.

Table 1.0 Tree Retention Value - Priority Matrix.



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Footprint Green Pty Ltd 2001, *Footprint Green Tree Significance & Retention Value Matrix*, Avalon, NSW Australia, www.footprintgreen.com.au

Appendix B

Matrix - Sustainable Retention Index Value (SRIV) ©

Version 4, 2010

Developed by IACA – Institute of Australian Consulting Arboriculturists www.iaca.org.au

The matrix is to be used with the value classes defined in the Glossary for Age / Vigour / Condition.
An index value is given to each category where ten (10) is the highest value.

Age Class	Vigour Class and Condition Class					
	Good Vigour & Good Condition (GVG)	Good Vigour & Fair Condition (GVF)	Good Vigour & Poor Condition (GVP)	Low Vigour & Good Condition (LVG)	Low Vigour & Fair Condition (LVF)	Low Vigour & Poor Condition (LVP)
	Able to be retained if sufficient space available above and below ground for future growth. No remedial work or improvement to growing environment required. May be subject to high vigour. Retention potential - Medium – Long Term.	Able to be retained if sufficient space available above and below ground for future growth. Remedial work may be required or improvement to growing environment may assist. Retention potential - Medium Term. Potential for longer with remediation or favourable environmental conditions.	Able to be retained if sufficient space available above and below ground for future growth. Remedial work unlikely to assist condition, improvement to growing environment may assist. Retention potential - Short Term. Potential for longer with remediation or favourable environmental conditions.	May be able to be retained if sufficient space available above and below ground for future growth. No remedial work required, but improvement to growing environment may assist vigour. Retention potential - Short Term. Potential for longer with remediation or favourable environmental conditions.	May be able to be retained if sufficient space available above and below ground for future growth. Remedial work or improvement to growing environment may assist condition and vigour. Retention potential - Short Term. Potential for longer with remediation or favourable environmental conditions.	Unlikely to be able to be retained if sufficient space available above and below ground for future growth. Remedial work or improvement to growing environment unlikely to assist condition or vigour. Retention potential - Likely to be removed immediately or retained for Short Term. Potential for longer with remediation or favourable environmental conditions.
(Y) Young	**YGVG - 9** **Index Value 9** Retention potential - Long Term. Likely to provide minimal contribution to local amenity if height <5 m. High potential for future growth and adaptability. Retain, move or replace.	**YGVF - 8** **Index Value 8** Retention potential - Short – Medium Term. Potential for longer with improved growing conditions. Likely to provide minimal contribution to local amenity if height <5 m. Medium-high potential for future growth and adaptability. Retain, move or replace.	**YGVP - 5** **Index Value 5** Retention potential - Short Term. Potential for longer with improved growing conditions. Likely to provide minimal contribution to local amenity if height <5 m. Low-medium potential for future growth and adaptability. Retain, move or replace.	**YLVG - 4** **Index Value 4** Retention potential - Short Term. Potential for longer with improved growing conditions. Likely to provide minimal contribution to local amenity if height <5 m. Medium potential for future growth and adaptability. Retain, move or replace.	**YLVF - 3** **Index Value 3** Retention potential - Short Term. Potential for longer with improved growing conditions. Likely to provide minimal contribution to local amenity if height <5m. Low-medium potential for future growth and adaptability. Retain, move or replace.	**YLVP - 1** **Index Value 1** Retention potential - Likely to be removed immediately or retained for Short Term. Likely to provide minimal contribution to local amenity if height <5 m. Low potential for future growth and adaptability.
(M) Mature	**MGVG - 10** **Index Value 10** Retention potential - Medium - Long Term.	**MGVF - 9** **Index Value 9** Retention potential - Medium Term. Potential for longer with improved growing conditions.	**MGVP - 6** **Index Value 6** Retention potential - Short Term. Potential for longer with improved growing conditions.	**MLVG - 5** **Index Value 5** Retention potential - Short Term. Potential for longer with improved growing conditions.	**MLVF - 4** **Index Value 4** Retention potential - Short Term. Potential for longer with improved growing conditions.	**MLVP - 2** **Index Value 2** Retention potential - Likely to be removed immediately or retained for Short Term.
(O) Over-mature	**OGVG - 6** **Index Value 6** Retention potential - Medium - Long Term.	**OGVF - 5** **Index Value 5** Retention potential - Medium Term.	**OGVP - 4** **Index Value 4** Retention potential - Short Term.	**OLVG - 3** **Index Value 3** Retention potential - Short Term. Potential for longer with improved growing conditions.	**OLVF - 2** **Index Value 2** Retention potential - Short Term.	**OLVP - 0** **Index Value 0** Retention potential - Likely to be removed immediately or retained for Short Term.

Appendix C

Extract from Australian Standard AS4970 2009 Protection of trees on development sites

Section 3, Determining the tree protection zones of the selected trees

3.1 Tree protection zone (TPZ)

"The tree protection zone (TPZ) is the principal means of protecting trees on development sites. The TPZ is a combination of the root area and crown area requiring protection. It is an area isolated from construction disturbance, so that the tree remains viable.

The TPZ incorporates the structural root zone (SRZ) (refer to Clause 3.3.5)."

3.2 Determining the TPZ

The radius of the TPZ is calculated for each tree by multiplying its DBH x 12.

TPZ = DBH x 12

where

DBH = trunk diameter measured at 1.4 m above ground

Radius is measured from the centre of the stem at ground level.

3.3.5 Structural root zone (SRZ)

"The SRZ is the area required for street stability. A larger area is required to maintain a viable tree. The SRZ only needs to be calculated when a major encroachment into a TPZ is proposed. Root investigation may provide more information on the extent of these roots."

Determining the SRZ

The radius of the TPZ is calculated for each tree by multiplying its DBH x 12.

SRZ radius = $(D \times 50)^{0.42} \times 0.64$

where

D = trunk diameter, in metres, measured above the root buttress.

Note: The SRZ for trees less than 0.15 m will be 1.5 m (see Figure 1).

The curve can be expressed by the following formula:

$R_{SRZ} = (D \times 50)^{0.42} \times 0.64$

NOTES:

1 R_{SRZ} is the structural root zone radius.

2 D is the stem diameter measured immediately above root buttress.

3 The SRZ for trees less than 0.15 m diameter is 1.5 m.

4 The SRZ formula and graph do not apply to palms, other monocots, cycads and tree ferns.

5 This does not apply to trees with an asymmetrical root plate.

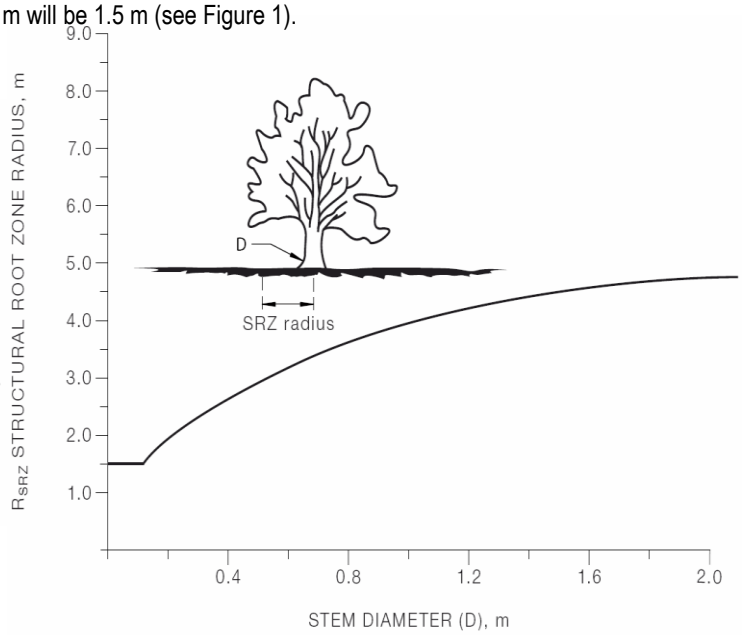


FIGURE 1 STRUCTURAL ROOT ZONE

Appendix D

Glossary

From

Dictionary for Managing Trees in Urban Environments by Draper BD and Richards PA 2009, Institute of Australian Consulting Arboriculturists (IACA), CSIRO Publishing, Collingwood, Victoria, Australia.

Age of Trees

Age Most trees have a stable biomass for the major proportion of their life. The estimation of the age of a tree is based on the knowledge of the expected lifespan of the taxa in situ divided into three distinct stages of measurable biomass, when the exact age of the tree from its date of cultivation or planting is unknown and can be categorized as *Young*, *Mature* and *Over-mature* (British Standards 1991, p. 13, Harris *et al*, 2004, p. 262).

Young Tree aged less than <20% of life expectancy, *in situ*.

Mature Tree aged 20-80% of life expectancy, *in situ*.

Over-mature Tree aged greater than >80% of life expectancy, *in situ,* or *senescent* with or without reduced *vigour*, and declining gradually or rapidly but irreversibly to death.

Condition of Trees

Condition A tree's *crown form* and growth habit, as modified by its *environment* (aspect, suppression by other trees, soils), the *stability* and *viability* of the *root plate*, trunk and structural branches (first (1st) and possibly second (2nd) order branches), including structural defects such as wounds, cavities or hollows, *crooked* trunk or weak trunk/branch junctions and the effects of predation by pests and diseases. These may not be directly connected with *vigour* and it is possible for a tree to be of *normal vigour* but in *poor condition*. Condition can be categorized as *Good Condition*, *Fair Condition*, *Poor Condition* and *Dead*.

Good Condition Tree is of good habit, with *crown form* not severely restricted for space and light, physically free from the adverse effects of *predation* by pests and diseases, obvious instability or structural weaknesses, fungal, bacterial or insect infestation and is expected to continue to live in much the same condition as at the time of inspection provided conditions around it for its basic survival do not alter greatly. This may be independent from, or contributed to by vigour.

Fair Condition Tree is of good habit or *misshapen*, a form not severely restricted for space and light, has some physical indication of *decline* due to the early effects of *predation* by pests and diseases, fungal, bacterial, or insect infestation, or has suffered physical injury to itself that may be contributing to instability or structural weaknesses, or is faltering due to the modification of the *environment* essential for its basic survival. Such a tree may recover with remedial works where appropriate, or without intervention may stabilise or improve over time, or in response to the implementation of beneficial changes to its local environment. This may be independent from, or contributed to by vigour.

Poor Condition Tree is of good habit or *misshapen*, a form that may be severely restricted for space and light, exhibits symptoms of advanced and *irreversible decline* such as fungal, or bacterial infestation, major die-back in the branch and *foliage crown*, *structural deterioration* from insect damage e.g. termite infestation, or storm damage or lightning strike, ring barking from borer activity in the trunk, root damage or instability of the tree, or damage from physical wounding impacts or abrasion, or from altered local environmental conditions and has been unable to adapt to such changes and may decline further to death regardless of remedial works or other modifications to the local *environment* that would normally be sufficient to provide for its basic survival if in *good* to *fair* condition. Deterioration physically, often characterised by a gradual and continuous reduction in vigour but may be independent of a change in vigour, but characterised by a proportionate increase in susceptibility to, and *predation* by pests and diseases against which the tree cannot be sustained. Such conditions may also be evident in trees of advanced senescence due to normal phenological processes, without modifications to the growing environment or physical damage having been inflicted upon the tree. This may be independent from, or contributed to by vigour.

Senescent / Moribund Advanced state of decline, dying or nearly dead.

Dead Tree is no longer capable of performing any of the following processes or is exhibiting any of the following symptoms;
Processes
Photosynthesis via its foliage crown (as indicated by the presence of moist, green or other coloured leaves);
Osmosis (the ability of the root system to take up water);
Turgidity (the ability of the plant to sustain moisture pressure in its cells);
Epicormic shoots or *epicormic strands* in Eucalypts (the production of new shoots as a response to stress, generated from latent or adventitious buds or from a *lignotuber*);
Symptoms
Permanent leaf loss;
Permanent wilting (the loss of turgidity which is marked by desiccation of stems leaves and roots);
Abscission of the *epidermis* (bark desiccates and peels off to the beginning of the sapwood).

Removed No longer present, or tree not able to be located or having been cut down and retained on a site, or having been taken away from a site prior to site inspection.

Branch

Branch An elongated woody structure arising initially from the trunk to support leaves, flowers, fruit and the development of other branches. A branch may itself fork and continue to divide many times as successive *orders of branches* with the length and taper decreasing incrementally to the *outer extremity* of the *crown*. These may develop initially as a gradually tapering continuation of the *trunk* with minimal division as in a *young* tree or a tree of *excurrent habit*, or in a *sapling*, or may arise where the trunk terminates at or some distance from the *root crown*, dividing into *first order branches* to form and support the *foliage crown*. In an *acaulescent* tree, branches arise at or near the *root crown*. Similarly branches may arise from a *sprout mass* from damaged *roots*, *branches* or *trunk*.

Orders of branches The marked divisions between successively smaller branches (James 2003, p. 168) commencing at the initial division where the trunk terminates on a *deliquescent* tree or from *lateral* branches on an *excurrent* tree. Successive branching is generally characterised by a gradual reduction in branch diameters at each division, and each gradation from the trunk can be categorised numerically, e.g. first order, second order, third order etc. (See Figure 21.)

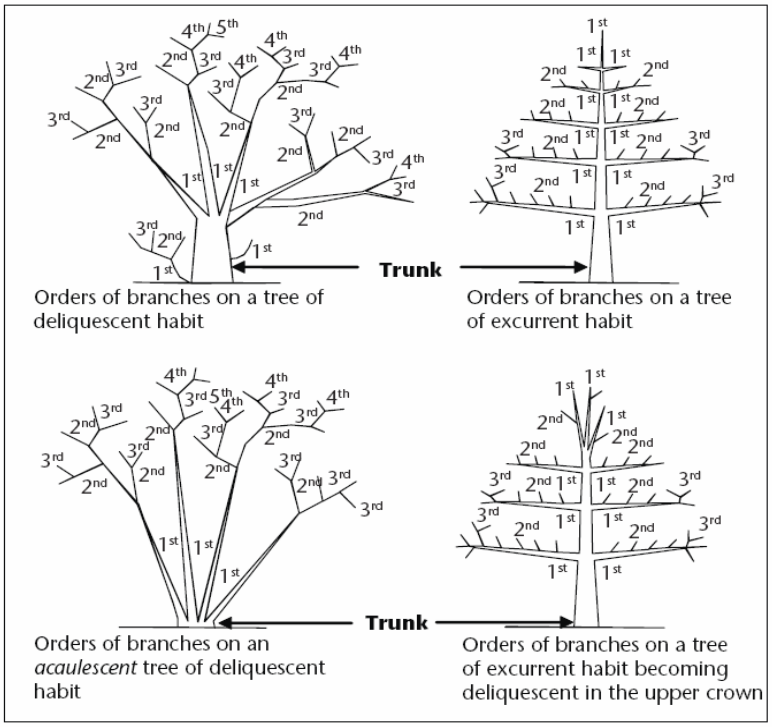


Figure 21 Orders of branches

Crown

Canopy 1. Of multiple trees, the convergence, or merging in full or part, of the crowns of two or more trees due to their proximity, or where competition for light and space available in a forest environment is limited as each tree develops forming a continuous layer of foliage. 2. Used as a plural for crown. 3. Sometimes synonymously used for crown (USA).

Crown Of an individual tree all the parts arising above the trunk where it terminates by its division forming branches, e.g. the branches, leaves, flowers and fruit; or the total amount of foliage supported by the branches. The crown of any tree can be divided vertically into three sections and can be categorised as *lower crown*, *mid crown* and *upper crown* (Figure 8). For a *leaning* tree these can be divided evenly into crown sections of one-third from the *base* to *apex*. The volume of a crown can be categorised as the *inner crown*, *outer crown* and *outer extremity of crown*.

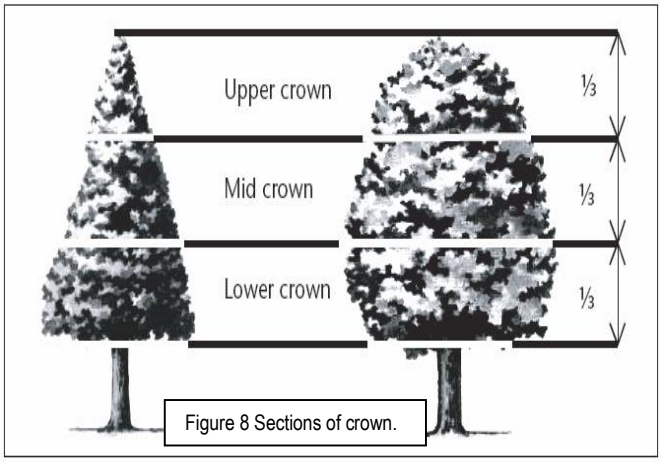


Figure 8 Sections of crown.

Lower crown The *proximal* or lowest section of a crown when divided vertically into one-third (⅓) increments. See also *Crown*, *Mid crown* and *Upper crown*.

Mid crown The middle section of a crown when divided vertically into one-third (⅓) increments. See also *Crown*, *Lower crown* and *Upper crown*.

Upper crown The *distal* or highest section of a crown when divided vertically into one-third (⅓) increments. See also *Crown*, *Mid crown* and *Lower crown*.

Crown Projection (CP) Area within the *dripline* or beneath the lateral extent of the *crown* (Geiger 2004, p. 2). See also *Crown spread* and *Dripline*.

Dripline A line formed around the edge of a tree by the lateral extent of the *crown*. Such a line may be evident on the ground with some trees when exposed soil is displaced by rain shed from the crown. See also *Crown Projection*.

Crown Form of Trees

Crown Form The shape of the crown of a tree as influenced by the availability or restriction of space and light, or other contributing factors within its growing environment. Crown Form may be determined for tree shape and habit generally as *Dominant*, *Codominant*, *Intermediate*, *Emergent*, *Forest* and *Suppressed*. The habit and shape of a *crown* may also be considered qualitatively and can be categorized as *Good Form* or *Poor Form*.

Good Form Tree of *typical* crown shape and habit with proportions representative of the taxa considering constraints such as origin e.g. indigenous or exotic, but does not appear to have been adversely influenced in its development by environmental factors in situ such as *soil water* availability, prevailing wind, or cultural practices such as lopping and competition for space and light.

Poor Form Tree of *atypical* crown shape and habit with proportions not representative of the species considering constraints and appears to have been adversely influenced in its development by environmental factors in situ such as *soil water* availability, prevailing wind, cultural practices such as lopping and competition for space and light; causing it to be *misshapen* or disfigured by disease or vandalism.

Crown Form Codominant Crowns of trees restricted for space and light on one or more sides and receiving light primarily from above e.g. constrained by another tree/s or a building.

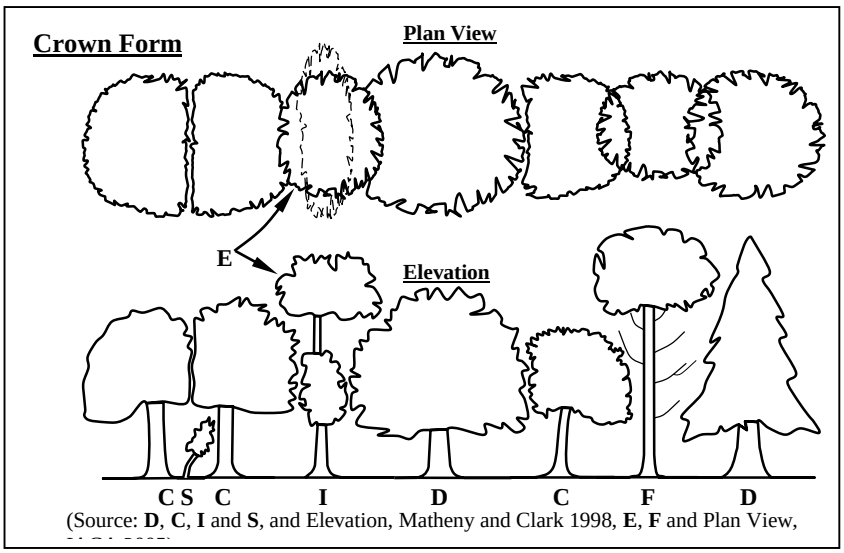
Crown Form Dominant Crowns of trees generally not restricted for space and light receiving light from above and all sides.

Crown Form Emergent Crowns of trees restricted for space on most sides receiving most light from above until the *upper crown* grows to protrude above the canopy in a stand or forest environment. Such trees may be *crown form dominant* or transitional from *crown form intermediate* to *crown form forest* asserting both *apical dominance* and *axillary dominance* once free of constraints for space and light.

Crown Form Forest Crowns of trees restricted for space and light except from above forming tall trees with narrow spreading crowns with foliage restricted generally to the top of the tree. The trunk is usually erect, straight and continuous, tapering gradually, crown often excurrent, with first order branches becoming structural, supporting the live crown concentrated towards the top of the tree, and below this point other first order branches arising radially with each *inferior* and usually temporary, divergent and ranging from horizontal to ascending, often with internodes exaggerated due to competition for space and light in the *lower crown*.

Crown Form Intermediate Crowns of trees restricted for space on most sides with light primarily from above and on some sides only.

Crown Form Suppressed Crowns of trees generally not restricted for space but restricted for light by being *overtopped* by other trees and occupying an understorey position in the canopy and growing slowly.



(Source: **D**, **C**, **I** and **S**, and Elevation, Matheny and Clark 1998, **E**, **F** and Plan View,

Deadwood

Deadwood Dead branches within a tree's crown and considered quantitatively as separate to *crown cover* and can be categorised as *Small Deadwood* and *Large Deadwood* according to diameter, length and subsequent *risk* potential. The amount of dead branches on a tree can be categorized as *Low Volume Deadwood*, *Medium Volume Deadwood* and *High Volume Deadwood*. See also *Dieback.*

Deadwooding Removing of dead branches by *pruning*. Such pruning may assist in the prevention of the spread of *decay* from *dieback* or for reasons of safety near an identifiable target.

Small Deadwood A dead branch up to 10mm diameter and usually <2 metres long, generally considered of low *risk* potential.
Large Deadwood A dead branch >10mm diameter and usually >2 metres long, generally considered of high *risk* potential.
High Volume Deadwood High Volume Deadwood Where >10 dead branches occur that may require *removal*.
Medium Volume Deadwood Where 5-10 dead branches occur that may require *removal*.
Low Volume Deadwood Where <5 dead branches occur that may require *removal*.

Dieback

Dieback The death of some areas of the *crown*. Symptoms are leaf drop, bare twigs, dead branches and tree death, respectively. This can be caused by root damage, root disease, bacterial or fungal canker, severe bark damage, intensive grazing by insects, *abrupt changes* in growth conditions, drought, water-logging or over-maturity. Dieback often implies reduced *resistance, stress* or *decline* which may be temporary. Dieback can be categorized as *Low Volume Dieback*, *Medium Volume Dieback* and *High Volume Dieback*.

High Volume Dieback Where >50% of the *crown cover* has died.
Medium Volume Dieback Where 10-50% of the *crown cover* has died.
Low Volume Dieback Where <10% of the *crown cover* has died. See also *Dieback*, *High Volume Dieback* and *Medium Volume Dieback*.

Epicormic shoots

Epicormic Shoots Juvenile shoots produced at branches or trunk from *epicormic strands* in some Eucalypts (Burrows 2002, pp. 111-131) or sprouts produced from dormant or latent buds concealed beneath the bark in some trees. Production can be triggered by fire, pruning, wounding, or root damage but may also be as a result of *stress* or *decline*. Epicormic shoots can be categorized as *Low Volume Epicormic Shoots*, *Medium Volume Epicormic Shoots* and *High Volume Epicormic Shoots*.

High Volume Epicormic Shoots Where >50% of the *crown cover* is comprised of live *epicormic shoots*.
Medium Volume Epicormic Shoots Where 10-50% of the *crown cover* is comprised of live *epicormic shoots*.
Low Volume Epicormic Shoots Where <10% of the c*rown cover* is comprised of live *epicormic shoots*.

General Terms

Cavity A usually shallow void often localized initiated by a *wound* and subsequent *decay* within the trunk, branches or roots, or beneath bark, and may be enclosed or have one or more opening.

Decay Process of degradation of wood by microorganisms (Australian Standard 2007, p. 6) and fungus.

Hazard The threat of danger to people or property from a tree or tree part resulting from changes in the physical condition, growing environment, or existing physical attributes of the tree, e.g. included bark, soil erosion, or thorns or poisonous parts, respectively.

Included bark 1. The bark on the inner side of the *branch union*, or is within a concave *crotch* that is unable to be lost from the tree and accumulates or is trapped by *acutely divergent* branches forming a *compression fork*. 2. Growth of bark at the interface of two or more branches on the inner side of a branch union or in the crotch where each branch forms a branch collar and the collars roll past one another without forming a graft where no one collar is able to subsume the other. Risk of failure is worsened in some taxa where branching is *acutely divergent* or *acutely convergent* and ascending or erect.

Hollow A large void initiated by a *wound* forming a *cavity* in the trunk, branches or roots and usually increased over time by *decay* or other contributing factors, e.g. fire, or fauna such as birds or insects e.g. ants or termites. A hollow can be categorized as an *Ascending Hollow* or a *Descending Hollow*.

Risk The random or potentially foreseeable possibility of an episode causing harm or damage.

Significant Important, weighty or more than ordinary.

Significant Tree A tree considered important, weighty or more than ordinary. Example: due to prominence of location, or *in situ*, or contribution as a component of the overall landscape for *amenity* or aesthetic qualities, or *curtilage* to structures, or importance due to uniqueness of taxa for species, subspecies, variety, *crown form*, or as an historical or cultural planting, or for age, or substantial dimensions, or habit, or as *remnant vegetation*, or habitat potential, or a rare or threatened species, or uncommon in cultivation, or of aboriginal cultural importance, or is a commemorative planting.

Substantial A tree with large dimensions or proportions in relation to its place in the landscape.

Sustainable Retention Index Value (SRIV) A visual tree assessment method to determine a qualitative and numerical rating for the viability of urban trees for development sites and management purposes, based on general tree and landscape assessment criteria using classes of *age*, *condition* and *vigour*. SRIV is for the professional manager of urban trees to consider the tree *in situ* with an assumed knowledge of the *taxon* and its growing environment. It is based on the physical attributes of the tree and its response to its environment considering its position in a matrix for age class, vigour class, condition class and its sustainable retention with regard to the safety of people or damage to property. This also factors the ability to retain the tree with remedial work or beneficial modifications to its growing environment or removal and replacement. SRIV is supplementary to the decision made by a tree management professional as to whether a tree is retained or removed (IACA - Institute of Australian Consulting Arboriculturists 2005).

Visual Tree Assessment (VTA) A visual inspection of a tree from the ground based on the principle that, when a tree exhibits apparently superfluous material in its shape, this represents repair structures to rectify *defects* or to reinforce weak areas in accordance with the *Axiom of Uniform Stress* (Mattheck & Breloer 1994, pp. 12-13, 145). Such assessments should only be undertaken by suitably competent practitioners.

Leaning Trees

Leaning A tree where the *trunk* grows or moves away from upright. A lean may occur anywhere along the *trunk* influenced by a number of contributing factors e.g. genetically predetermined characteristics, competition for space or light, prevailing winds, aspect, slope, or other factors. A *leaning* tree may maintain a *static lean* or display an increasingly *progressive lean* over time and may be hazardous and prone to *failure* and *collapse*. The degrees of leaning can be categorized as *Slightly Leaning*, *Moderately Leaning*, *Severely Leaning* and *Critically Leaning*.

Slightly Leaning A leaning tree where the trunk is growing at an angle within 0^{O}-15^{O} from upright.
Moderately Leaning A leaning tree where the trunk is growing at an angle within 15^{O}-30^{O} from upright.
Severely Leaning A leaning tree where the trunk is growing at an angle within 30^{O}-45^{O} from upright.
Critically Leaning A leaning tree where the trunk is growing at an angle greater than $>45^{O}$ from upright.
Progressively Leaning A tree where the degree of *leaning* appears to be increasing over time.
Static Leaning A leaning tree whose lean appears to have stabilized over time.

Periods of Time

Periods of Time The life span of a tree in the urban environment may often be reduced by the influences of encroachment and the dynamics of the environment and can be categorized as *Immediate*, *Short Term*, *Medium Term* and *Long Term*.

Immediate An *episode* or occurrence, likely to happen within a twenty-four (24) hour period, e.g. tree failure or collapse in full or part posing an imminent danger.
Short Term A period of time less than <1 – 15 years.
Medium Term A period of time 15 – 40 years.
Long Term A period of time greater than >40 years.

Roots

First Order Roots (FOR) Initial woody roots arising from the *root crown* at the base of the *trunk*, or as an *adventitious root mass* for structural support and *stability*. Woody roots may be buttressed and divided as a marked gradation, gradually tapering and continuous or tapering rapidly at a short distance from the root crown. Depending on soil type these roots may descend initially and not be evident at the root crown, or become buried by changes in soil levels. Trees may develop 4-11 (Perry 1982, pp. 197-221), or more first order roots which may radiate from the trunk with a relatively even distribution, or be prominent on a particular aspect, dependent upon physical characteristics e.g. leaning trunk, *asymmetrical* crown; and constraints within the growing *environment* from topography e.g. slope, soil depth, rocky outcrops, exposure to predominant wind, soil moisture, depth of *water table* etc.

Orders of Roots The marked divisions between woody roots, commencing at the initial division from the base of the trunk, at the *root crown* where successive branching is generally characterised by a gradual reduction in root diameters and each gradation from the trunk and can be categorized numerically, e.g. *first order roots*, second order roots, third order roots etc. Roots may not always be evident at the *root crown* and this may be dependent on species, age class and the growing environment. Palms at maturity may form an adventitious root mass.

Root Plate The entire root system of a tree generally occupying the top 300-600mm of soil including roots at or above ground and may extend laterally for distances exceeding twice the height of the tree (Perry 1982, pp. 197-221). Development and extent is dependent on water availability, soil type, *soil depth* and the physical characteristics of the surrounding landscape.

Root Crown Roots arising at the base of a trunk.

Zone of Rapid Taper The area in the *root plate* where the diameter of *structural roots* reduces substantially over a short distance from the *trunk.* Considered to be the minimum radial distance to provide structural support and *root plate* stability. See also *Structural Root Zone (SRZ)*.

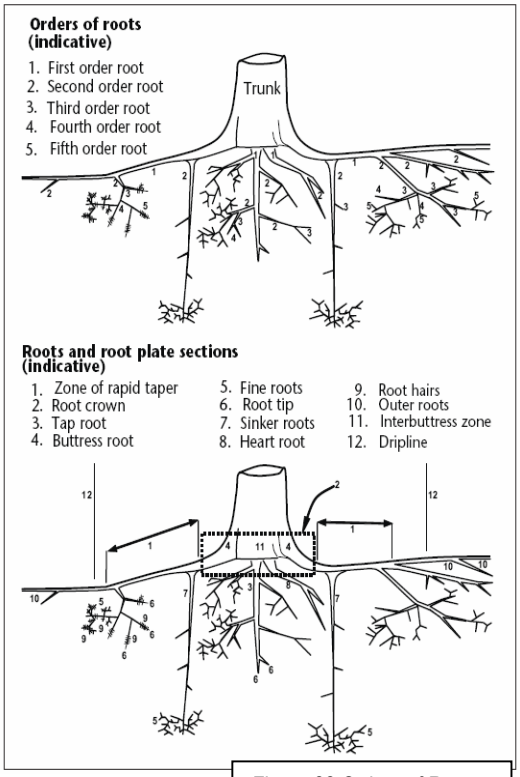


Figure 22 Orders of Roots.

Structural Roots Roots supporting the infrastructure of the *root plate* providing strength and *stability* to the tree. Such roots may taper rapidly at short distances from the *root crown* or become large and woody as with gymnosperms and dicotyledonous angiosperms and are usually 1st and 2nd order roots, or form an *adventitious root mass* in monocotyledonous angiosperms (palms). Such roots may be crossed and grafted and are usually contained within the area of *crown projection* or extend just beyond the *dripline*.

Symmetry

Symmetry Balance within a *crown,* or *root plate,* above or below the *axis* of the trunk of branch and foliage, and root distribution respectively and can be categorized as *Asymmetrical* and *Symmetrical*.

Asymmetrical Imbalance within a crown, where there is an uneven distribution of branches and the foliage *crown* or *root plate* around the vertical *axis* of the trunk. This may be due to *Crown Form Codominant* or *Crown From Suppressed* as a result of natural restrictions e.g. from buildings, or from competition for space and light with other trees, or from exposure to wind, or artificially caused by pruning for clearance of roads, buildings or power lines. An example of an expression of this may be, crown asymmetrical, bias to west.

Symmetrical Balance within a crown, where there is an even distribution of branches and the *foliage crown* around the vertical *axis* of the trunk. This usually applies to trees of *Crown Form Dominant* or *Crown Form Forest*. An example of an expression of this may be crown symmetrical.

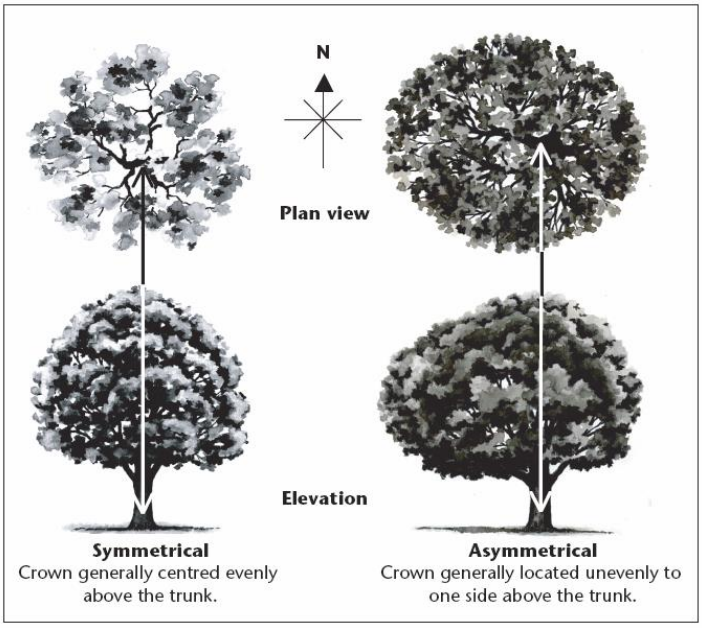


Figure 27 Symmetry within crown

Trunk

Trunk A single stem extending from the *root crown* to support or elevate the *crown*, terminating where it divides into separate *stems* forming *first order branches*. A trunk may be evident at or near ground or be absent in *acaulescent* trees of *deliquescent* habit, or may be continuous in trees of *excurrent* habit. The trunk of any *caulescent* tree can be divided vertically into three (3) sections and can be categorized as *Lower Trunk*, *Mid Trunk* and *Upper Trunk*. For a *leaning* tree these may be divided evenly into sections of one third along the trunk.

Acaulescent A *trunkless* tree or tree growth forming a very short *trunk*. See also *Caulescent.* (See Fig. 21)

Caulescent Tree grows to form a *trunk*. See also *Acaulescent*. (See Fig. 21)

Lower trunk Lowest, or *proximal* section of a trunk when divided into one-third (⅓) increments along its *axis*. See also *Trunk*, *Mid trunk* and *Upper trunk*.

Mid trunk A middle section of a trunk when divided into one-third (⅓) increments along its *axis*. See also *Trunk*, *Lower trunk* and *Upper trunk*.

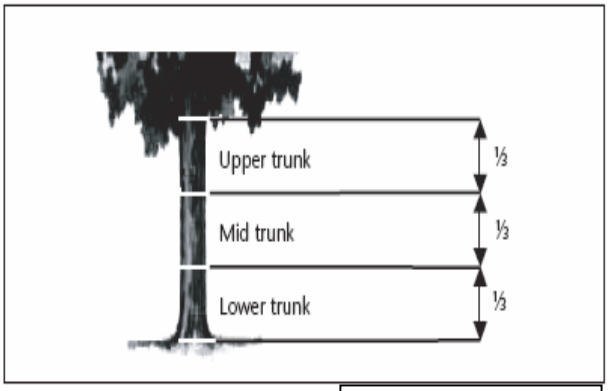


Figure 28 Trunk sections.

Upper trunk Highest, or *distal* section of a trunk when divided into one-third (⅓) increments along its *axis*. See also *Trunk*, *Lower trunk* and *Mid trunk*.

Diameter at Breast Height (DBH) Measurement of trunk width calculated at a given distance above ground from the base of the tree often measured at 1.4 m. The trunk of a tree is usually not a circle when viewed in cross section, due to the presence of *reaction wood* or *adaptive wood*, therefore an average diameter is determined with a *diameter tape* or by recording the trunk along its narrowest and widest axes, adding the two dimensions together and dividing them by 2 to record an average and allowing the orientation of the longest axis of the trunk to also be recorded. Where a tree is growing on a lean the distance along the top of the trunk is measured to 1.4m and the diameter then recorded from that point perpendicular to the edge of the trunk. Where a *leaning* trunk is *crooked* a vertical distance of 1.4m is measured from the ground. Where a tree branches from a trunk that is less than 1.4m above ground, the trunk diameter is recorded perpendicular to the length of the *trunk* from the point immediately below the base of the flange of the *branch collar* extending the furthest down the trunk, and the distance of this point above ground recorded as *trunk* length. Where a tree is located on sloping ground the DBH should be measured at half way along the side of the tree to average out the angle of slope. Where a tree is *acaulescent* or *trunkless* branching at or near ground an average diameter is determined by recording the radial extent of the trunk at or near ground and noting where the measurement was recorded e.g. at ground.

Vigour

Vigour Ability of a tree to sustain its life processes. This is independent of the *condition* of a tree but may impact upon it. Vigour can appear to alter rapidly with change of seasons (seasonality) e.g. *dormant*, deciduous or semi-deciduous trees. Vigour can be categorized as *Normal Vigour, High Vigour*, *Low Vigour* and *Dormant Tree Vigour*.

Normal Vigour Ability of a tree to maintain and sustain its life processes. This may be evident by the *typical* growth of leaves, *crown cover* and *crown density*, branches, roots and trunk and *resistance* to *predation*. This is independent of the *condition* of a tree but may impact upon it, and especially the ability of a tree to sustain itself against predation.

High Vigour *Accelerated growth* of a tree due to incidental or deliberate artificial changes to its growing *environment* that are seemingly beneficial, but may result in *premature aging* or failure if the favourable conditions cease, or promote *prolonged senescence* if the favourable conditions remain, e.g. water from a leaking pipe; water and nutrients from a leaking or disrupted sewer pipe; nutrients from animal waste, a tree growing next to a chicken coop, or a stock feed lot, or a regularly used stockyard; a tree subject to a stringent watering and fertilising program; or some trees may achieve an extended lifespan from continuous *pollarding* practices over the life of the tree.

Low Vigour Reduced ability of a tree to sustain its life processes. This may be evident by the *atypical* growth of leaves, reduced *crown cover* and reduced *crown density*, branches, roots and trunk, and a deterioration of their functions with reduced *resistance* to *predation*. This is independent of the *condition* of a tree but may impact upon it, and especially the ability of a tree to sustain itself against predation.

Appendices E & F

Appendix E – Survey of Subject Tree/s
Appendix F – Tree Protection Plan

Trees the subject of this report are marked on the plans in the following appendices and are numbered as listed below.

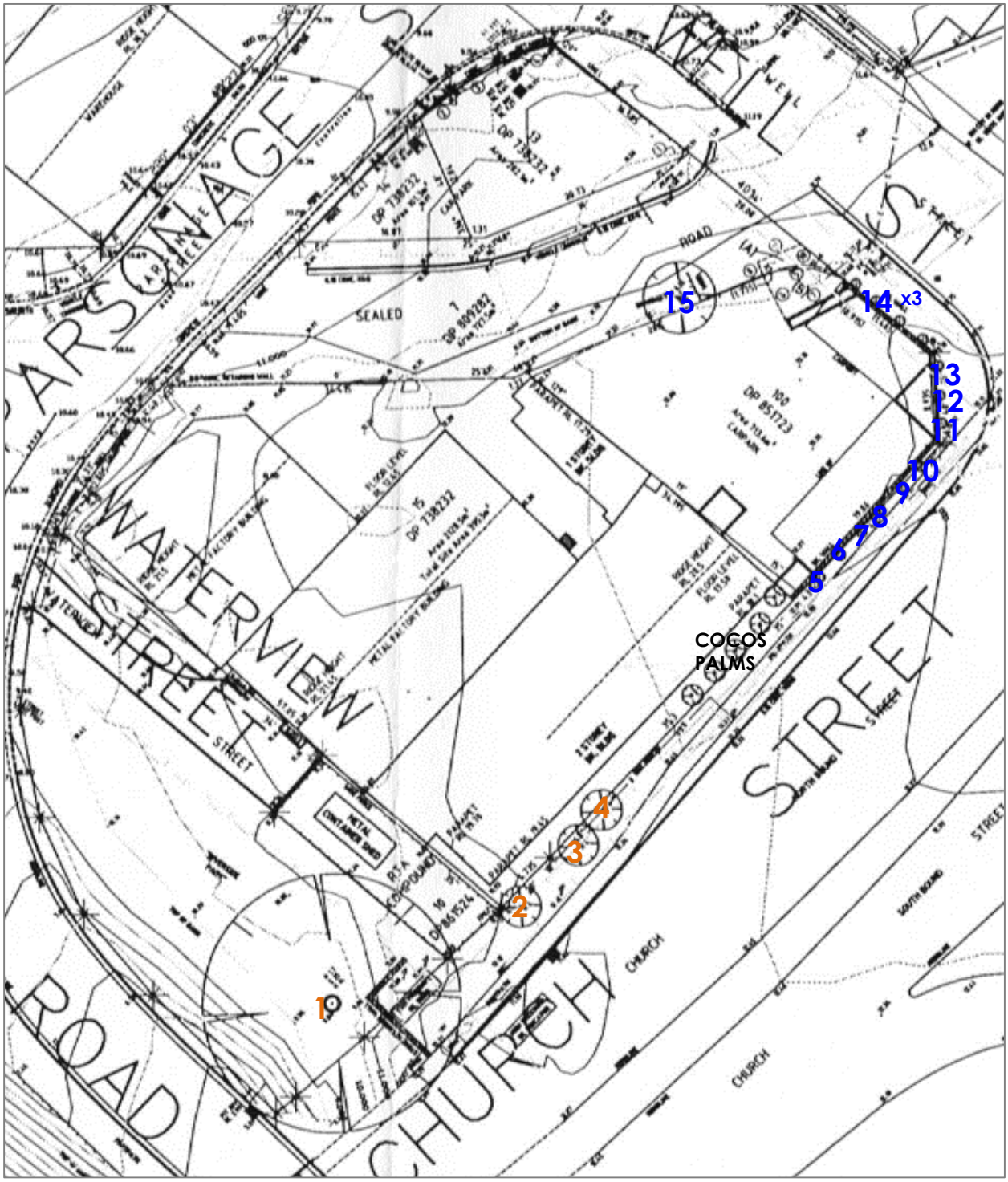
Redgum Tree / Stand No.	*Genus and species*	Common name	Recommendation
1	*Ficus rubiginosa*	Port Jackson Fig	Retain and protect – Council reserve
2	*Jacaranda mimosifolia*	Jacaranda	Retain and protect – Street tree
3	*Allocasuarina littoralis*	Black She Oak	Retain and protect – Street tree
4	*Allocasuarina littoralis*	Black She Oak	Retain and protect – Street tree
5	*Melaleuca bracteata 'Revolution Green'*	Revolution Green Paperbark	Remove and Replace – Street tree
6	*Melaleuca bracteata 'Revolution Green'*	Revolution Green Paperbark	Remove and Replace – Street tree
7	*Melaleuca bracteata 'Revolution Green'*	Revolution Green Paperbark	Remove and Replace – Street tree
8	*Melaleuca bracteata 'Revolution Green'*	Revolution Green Paperbark	Remove and Replace – Street tree
9	*Melaleuca bracteata 'Revolution Green'*	Revolution Green Paperbark	Remove and Replace – Street tree
10	*Melaleuca bracteata 'Revolution Green'*	Revolution Green Paperbark	Remove and Replace – Street tree
11	*Melaleuca bracteata 'Revolution Green'*	Revolution Green Paperbark	Remove and Replace – Street tree
12	*Melaleuca bracteata 'Revolution Green'*	Revolution Green Paperbark	Remove and Replace – Street tree
13	*Melaleuca bracteata 'Revolution Green'*	Revolution Green Paperbark	Remove and Replace – Street tree
14/2	*Melaleuca bracteata 'Revolution Green' x3*	Revolution Green Paperbark	Remove and Replace – Street tree
15	*Gleditsia triacanthos sunburst*	Honey Locust	Remove and Replace

Plan Details

1. Original Survey Plan, Sheet 1 of 1, Date 19/05/2010, scale 1:200 supplied by Robertson & Marks Architects Pty Ltd
2. *Non-Complying-Ground Plan, Scale 1:100 @ A0 by Cox Architecture + Kennedy Associates Architects, 8 Parsonage Street, Ryde NSW*

Appendix E - Site Plan A – Survey of Subject Trees

Plan has been reproduced from electronic transmission and is no longer to original scale.



Legend

- Trees numbered in **orange** are recommended for **retention**.
- Trees numbered in **blue** are recommended for removal.

Appendix F - Site Plan B
Survey of Trees to be Retained and Tree Protection Plan

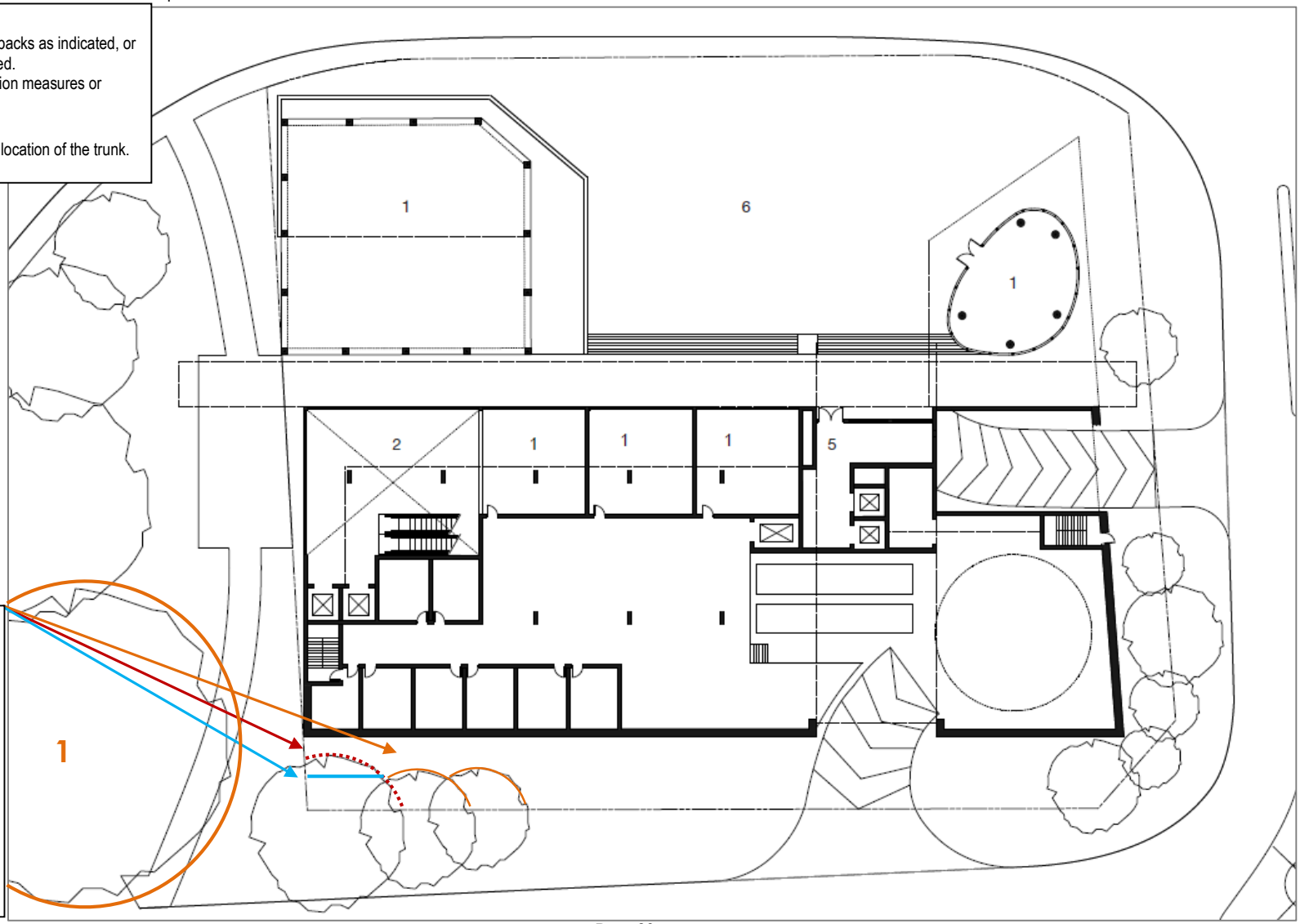
Plan has been reproduced from electronic transmission and is no longer to original scale.
For other tree protection measures see sections 5.0 and 7.0. All Tree Protection Zones are to be measured on site.

Legend

Tree Protection Zone (TPZ), fencing with setbacks as indicated, or other protection measures or works as indicated.

Tree Protection Zone, area of special protection measures or works outside of fenced area.

Tree numbers – trees to be retained only.
Subject trees represented by the approximate location of the trunk.



Indicative location of Tree Protection fencing which is to be measured on site and positioned along the Tree Protection Zone, excavation zone or proposed building footprint and to remain installed for the duration of the development. Installation of boundary fences within rootzone to be of pier and beam construction. Red dotted Tree Protection around trees relates to relocation of fencing when construction is to be undertaken within these areas. All works to be carried out within the blue Tree Protection area after works commences is to be undertaken in consultation with site arboriculturist.