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### **REPORT:**

# ARBORICULTURAL IMPACT ASSESSMENT

194 Campelltown Road Denham Court NSW

Prepared July 2013 Reference 15179

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#### **SUMMARY**

This report considers a total of 136 trees within and adjacent to the site, which were assessed as part of the proposed development.

Some trees were of the Cumberland Plain Woodland which is a critically endangered ecological community (CEEC).

Of the trees assessed, 45 are proposed to be removed and 91 retained with the design and construction methods proposed.

Forty one (41) trees formed part of the Cumberland Plain Woodland with 14 proposed for removal and 27 retained.

Trees 7-26, 30-34, 39-72, 87-101, 103 and 106-121 are proposed to be retained. No encroachment by construction works is proposed within the Tree Protection Zone of Trees 7-26, 30-34, 39-70, 87, 88, 95, 96, 106-121 with low to no impact therefore expected. Encroachment is considered minor (AS4970) for Trees 71 and 72 with low impact expected. Encroachment is considered major (AS4970) for Trees 89-94, 97-10 and 103, although low to medium impact is expected as tree sensitive construction methods are proposed. The trees to be retained will be protected and incorporated into the landscape works for the site.

Trees 1-6, 27-29, 35-38, 73-86, 102, 104, 105 and 122-136 are proposed to be removed as they are situated within or too close to the proposed construction envelope and are unable to be retained with the design proposed.

The general condition of the subject tree/s affected by the proposed development is listed below in Table 1.0 and a summary of works in Table 2.0.

 Table 1.0
 General condition of tree/s. Trees described in greater detail in section 5.0.

UTM Tree No.	Genus and species	Common name	Condition  G = Good F = Falr P = Poor D = Dead
1-3 Stand 1	Arecastrum romanzoffianum	Cocas Palm	G
4-6 Stand 2	Eucalyptus moluccana	Grey Box	F
7-11 Stand 3	Callistemon viminalis Corymbia maculata	Weeping Bottlebrush Spotted Gum	G
12	Eucalyptus moluccana	Grey Box	F
13	Eucalyptus moluccana	Grey Box	G
14-38 Stand 4	Eucalyptus moluccana	Grey Box	G
39-70 Stand 5	Corymbia maculata	Spotted Gum	G
71-72 Stand 6	Pinus pinea	Stone Pine	G
73-88 Stand 7	Casuarina glauca	Swamp She-Oak	F-G
89-94 Stand 8	Eucalyptus moluccana	Grey Box	G-P
95	Eucalyptus moluccana	Grey Box	G
96	Eucalyptus moluccana	Grey Box	G
97-101 Stand 9	Eucalyptus moluccana	Grey Box	G-F

Table 1.0 Continues.

UTM Tree No.	Genus and species	Common name	Condition G = Good F = Fair P = Poor D = Dead
102	Eucalyptus moluccana	Grey Box	Р
103	Eucalyptus tereticornis	Forest red Gum	F
104-114 Stand 10	Eucalyptus moluccana	Grey Box	G-F
115-118 Stand 11	Eucalyptus moluccana Eucalyptus sideroxylon	Grey Box Mugga Ironbark	G-F
119-121 Stand 12	Casuarina glauca	Swamp She-Oak	G
122-130 Stand 13	Eucalyptus moluccana	Grey Box	G
131-136 Stand 14	Callistemon salignus	Willow Bottlebrush	G-F

 Table 2.0
 Schedule of works and trees affected. Trees described in greater detail in section 5.0.

UTM Tree No.	Common Name	Description of work to be done
- 1-3	Cocas Palm	Propose to remove and replace with new plantings as per Landscape Plan.
4-6	Grey Box	Propose to remove and replace with new plantings as per Landscape Plan.
7-11	Weeping Bottlebrush Spotted Gum	Retain and protect within a Tree Protection Zone (TPZ) as per the Tree Protection Plan Appendix I.
12	Grey Box	Retain and protect within a Tree Protection Zone (TPZ) as per the Tree Protection Plan Appendix I.
13	Grey Box	Retain and protect within a Tree Protection Zone (TPZ) as per the Tree Protection Plan Appendix I.
14-26	Grey Box	Retain and protect within a Tree Protection Zone (TPZ) as per the Tree Protection Plan Appendix I.
27-29	Grey Box	Propose to remove and replace with new plantings as per Landscape Plan.
30-34	Grey Box	Retain and protect within a Tree Protection Zone (TPZ) as per the Tree Protection Plan Appendix I.
35-38	Grey Box	Propose to remove and replace with new plantings as per Landscape Plan.
39-70	Spotted Gum	Retain and protect within a Tree Protection Zone (TPZ) as per the Tree Protection Plan Appendix I.
71-72	Stone Pine	Retain and protect within a Tree Protection Zone (TPZ) as per the Tree Protection Plan Appendix I.
73-86	Swamp She-Oak	Propose to remove and replace with new plantings as per Landscape Plan.
87-88	Swamp She-Oak	Retain and protect within a Tree Protection Zone (TPZ) as per the Tree Protection Plan Appendix I.
89-94	Grey Box	Retain and protect within a Tree Protection Zone (TPZ) as per the Tree Protection Plan Appendix I.
95	Grey Box	Retain and protect within a Tree Protection Zone (TPZ) as per the Tree Protection Plan Appendix I.
96	Grey Box	Retain and protect within a Tree Protection Zone (TPZ) as per the Tree Protection Plan Appendix I.
97-101	Grey Box	Retain and protect within a Tree Protection Zone (TPZ) as per the Tree Protection Plan Appendix I.
102	Grey Box	Propose to remove and replace with new plantings as per Landscape Plan.
103	Forest red Gum	Retain and protect within a Tree Protection Zone (TPZ) as per the Tree Protection Plan Appendix I.
104-105	Grey Box	Propose to remove and replace with new plantings as per Landscape Plan.
106-114	Grey Box	Retain and protect within a Tree Protection Zone (TPZ) as per the Tree Protection Plan Appendix I.
115-118	Grey Box Mugga Ironbark	Retain and protect within a Tree Protection Zone (TPZ) as per the Tree Protection Plan Appendix I.
119-121	Swamp She-Oak	Retain and protect within a Tree Protection Zone (TPZ) as per the Tree Protection Plan Appendix I.
122-130	Grey Box	Propose to remove and replace with new plantings as per Landscape Plan.
131-136	Willow Bottlebrush	Propose to remove and replace with new plantings as per Landscape Plan.

#### 1.0 INTRODUCTION

Urban Tree Management © has prepared this report for Alfi Arcuri of Mosca Pserras Architects, on behalf of Xpress Group Pty Ltd (the applicant).

The land is located in the Campbelltown City Council (*the Council*) Local Government Area (*LGA*) and a Tree Preservation Order (TPO) applies.

The site currently consists of a residential property to the north and vacant grazing land to the south, being Lots 100 & 101 in D.P. 1176622 known as 194 Campbelltown Road, Denham Court (the site). The proposed D.A. involves the demolition and construction of a service station and car wash, with allocated areas for truck parking.

Mr Laurie Dorfer (the author) attended the site on Monday 1 July April 2013 and the trees and their growing environment were examined by a visual assessment from the ground.

Parts of the site currently support trees of highly fragmented and modified bushland which have been impacted by numerous past land use activates.

These remnant trees form part of an area identified as Cumberland Plain Woodland which is listed as a critically endangered ecological community (CEEC), under Part 2 of Schedule1A of the NSW TSC Act (1995).

The site is subject to a Development Application and this report and any works recommended herein, that require approval from the consenting authority are provided to form part of that development application and its consent conditions.

The tree/s are indicated in Appendix H – Survey of Subject Tree/s. This report has relied upon the following plan/s and documents:

- 1. Site Plan, by Mosca Pserras Architects, Dwg. File: 12033 AP01, Issue A, dated 04/02/2013.
- 2. Floor Plan, by Mosca Pserras Architects, Dwg. File: 12033 AP02, Issue A, dated 04/02/2013.
- 3. Survey Plan by Project Surveyors, Ref No. 81338, Dwg. No. 81338-1, Sheet 1 of 3, dated 5 June 2013.

#### 2.0 AIMS & OBJECTIVES

#### <u>Aims</u>

Detail the condition of the tree/s on the site or on adjoining properties where such trees may be affected by the proposed works. This will be undertaken by assessment of individual specimens or stands, and indicate remedial works or protection measures for their retention in a safe and healthy condition, or a condition not less than that at the time of initial inspection for this report, or in a reduced but sustainable condition due to the impact of the development. Where possible expected impacts will be ameliorated through tree protection measures able to be applied, and will consider the location and condition of the trees in relation to the proposed building works, or recommend removal and replacement where appropriate.

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.

Determine from the assessment 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.

#### **Objectives**

Assess the condition of the subject tree/s.

Determine impact of development on the subject tree/s.

Provide recommendations for retention or removal of the subject tree/s.

Provide specifications for protection of tree/s to be retained.

Provide recommendations for replacement tree/s where appropriate.

#### 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 Significance of a Tree, Assessment Rating System (STARS) (IACA, 2010) ©
- 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 of each individual tree, or stand of trees, or a representative population sample.
- 3.3 Any dimensions recorded as averages, or by approximation are noted accordingly.
- 3.4 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 B) 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 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,
  - Engineering e.g. techniques to ameliorate impact on trees such as structural soil, gap graded fill, lateral boring,
  - Construction e.g. techniques to ameliorate impact on trees such as pier and beam, bridge footings, suspended slabs,
  - 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.

- 3.5 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.
- 3.6 The trees/s have been allocated a significance rating as determined by using the Tree Significance Assessment Criteria of the IACA Significance of a Tree, Assessment Rating System (STARS)© (IACA, 2010), Appendix A.
- 3.7 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 G.

### 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, 1998.
- 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.

#### TREE ASSESSMENT 5.0

#### 5.1 Assessment of tree/s or stand/s of trees.

UTM Tree No / Stand No	Geeux & sproces f. Common Neme	Pge Y = Young M = Michine O = Overmellum	G = Good F = Fair P = Poor D = Deed	Crown Form D = Dormani C = Co-dorminel i = (nlemmdale S = Suppressed F = Forest E = Emergeni	Ht. Approx matres	epprox. repres. retres // Oneolalien R = Radiel, or other	Crown Symmetry 1 = symmetrical 2 = asymmetrical f Orientitalon	Crown cover / Crown density % / D = dorment	DBH un ram @ 14m, or other, as indicated and trunk contribution other than R = redial, e.g. NiS J DARB Diameter above rook buthess	Trunk Limin 1 = Upopli-Slight 2 = Moderaby 3 = Severe 4 = Critical 5 = Acastescent f Constation f ST = State P = Progressive Se = Safeareating	Roots encornt @ roof crown = None = 2 A A S S S S S S S S S S S S S S S S S	ress & discusses 1 = No or 2 = Yes (if 2 sale corrunents)	Bark included 1 = Ni or 2 = Yes or 3 = N/A	Vigour 1 = Goad Vigour 2 = Low Vigour	Form I = Good form 2 = Poor larm	SRIV Age, Vigitar, Condition / Index Rehing www.nea.org.ml // ESTIMATED LIFE EXPECTANCY 1 Long 2 Madium a Shed	Significance scale STARS with estary states and states with estary states and
1-3 Sland 1	Arecastrum romanzoffianum Cocas Palm	M	G	D-C	6-8	3-5	1	90 90	250-350	1	-	2	1	1	1	MGVF - 10	3
4-6 Stand 2	Eucalyptus moluccana Grey Box	М	F	D	15	5-7 -	1	90 90	300-350	1	1	1	1-2	1	1-2	MGVF - 9 1-2	1-3 1-3
7-11 Stand 3	Callistemon viminalis Corymbia maculata	Y	G	C-D	6-8	3-5	1	90 90	150-250	1	1	1	1-2	1	1	YGVG -9 1-2	1-2 1-2
12	Eucalyptus moluccana Grey Box	М	F	С	14	8X5 N/S	2 W	90 90	430 R 480	1	1	1	2	1	1	MGVF - 9 2	1 2
13	Eucalyptus moluccana Grey Box	М	G	D	16	10X8 N/S	2 E	90 90	490 AV 500	1	1	1	2	1	1	MGVG -10 1	2
14-38 Stand 4	Eucalyptus moluccana Grey Box	Y	G	D	4-7	4-7	1	90 90	60-140		1	1	1	1	1	YGVG - 9	2 2

1-3 4-6 7-11 12 13

"

Al Dual leader at GL. 5/ Previously failed at trunk – approx. 2.5m above GL.

7/ Growing adjacent to Callistemor salignus – included at first order structural branch (FCSB) junction. 8-11/ Street trees.

Medium volume borer activity ay lower and mid trunk. Previously failed at lower crown to W. Low volume large deadwood at lower crown. Included at FCSB junction – round edge rib at seams to NE and SW. Low volume large deadwood at lower crown.

#### 5.1 Assessment of tree/s or stand/s of trees - Continues

Tree No	Genus Aspones Common Name	Age A ≈ Covermetive O = Covermetive	Condition G = Good F = Fier P = Poor D = Deard	Crows Form D = Dorrinant C = Co-dormanni I = Intermediate S = Suppressed F = Forest E = Emergant	HI. Approx. metres	Crown spread spread repress / Onentalion R = Redial, or other	Crown Symmetry 1 = symmetrical 2 = symmetrical 3 = symmetrical 4   On en   saloon	Crown cover / / Crown density % / D = dommant	in rim @ 1 4m, or other, as indicated truth one listen other than R = radief, e.g. N/5 / DARB Overneter showe not buttress	Trunis Lean 1 = Upnghi-Sighi 2 = Modaraba 3 = Severa 4 = Critical 5 = Accud oscaril f Onenlation f ST = Stato: P = Progressive Se = Suil-cornelog	Rocks mediant (g) rook crown rook crown rook crown 2 = Advanil bous 3 = Bastal Farra 4 = Buthreaser 5 = Farst Order Rocks (FOR), No & distribution a g, R = redding, or one seach to N, S, E, NE and M	Perts & disamples I = No or 2 = Yes [ii 2 see comments]	Branch Bark Included 1 = No or 2 = Yes or 3 = N/A	Vigour 1 = Good Vigour 2 = Low Vigour	Form   = Good form 2 = Poor form	SRTV Ago, Vigour, Condition / Index Rating WHY ISES on SU IF EXPECTANCY I Long 2 Medium 3 Shool	Srgmittance state www.legg.org.co  =Negli   2=Medium   3=Low   Retention Value  =Negli   2=Medium   3=Low   4:Remove
39-70 Sland 5	Corymbia maculata Spotted Gum	Y	G	D	4-7	4-7	1	90 90	60-120	1	11	1	1	1	1	YGVG - 9	2
71-72 Stand 6	Pinus pinea Stone Pine	М	G	D	8	8-10	1	90	350-380	1	1	1	1-2	1	1	MGVG = 10 1	1
73-88 Stand 7	Casuarina glauca Swamp She-Oak	Y-M	F-G	C-I-S	6-10	3-6	1-2	80-90 90	120-350	1	1	1-2	1-2	1	1-2	1-3	1-3 1-3
89-94 Stand 8	Eucalyptus moluccana Grey Box	М	G-P	C-S	5-14	2-5 -	1-2	90 90	120-350	1	1	1	1-2	1	1-2	1-2	1-3 1-4
95	Eucalyptus moluccana Grey Box	М	G	D	12	6X6 R	1	90 90	400 @ 900 450	1	1	1	1	1	1	MGVG -10	1
96	Eucalyptus moluccana Grey Box	М	G	D	14	8X8 R	1	90 90	610 AV 650	1	1	1	1	1	1	MGVG = 10 1	1:
97- 101 Stand 9	Eucalyptus moluccana Grey Box	м	G-F	С	14-16	5-8	1-2	90 90	100-380	1	1	1	1-2	1	1	1	1

39-70 71-72 73-88 89-94 95 96 97-101

All included at first and second order structural branch junctions – except 193, 93/ recently failed at trunk, approx. 4m above GL with epicormic growth emerging. Bark delaminated at lower trunk to W = 400x200mm approx.

98/ Low volume large deadwood throughout crown.

#### Assessment of tree/s or stand/s of trees - Continues

Stand No	Genera & spacres Common Nema	Pgo Y = Young M = Meture O = Overmeture	Generation G = Good F = Fair P = Poor D = Dead	Crows Ferm D = Dominant G = Co-domwant i = Intermetals S = Suppressed F = Fores E = Emergent	Ht. Approx. metres	crown spread sports. sports. retres // Chentation R = Radial, or other	Crown Symmoury 1 = symmotrical 2 = asymmotrical / On antakon	cover density % ) D= dorment	OBH In ran @ 14m, or other, as indicated and Iranis on entation other than R = radid, a g N/S / DARB Dementer above rool bultrass	Trura Leen  1 = Uprig M-Sight  2 = Modemile  3 = Severs  4 = Critical  5 = Acsul excent  Conentration  / ST = State  P = Programine  Se = Sall-corracting	Roots evident (g) root crown 1 = None 2 = Adventibous 3 = Bessel Flare 4 = Buttmenes 5 = First Order Roots (FOR), No & distribution a.g. R = racida, or one each to N, S, E, NE and W	Pests 8. dename 1 = No or 2 = Yos (f/2	Brunch Bark indisided I = No or 2 = Yes or 3 = N/A	Vigour 1 = Good Vigour 2 = Low Vigour	Form  I =  Good  form  2 =  Poor  form	SRIV Age, Vigour, Candition / Index Rating WHYM LIKE STEP BY ESTIMATED LIFE EXPECTANCY 1. Long 2 Medium 3 Short	Significance ocitie with use or sile with use or sile in the sile with use or sile in the
102	Eucalyptus moluccana Grey Box	М	Р	С	15	8X8 R	2 NE	80 90	720 AV	1	1	2	1	2	2	MLVP – 2	3 4
103	Eucalyptus tereticomis Forest Red Gum	М	F	D	18	15X12 N/S	2 W	80 90	900 R	1	1	2	1	1	1	MGVF -9	3
104-114 Stand 10	Eucalyplus moluccana Grey Box	Y-M	G-F	D-C-I	8-14	3-8	1-2	90 90	140-380	1	1	1	1-2	1	1	1	1
115-118 Stand 11	Eucalyptus moluccana Eucalyptus sideroxylon	Y-M	G-F	D-C	6-8	3-5	1	90	150-280	1	1	1	1-2	1	1	1-2	1-2
119-121 Stand 12	Casuarina glauca Swamp She-Oak	Y-M	G	С	8	3-4 R	1-2	90 90	120-180	1	1	1	1-2	1	1	Ť	1
122-130 Stand 13	Eucalyptus moluccana Grey Box	Y-M	G	С	7-14	3-6	1	90 90	100-350 APPROX	1	1	1	1-2	1	1	1	1
131-136 Stand 14	Callistemon salignus Willow Bottlebrush	Y	G-F	D	3-5	3-4	1	90 90	200-250 APPROX	1	8	1	1-2	1	1	2	3
102 103 104-114 115-118 119-121 122-130	Previously failed at trunk approx. Numerous branch failures at low Low volume small and large dea 115/ Included at first and second Low volume large deadwood the	er and mid crow dwood througho order structura	m – from 150 oul crown I branch jund	Omm Ø to 400mm	. Hollows	evident with Ga	alahs present to	one at mid	me epicormic gro crown. High valu	me large deadwo	rown. Medium vo	lume large d own. Termili	eadwood a e flight cut	at mid uppo s at lower a	er crown, and mid t	Recommend re runk	moval.

131-136

#### Observations

- 5.2 The trees were determined to be of self-sown (remnant) & planted origin, locally indigenous, indigenous & exotic, evergreen specimens which all form part of the local canopy.
- 5.3 The planted specimens were mostly located around the perimeters of the site which provide visual screening to and from the surrounding arterial roads. These are all considered common taxa and determined to be approximately between 5-10 years of age. Collectively only do they provide prominence and significant visual amenity.
- 5.4 The remnant trees were considered prominent when viewed from various directions within the landscape. These formed various stands within the site which formed part of the Cumberland Plain Woodland which is listed as a critically endangered ecological community under the Threatened Species Conservation Act 1995.
- 5.5 The CEEC was highly modified with predominantly only trees remaining of the Cumberland Plain Woodland. These also were fragmented in parts subjecting some trees to recent and past impacts affecting condition and vigour. The floristic diversity for the community was very poor.
- 5.6 The understory consisted of a disturbed mix of indigenous and mostly exotic herbs and grasses predominantly of Kikuyu grass.
- 5.7 Tree 103 only was observed to support hollows for wildlife habitat.
- 5.8 Current land use surrounding the trees of this community currently incorporates grazing animals which are likely to have been present for several years.

### Tree Significance

5.9 Determined by using the Tree Significance - Assessment Criteria of the *IACA Significance of a Tree, Assessment Rating System* (STARS) © (IACA, 2010), Appendix A. The Tree Significance rating was assessed on individual tree merit, not collectively as bushland.

### **Significance Scale**

1 – High 2 – Medium 3 – Low

Significance Scale	1	2	3
UTM Tree No. / Stand No.	4-6, 7-11, 12, 73-88, 89-94, 89-94, 95, 96, 97-101, 104-114, 115- 118, 122-130	1-3, 4-6, 7-11, 13, 14- 38, 39-70, 71-72, 73- 88, 89-94, 103, 115- 118, 119-121, 131- 136	4-6, 73-88, 89-94, 102

Some trees (stands) are displayed in more than one category due to various levels of significance of individual specimens within that stand.

### Tree Retention Value

5.10 Determined by using the Retention Value - Priority Matrix of the *IACA Significance of a Tree, Assessment Rating System* (STARS) © (IACA, 2010), Appendix A. The Tree retention Value was assessed on individual tree merit, not collectively as bushland.

#### **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
UTM Tree No. / Stand No.	4-6, 7-11, 13, 71-72, 73-88, 89- 94, 95, 96, 97-101, 104-114, 115-118, 119- 121, 122-130	4-6, 7-11, 12, 14-38, 39-70 , , 73-88 , 89- , 94 , 115-118	1-3, 4-6, 73- 88 , 89-94, 102, 103,131- 136	93 , 102

Tree/s located within the neigbouring property and should be retained and protected

Some trees (stands) are displayed in more than one category due to various retention values of individual specimens within that stand.

#### Discussion

- 5.11 AS4970 (2009) section 3 requires a Tree Protection Zone (TPZ) setback of 12 x DBH from center of trunk (COT) but allows for a 10% reduction of area equal to a reduction of 30% of radius on one side only with the setbacks as shown in Table 3.0. 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.
- 5.12 The proposed construction layout will provide for the retention of Trees 7-26, 30-34, 39-72, 87-101, 103 and 106-121. Tree sensitive construction methods are proposed and required to be implemented to retain and minimise impact on trees along the western boundary.

#### Table 3.0

Notes - 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 construction works e.g. excavation (see explanatory notes below).

#### Explanatory notes for Table 3.0.

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."

Refer also to sections 3.4 and Appendix F, 1.1.3 for further explanation of modifications to these setbacks.

Table 3.0 - Continues

1. UTM Tree No. / Stand No.	2. Trunk Diameter at Breast Height  DBH  1.4 m above ground, AS4970 (2009), or mm or m above ground where indicated. # = average.  (mm)	3. Structural Root Zone SRZ From centre of trunk (COT), trunk diameter above root buttress (DARB) AS4970 (2009) Section 3, 3.3.5 (see Appendix C) where applicable (m)	4. Tree Protection Zone (TPZ) =  12 x DBH  From centre of trunk (COT) in metres AS4970 (2009) Section 3 (see Appendix B)	5.  TPZ reduced by 10%  of area on one side of tree only, in metres equating to approx. 0.3 radius as per AS4970 (2009) Section 3, 3.3 (m)	6. Proposed distance of works on the side closest to construction in metres From centre of trunk (COT), (m)
7-11	300-350	2.1	4.2	3	10.5
12	430	2.4	5.2	3.6	9
13	490	2.5	5.9	4.1	10.5
14-26	140-160	1.6	2	2	>4.5
30-34	140-160	1.6	2	2	>4.5
39-70	60-120	1.4	2	2	>4
71-72	350-380	2.3	4.6	3.2	4.5
87-88	350	2.1	4.2	3	9
89-94	120-350	2.1	4.2	3	1.5-7. 18, 21, 25
95	400	2.3	4.8	3.3	15
96	610	2.7	7.2	5	21
97-101	100-380	2.3	4.6	3.2	1.5-3 18, 21, 25
103	900	3.2	10.8	7.5	6.8
106-114	140-380	2.3	4.6	3.2	6.8
115-118	150-280	2	3.4	2.3	>53
119-121	100-350	2.1	4.2	3	5.3

#### Descriptors for modified setbacks in Column 6.

- Special conditions apply to protect the roots of trees generally, see Appendix E. Additional protective fencing information is detailed in Appendices E and I.
- Acceptable due to the good relative tolerance of the species to development impacts.

  Range of setbacks for the trees at each end of a linear stand, see Appendix 1.

  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. Acceptable due to additional special protection works, see Section 5.0 for this tree.
- Acceptable as pre-existing site conditions were conducive to having restricted the development of root growth in this direction.
- Street tree with protective fencing of minimal width to allow for pedestrian access along road reserve Acceptable as tree transplanted reducing the area of the root zone.

- Acceptable as not effected by development works.

  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.
- Acceptable as tree growing on a lean and encroachment on compression wood side where root growth is of reduced structural importance. Acceptable as root mapping has indicated extent of structural woody roots with a diameter of 20 mm or more.

- Acceptable as a specimen of palm taxa tolerant of encroachment.

  Acceptable as excavation on down slope or across slope side of tree.

  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.
- Acceptable as encroachment by pier, with minimal disturbance.

  Acceptable as encroachment above grade without excavation or sub-base compaction.
- Acceptable as located within 0.5 m from edge of dripline.
- Acceptable as encroachment with gap graded fill that can accommodate gaseous exchange between roots/soil and the atmosphere and ongoing root growth. Minimum TPZ setback 2 m, AS4970 (2009) section 3, 3.2.
- Maximum TPZ setback 15 m, AS4970 (2009) section 3, 3.2.
- Tree is a palm, other monocol, cycad or tree fern TPZ is to be 1 m outside crown projection AS4970 (2009) section 3, 3.2.
- Acceptable with Tree Sensitive Construction methods.
- Root mapping required to determine impact.

#### Impact by Proposed Works

- Trees 1-3, 4-6, 27-29, 35-38, 73-86, 102, 104, 122-130 & 131-136 Direct 5.13 impact is expected as the trees are situated within or too close to the proposed construction envelope and are unable to be retained.
- 5.14 Trees 7-11, 12, 13, 14-26, 30-34, 39-70, 87-88, 95, 96, 106-114, 115-118 & 119-121 - No direct impact is expected as the proposed setbacks from works are outside the Tree Protection Zone setbacks (Table 3 - Column 4). Low to no impact is expected.

- 5.15 <u>Trees 71-72</u> Encroachment by the proposed works is considered minor (AS4970) as situated within the TPZ, although outside the allowable reduced (10%) set back (Table 3 Column 5). Low impact is expected.
- 5.16 <u>Trees 89-94, 97-101 & 103</u> Encroachment by the proposed works is considered major (AS4970) as situated within the 10% allowable setback (Table 3 Column 5). However, with tree sensitive construction methods low to medium impact is expected.

### **General Comments**

5.17 Trees 93 & 102 have previously failed during recent storms with their long term viability and structural integrity compromised. Removal should be considered within the short term. Additionally, Tree 103 supported hollows and numerous structural defects which require further investigation. A hazard assessment including an aerial inspection with internal diagnostic testing is recommended. These trees are situated on RMS land and require owners consent for any works undertaken.

#### Tree Protection Works - General

- 5.18 The Tree Protection Zones for Trees 7-26, 30-34, 39-72, 87-101, 103 and 106-121 are to be incorporated into the construction works for the site with the protection maintained in situ as indicated in Appendix I – Tree Protection Plan.
- 5.19 The Tree Protection Zones are to be constructed as described here and detailed in Appendix I Tree Protection Plan, and in Appendix E. The trees will be sustained within the constraints of the modifications to the site by development works. Attention is drawn specifically to Appendix F for the protection of all trees to be retained and particular sections where detailed.

#### Tree Protection Works - Specific

#### **During Demolition**

5.20 Removal of Trees 1-6, 27-29, 35-38, 73-86, 102, 104, 105 and 122-136 should be undertaken only by cutting down without damaging trees to be retained. Where damage is likely, removal should be undertaken manually by aerial sectioning and lowering, and the grinding out of its stump.

#### **Prior to Construction**

5.21 Tree Protection Zones (TPZ) including fencing are to be installed around Trees 7-26, 30-34, 39-72, 87-101, 103 and 106-121 with setbacks as detailed in Table 3 and/or Appendix I -Tree Protection Plan. Works are to be certified by the Project Arborist.

#### **During Construction**

5.22 Maintain the Tree Protection Zone fences for the entire construction period.

- 5.23 Within the Tree Protection Zone (TPZ) of Trees 89-94, 98-101 & 103 driveway constructions should be undertaken by concrete above the existing grade layed on top or piered/suspended in section. A gap graded aggregate is to be used to accommodate any level changes to maintain gaseous exchange. No excavation or compaction shall occur within the Tree Protection Zone. Soil levels are not to be disturbed or modified. Works are to be monitored and certified by the Project Arborist.
- 5.24 If piers are used, the excavation is to be undertaken manually to 500mm deep to determine the location of structural roots. Further excavation can be undertaken mechanically, with the diameter of the hole to be smaller or the same as the hand excavated section to prevent root damage. The construction should be engineered to enable the location of piers to be flexible as to have a minimum clearance above or beside structural roots of 100mm, or further as required to allow for future and ongoing growth. Works are to be undertaken mechanically outside the setbacks provided only.
- 5.25 Structural roots are to be protected and not severed except in consultation with the Project Arborist as per AS4970 (2009).
- 5.26 Where a situation occurs that a structural root (a root greater than >20 mm diameter) requires pruning or removal from a retained tree, the root is to be severed cleanly with a final cut to undamaged tissue. This will prevent tearing damage to the roots from excavation equipment which can extend beyond the point of excavation back towards the tree.
- 5.27 No additional works are to be undertaken within a TPZ. If pedestrian or vehicular access is required within a Tree Protection Zone the roots of these trees are to be protected from soil compaction. The application of ground protection as per AS4970 (2009) Ground Protection (see Appendix F 1.2.2) is recommended. The ground protection works are to remain in place until building works are completed.
- 5.28 Any utility services to be located underground within a TPZ of a retained tree are to be undertaken utilising excavation techniques that prevent or minimise damage to structural roots (roots greater than >20 mm diameter). Such works should be conducted with non-motorised hand tools or with an air knife or water knife or with directional drilling (underboring) to prevent root damage. Works are to be monitored and certified by the Project Arborist.

#### Post Construction

- 5.29 Tree Protection Zone fences should only be removed at completion of construction.
- 5.30 Excavation for landscape plantings within the tree protection zones should be undertaken manually to prevent damage to structural roots. Existing soil grades should be maintained with plant container size restricted to a maximum size of 5 litres. No more than 2 plants per square metre for 5 litre and 5 plants per square metre for 150 mm pot size.

#### 6.0 CONCLUSION

Of the 136 trees assessed, 91 are proposed to be retained and protected with the design proposed.

Forty five (45) trees are proposed to be removed; of which 18 are of high retention value, 7 of medium and 20 of low retention value.

Forty one (41) trees formed part of the Cumberland Plain Woodland with 14 proposed for removal and 27 retained. Trees of the CEEC within the centre of the site only are proposed for removal, with all trees of the CEEC towards the perimeters retained and protected by tree sensitive construction methods.

Considerable deep soil area has been retained and allocated for landscaping. Plant selection should be based on taxa of the Cumberland Plain Woodland with trees obtained of local provenance.

If all the recommendations and procedures detailed herein are adhered to, the subject tree/s to be retained will continue to grow and develop as important landscape component/s providing element/s 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.

#### 7.0 RECOMMENDATIONS

- 7.1 Trees 7-26, 30-34, 39-72, 87-101, 103 and 106-121 are to be retained and protected within Tree Protection Zone/s. These are to be maintained and special protection works undertaken as detailed in 5.18-5.30 and Appendices B, E and I and maintained until all construction works are completed.
- 7.2 Where Tree Protection Zone works are to be modified or relocated this must be undertaken in consultation with the Project Arborist to ensure that tree protection is maintained.
- 7.3 No further cut or fill is to be undertaken within the TPZ of any tree to be retained, unless specified by the Consulting Arboriculturist.
- 7.4 Trees 89-94, 98-101 & 103 should be further protected by tree sensitive construction methods as detailed in 5.23 5.24.
- 7.5 Trees 1-6, 27-29, 35-38, 73-86, 102, 104, 105 and 122-136 are to be removed as detailed in 5.13, and undertaken in accordance with section 4.0.

Laurie Dorfer Senior Consultant IACA ACM0242005

Urban Tree Management Australia P/L

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- 3. IACA, 2010, Sustainable Retention Index Value (SRIV), Version 4, A visual method of objectively rating the viability of urban trees for development sites and management, based on general tree and landscape assessment criteria, Institute of Australian Consulting Arboriculturists, Australia, www.iaca.org.au.
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- 7. Work Cover NSW 1998, Code of Practice Tree Work, New South Wales Government, Australia.

#### **DISCLAIMER**

The author and Urban Tree Management take no responsibility for actions taken and their consequences, contrary to those expert and professional instructions given as recommendations pertaining to safety by way of exercising our responsibility to our client and the public as our duty of care commitment, to mitigate or prevent hazards from arising, from a failure moment in full or part, from a structurally deficient or unsound tree or a tree likely to be rendered thus by its retention and subsequent deterioration from modification/s to its growing environment either existing or proposed, either above or below ground, contrary to our advice.

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## 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.** 

	H			Significance							
		1. High	2. Medium		3. Low						
		Significance in Landscape	Significance in Landscape	Significance in Landscape	Environmental Pest / Noxious Weed Species	Hazardous / Irreversible Decline					
Estimated Life Expectancy	1. Long >40 years  2. Medium 15-40 Years  3. Short <1-15 Years										
Lege	end for Matr	ix Assessment				E OF AUSTRALIAN  A C A					
	protecte prescribe	y for Retention (H d. Design modification ed by the Australian S es must be implemented	or re-location of build tandard AS4970 <i>Protec</i>	ling/s should be constition of trees on deve	sidered to accommoda elopment sites. Tree s	te the setbacks as ensitive construction					
	critical; I	<b>Consider for Retention (Medium) -</b> These trees may be retained and protected. These are considered less critical; however their retention should remain priority with removal considered only if adversely affecting the proposed building/works and all other alternatives have been considered and exhausted.									
		der for Removal (L n modification to be impl			rtant for retention, nor r	equire special works					
	<b>Priority for Removal -</b> These trees are considered hazardous, or in irreversible decline, or weeds and should be removed irrespective of development.										

#### **REFERENCES**

Australia ICOMOS Inc. 1999, The Burra Charter – The Australian ICOMOS Charter for Places of Cultural Significance, International Council of Monuments and Sites, <a href="https://www.icomos.org/australia">www.icomos.org/australia</a>

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

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

### Appendix B

## 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.

## **Appendix C**

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

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

#### 3.3.5 Structural root zone (SRZ)

"The SRZ is the area required for tree 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 expressed by the curve is calculated by the following formula,

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

#### where

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

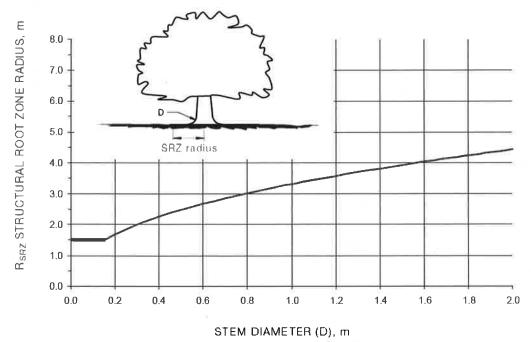


FIGURE 1 STRUCTURAL ROOT ZONE CALCULATION

(AS 4970 - 2009, Amendment No. 1 March 2010)

#### NOTES:

- 1 R<sub>SRZ</sub> is the calculated structural root zone radius (SRZ radius).
- 2 D is the stem diameter measured immediately above root buttress.
- 3 The R<sub>SRZ</sub> for trees less than 0.15 m diameter is 1.5 m.
- 4 The R<sub>SRZ</sub> 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.

## **Appendix D**

## 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.

Class		Vig	our Class and	Condition Cla	ass 🔝	TUTE OF AUSTRALIAN  A C A  CETING AIRBORICUTURISTS ®
Age	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)	YGVG - 9	YGVF - 8	YGVP - 5	YLVG - 4	YLVF - 3	YLVP - 1
) Young	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.	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.	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.	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.	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.	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)	MGVG - 10	MGVF - 9	MGVP - 6	MLVG - 5	MLVF - 4	MLVP - 2
Mature	Index Value 10 Retention potential - Medium - Long Term.	Index Value 9 Retention potential - Medium Term. Potential for longer with improved growing conditions.	Index Value 6 Retention potential - Short Term. Potential for longer with improved growing conditions.	Index Value 5 Retention potential - Short Term. Potential for longer with improved growing conditions.	Index Value 4 Retention potential - Short Term. Potential for longer with improved growing conditions.	Index Value 2 Retention potential - Likely to be removed immediately or retained for Short Term.
(0)	OGVG - 6	OGVF - 5	OGVP - 4	OLVG - 3	OLVF - 2	OLVP - 0
Over-mature	Index Value 6 Retention potential - Medium - Long Term.	Index Value 5 Retention potential - Medium Term.	Index Value 4 Retention potential - Short Term:	Index Value 3 Retention potential - Short Term. Potential for longer with improved growing conditions.	Index Value 2 Retention potential - Short Term.	Index Value 0 Retention potential - Likely to be removed immediately or retained for Short Term.

## Appendix E

#### 1.0 TREE PROTECTION ZONES - STANDARD PROCEDURE

1.1 The Protective fencing where required may delineate the 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."

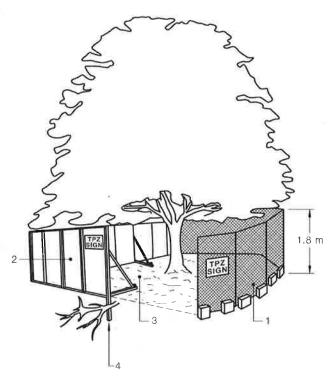
AS4970 Section 4, Tree protection Protective Figure 3 measures, fencing shows examples of such fencing.

#### "Legend:

- 1 Chain wire mesh panels with shade cloth (if required) attached, held in place with concrete feet.
- 2 Alternative plywood or wooden paling fence panels. The fencing material also prevents building materials or soil entering the TPZ.
- 3 Mulch installation across surface of TPZ (at the discretion of the project arborist). No excavation, construction activity, grade changes, surface treatment or storage of materials of any kind is permitted within
- 4 Bracing is permissible within the TPZ. Installation of supports should avoid damaging roots.
- 1.2 AS4970 Section 4, Tree protection measures, 4.2 Activities restricted within the TPZ

"Activities generally excluded from the TPZ included but are not limited to-

- Machine excavation including trenching;
- (b) Excavation for silt fencing;
- cultivation; (c)
- storage; (d)
- preparation of chemicals, including preparation of cement products; (e)
- parking of vehicles and plant;
- refuelling; (g)
- dumping of waste; (h)
- (i) wash down and cleaning of equipment;
- (i) placement of fill;
- (k) lighting of fires;
- (1) soil level changes:
- (m) temporary or permanent installation of utilities and signs, and
- physical damage to the tree."

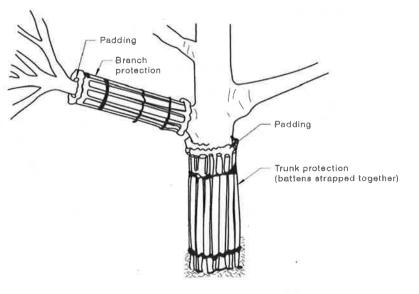


1.3 Tree Protection signage is to be attached to each *Tree Protection Zone* and displayed from within the development site in accordance with AS4970 2009 *Protection of trees on development sites*, Section 4.4 and example Appendix C1 (as shown) and lettering to comply with AS1319.



FIGURE C1 TREE PROTECTION ZONE SIGN

1.4 Where a tree is to be retained and a Tree Protection Zone cannot adequately established due to restricted access e.a. tree located along side an access way, the trunk and branches in the lower crown will be protected by wrapping 2 layers of hessian or carpet underfelt around the trunk and branches for a minimum of 2 m or lower branches as permit, then wire or rope secures 75x50x2000 mm



hardwood battens together around the trunk (do not nail or screw to the trunk or branches). The number of battens to be used is as required to encircle the trunk and the battens are to extend to the base of the tree (AS4970 2009 *Protection of trees on development sites*, Figure 4 Examples of Trunk, Branch and ground protection).

- 1.5 If a tree is growing down slope from an excavation, a silt fence located along the contours of the site in the area immediately above the *Tree Protection Zone* fencing may need to be installed and regularly maintained to prevent burial and asphyxiation of the roots of the tree. To allow for the maintenance of both fences, the silt fence must be constructed separately to the tree protection fence and the 2 fences must be constructed independently of each other and standalone. To reduce competition with the tree the area within the *Tree Protection Zone* is to be kept free of weeds. These are best removed by the application of foliar herbicide with Glyphosate as the active constituent. This is the preferred method rather than removal by cultivation of the soil within the dripline, to minimise root disturbance to the tree. The removal of woody weeds such as Privet should use the cut and paint method of herbicide application. Weeds to be controlled within the *Tree Protection Zone*, for the duration of the project.
- 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.
- 1.7 No services either temporary or permanent are to be located within the *Tree Protection Zone*. If services are to be located within the *Tree Protection Zone*, special details will need to be provided by the Project Arborist for the protection of the tree regarding the location of the service/s.
- 1.8 A tree will not be fertilised during its protection within the *Tree Protection Zone*, as this may hasten its decline if it were to decline. If a tree is to be fertilised this should be in consultation with the Project Arborist as per AS4970 (2009).
- 1.9 In the event of prolonged dry periods, or where a tree has been transplanted, or where excavation nearby, especially up slope, leads to drying out of a soil profile, or modification to ground water flow, or flows across an existing ground surface to the tree and its growing environment; deep root watering thoroughly at least twice a week is to be undertaken to irrigate the tree. The need for such watering is determined readily by observing the dryness of the soil surface within the dripline of the tree by scraping back some mulch. Mulch is to be reinstated afterwards. In the event of disrupted ground or surface water flows to the tree due to excavation, filling or construction, a reticulated irrigation system may be required to be installed within the *Tree Protection Zone*. If an irrigation system is to be installed, consideration must be given to volume, frequency, and drainage of water delivered, and this should be in consultation with the Project Arborist as per AS4970 (2009).

## Appendix F

#### 1.0 TREE PROTECTION ON CONSTRUCTION SITES

Note: Individual protection measures to be applied where stated as applicable.

- 1.1.0 General notes
- 1.2.0 Cautionary notes for the protection of retained trees
- 1.3.0 Demolition of built structures precautions to protect trees
- 1.4.0 Excavation and construction close to Tree Protection Zones

#### 1.1.0 General notes

- 1.1.1 The application of any measures for the protection of trees on development sites is determined by the species characteristics of the subject tree, and the existing physical constraints of the growing environment on site both above and below ground.
- 1.1.2 This report considers where applicable, Australian Standard AS4970 2009 Protection of trees on development sites.
- 1.1.3 This report applies the *Tree Protection Zone Standard Procedure* as developed and continually improved over time by URBAN TREE MANAGEMENT ® © for the effective protection of trees on development sites (see Appendix E). However, this does not restrict the author from applying additional or alternative conditions where it is deemed appropriate by the author for the protection of trees on development sites. Such additional or alternative conditions may be founded upon professional judgment based on:
  - the experience of the Project Arborist
  - scientific research
  - new technology
  - industry best practice
  - consideration of the individual tree species and its relative tolerance to development impacts
  - the individual or cumulative factors present or proposed to impact upon the growing environment essential for the trees' survival
- 1.1.4 Where this report makes reference to the retention of subject trees it is for their incorporation into the landscaping works for the site, and they are to be documented on a Landscape Plan for the site (the Landscape Plan).

#### 1.2.0 Cautionary notes for the protection of retained trees

#### 1.2.1 Installing underground services within TPZ

If an underground utility service is to be located within the area of the TPZ Australian Standard AS4970 2009 *Protection of trees on development sites*, Section 4, 4.5.5 Installing underground services within TPZ provides the following:

"All services should be routed outside the TPZ. If underground services must be routed within the TPZ, they should be installed by directional drilling or in manually excavated trenches.

The directional drilling bore should be at least 600 mm deep. The project arborist should assess the likely impacts of boring and bore pits on retained trees.

For manual excavation trenches the project arborist should advise on roots to be retained and should monitor the works. Manual excavation may include the use of pneumatic and hydraulic tools. Refer Clause 4.5.3."

#### 1.2.1.1

### **Location of services Option B** (Driveway Construction)

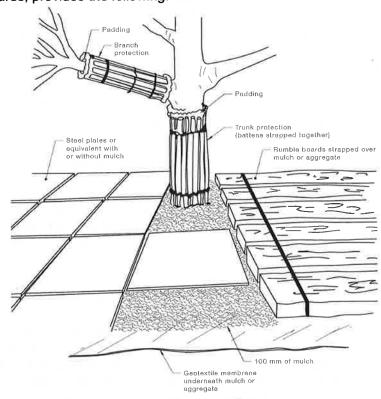
If a service is to be located within the area of the dripline of a protected tree or within the Tree Protection Zone, and site conditions such as shallow bed rock or if mass rooting has occurred from multiple trees growing in close proximity to each other, the service trench is to be elevated and positioned above natural ground level within the new driveway structure. The existing driveway surface is to be scabbled and a reinforced concrete topping is to be provided with down turned thickened edges constructed under the kerb edging to prevent lateral movement. A suitable subgrade material to manufacturers' recommendations is to be utilised if and where appropriate. Construction is to occur in a manner so as not to cause damage to the subject trees root system. All works to be in accordance with engineers' details.

#### 1.2.2 Precautions in respect of temporary work

For Precautions in respect of temporary work, Australian Standard AS4970 2009 *Protection of trees on development sites*, Section 4, Tree protection measures, 4.5 Other tree protection measures, provides the following:

#### "4.5.3 Ground protection

temporary access machinery is required within the 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 permeable membrane such as geotextile fabric beneath a layer of mulch or crushed rock below rumble boards as per Figure 4. These measures may be applied to root zones beyond the TPZ."



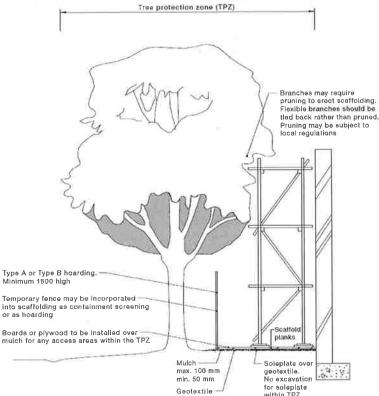
### "4.5.6 Scaffolding

Where scaffolding is required it

should be erected outside the TPZ. Where it is essential for scaffolding to be erected within TPZ, branch removal should be minimized. This can be achieved by designing scaffolding to avoid branches or tying back branches. Ground below the scaffolding should be protected by boarding (e.g. scaffolding board or plywood sheeting) as shown in Figure 5. Where access is required, a board walk or other surface material should be installed to minimise soil compaction. Boarding should be placed over a layer of mulch and impervious sheeting to prevent contamination. boarding should be left in place until the scaffolding removed."

"Notes:

For trunk and branch protection use boards and padding that will prevent damage to bark. Boards are to be strapped to trees, not nailed or screwed.
 Rumble boards should be a suitable thickness to prevent soll compaction and root damage."



NOTE: Execution required for the insertion of support posts for tree protection fencing should not involve the severance of any roots greater than 20 mm in diameter, without the prior approval of the project arborist.

### 1.3.0 Demolition of built structures - precautions to protect trees

#### 1.3.1 Demolition of existing Buildings

The demolition of the buildings should be undertaken with access restricted to the driveway and the building platform for each of the existing buildings, or to areas of the land where no trees are growing within 6m of any tree to be retained. Where access or space for a safe working environment is restricted, or where the area of the 6m set back must be compromised, a 100 mm layer of Eucalyptus wood mulch must be laid over the area of encroachment. Where vehicular access is required across the mulch layer further root protection should be provided by laying a temporary pathway over the mulch. Where temporary access is required within the TPZ, roots are to be protected from soil compaction by the application of ground protection as per AS4970 (2009) section 4, 4.5.3 Ground Protection, where a permeable membrane such as geotextile fabric is to be located at existing ground level beneath a layer of mulch or crushed rock with no fines 100 mm deep and covered with rumble boards or steel plates as per AS4970 (2009) Figure 4, (see Appendix F 1.2.2). Trunks of trees are to be protected from vehicular damage as per section 1.2.2.

#### 1.3.2 Demolition of landscape structures

The demolition of walls, driveways retaining walls, paths and pools etc. within 6 m of a tree to be retained should be undertaken manually using hand tools. Where a driveway is to be demolished being of concrete strip or slab type construction, it should be undertaken by working from the end of the driveway closest to the building back towards the street by utilising the driveway as a stable platform to prevent soil compaction. Where a concrete slab driveway passes less than 1 m from the base of a tree and the area beneath the driveway is to be undisturbed and incorporated into the landscape works for the site, the volume of space previously occupied by the driveway must be replaced with local top soil from the site or otherwise a loamy sand, to replace the mass of the concrete on the root plate which may be critical to the ballast and centre of mass for the stability of the tree. If the tree becomes unstable immediately contact the Project Arborist.

#### 1.3.3 Removal of existing trees near trees to be retained

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.

### 1.4.0 Excavation and construction close to Tree Protection Zones

### 1.4.1 Excavation close to Tree Protection Zones

#### 1.4.1.1

Where structural woody roots with a diameter of 20 mm or greater are to be pruned outside the area of the Tree Protection Zone, they are to be excavated manually first by using hand tools to determine their location. A Waterknife or Airknife can be used as a mechanised alternative to locate such structural woody roots. Once located those roots to be severed are to be cut cleanly with a final cut to undamaged woody tissue and this will prevent tearing damage to the roots from excavation equipment which can extend beyond the point of excavation back towards the tree.

#### 1.4.1.2

Where a large vigorous tree is to be retained near to built structure, and dependent upon its taxa, age class and propensity for its roots system to regenerate, it may be prudent to install a root barrier immediately adjacent to the footing of the new building, or to deepen and strengthen the footings themselves to act as a root barrier, but for such structural advice an appropriately qualified chartered structural engineer should be consulted.

## 1.4.2 Root location and protection where structures are to be positioned near a retained tree

#### 1.4.2.1

If walls or a driveway or other structures are to be constructed near a protected tree, careful excavation is 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. Boundary walls or fences should use columns or posts with in fill panels, or a wall to be constructed with suspended sections 100 mm clear above or beside any structural woody root or further as required, or any new wall to be built only to the depth of that existing. Structural woody roots to be further protected by utilising the construction techniques of pier or bridge footings, or screw piles between or over them with a minimum clearance above or beside of 100 mm, or further as required to allow for future and ongoing growth.

#### 1.4.2.2

Where a driveway or footpath is to pass by the tree a suspended slab is to be constructed or approved similar, to protect the roots that may be encountered at, near, or above ground, and may be constructed on gap graded fill. Where such a driveway or footpath is to be constructed the edge of the structure closest to the tree is to terminate no closer than 0.5 m from the closest edge of trunk, or further depending on the species and its likely further growth to allow for future development and expansion of the trunk, buttresses, and first order and lower order roots as may be advised the Project Arborist. The side of the driveway closest to a tree is to be edged with a concrete kerb of minimum dimensions of 150 x 150 mm, to prevent vehicular collision with the trunk. Here a Waterknife or an Airknife can be used as a mechanised alternative to locate first order and lower order structural woody roots.

#### 1.4.2.3

Alternatively a footpath or driveway may be constructed at ground level without any excavation, removing turf by raking, having sprayed with herbicide first if time permits. Here the path or driveway section is to extend for a distance past the tree equivalent to the lateral spread of the crown of that tree alongside the footpath, or driveway.

#### 1.4.2.4 Pervious pavement systems

Pavement to be constructed within a tree protection zone, e.g. driveways, parking bays or footpaths should use pervious systems of pavement such as permeable interlocking concrete pavers (PICP) or porous pavement as uniformly sized aggregates bonded with concrete or resins.

#### Permeable pavers

Typically joints and drainage voids are filled with 2-5 mm aggregate for drainage. Construction of the sub base materials should be undertaken in consultation with the Project Arborist and Structural Engineer. The duration of the working system will be influenced by maintenance such as sweeping to prevent clogging and replacement of the 2-5 mm aggregate as fill material.

#### Porous pavement

Typically aggregates are to be uniformly sized with no fines to maintain porosity and permeability. Construction of the sub base materials should be undertaken in consultation with the Project Arborist and Structural Engineer.

## 1.4.3 Root protection where a driveway close to a tree is to be demolished and a new driveway constructed in a similar location to a previous driveway.

After demolition of an existing driveway as per 1.3.2, the level of the base for the new driveway should be located at the same existing level as that of the base of the previous driveway, and should extend for a distance past the tree equivalent to the lateral spread of the crown of that tree alongside the driveway. To prevent excavation from damaging the existing roots which may be located at, near or above the surface of the soil beneath the base of the previous driveway, the new driveway may need to be raised by constructing it on pier or bridge footings between or over them (see 1.4.2 for minimum clearances), or based on a gap graded fill and the driveway constructed with any exposed edges concealed to the top of the driveway by minimal filling with a sandy soil and turf, or mulch, or a garden bed with minimal cultivation, or other landscape treatments as appropriate. Where roots have grown to occupy the soil between the concrete strips of a concrete, stone or brick strip driveway, they and the soil may be excavated to the level of the base of the concrete strips, but where such roots have a diameter of 20 mm or greater, the Project Arborist should be contacted prior to such works being undertaken. Where roots are to be severed, they are to be cut cleanly with a final cut to undamaged woody tissue.

## 1.4.3.1Root protection where a driveway or path is to be constructed at grade with aggregate

Existing grade within the TPZ is not to be altered. The driveway section is to be constructed with 20 mm aggregate, uniformly sized with no fines, laid on top of geotextile fabric. Minimum depth of 100 mm is required, contained by a timber plinth edge pegged into place and maintained to adequately displace vehicular loads to prevent soil compaction. Placement of gravel within the TPZ is to be undertaken manually. This is to allow for future root growth, percolation of rainwater and gaseous exchange between roots/soil and atmosphere. Where vegetation, leaf litter or mulch is to be removed this is to be undertaken manually. Hand excavation is to be monitored and certified by the Project Arborist as per AS4970 (2009).

#### 1.4.4 Root protection where a footpath is to be constructed close to a tree.

#### 1.4.4.1

A footpath may be constructed at ground level without any excavation, by first killing with herbicide the plants to be removed from the pathway area, and then removing that plant material by cutting the trunks of woody shrubs to ground level and by raking all other plant material to expose the top soil surface without organic matter. This will remove the need for physically disturbing the soil and the roots of the tree. The path section is to extend for a distance past each tree equivalent to the lateral spread of the crown of that tree where it extends alongside the footpath.

#### 1.4.4.2

To prevent excavation from damaging the existing roots which may be located at, near, or above the surface of the soil, a gap graded fill as a fill material of a media as appropriate, to a depth of 100 mm above the soil surface, or above the top of the root of any tree to be retained, or above the soil surface may be utilised as a base treatment to construct the foot path. Any exposed edges to be concealed to the top of the edges of the footpath and tapering back to the base of the trunk of each tree by minimal filling at each trunk of no greater than 100 mm with a sandy soil and turf, or mulch, or a garden bed with minimal cultivation with ground covers, or other landscape treatments as appropriate. The Project Arborist should be contacted prior to such works being undertaken or if any structural roots are considered appropriate to be severed being those roots of 20 mm diameter or greater.

#### 1.4.5 Structural Soil to accommodate load bearing conditions

A structural soil should only be considered as a new media into which the trees could be planted if the planting was into a new area where the area surrounding was to be load bearing such as a footpath, driveway or road.

#### 1.4.6 Gap graded fill to accommodate compacted sub grade and root growth

To further protect woody roots with a diameter of 20 mm or greater, a gap graded fill with no fines such as gravel 40 mm diameter should only be considered as a fill media above existing grade when soil levels are to be increased near existing trees and the roots can utilise the new media to develop ongoing and future root growth and provide for gaseous exchange between the soil and the atmosphere.

### Appendix G

### **Glossary**

From

Dictionary for Managing Trees in Urban Environments Institute of Australian Consulting Arboriculturists (IACA) 2009.

#### **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.

**Dormant Tree Vigour** Determined by existing turgidity in lowest order branches in the outer extremity of the crown, with good bud set and formation, and where the last *extension growth* is distinct from those most recently preceding it, evident by bud scale scars. Normal vigour during dormancy is achieved when such growth is evident on a majority of branches throughout the crown.

#### **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.

#### **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.

#### 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.

Caulescent Tree grows to form a trunk. See also Acaulescent.

Report: Arboricultural Impact Assessment, 194 Campelltown Rd, Denham Court NSW @

#### **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 (1<sup>st</sup>) and possibly second (2<sup>nd</sup>) 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..

**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.

#### **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°-15° from upright.

Moderately Leaning A leaning tree where the trunk is growing at an angle within 15°-30° from upright.

Severely Leaning A leaning tree where the trunk is growing at an angle within 30°-45° from upright.

Critically Leaning A leaning tree where the trunk is growing at an angle greater than >45° 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.

#### **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.

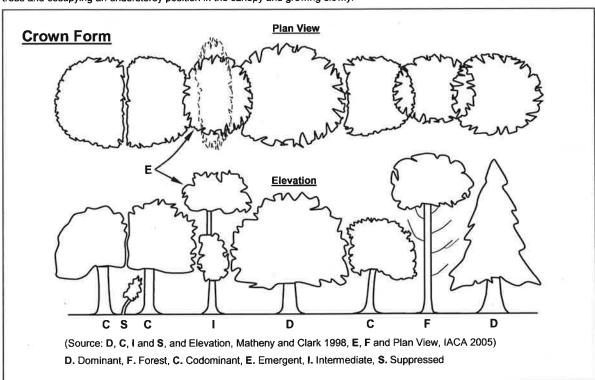
Crown Form Dominant Crowns of trees generally not restricted for space and light receiving light from above and all sides.

**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.



#### **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.

Crown Spread Orientation Direction of the axis of crown spread which can be categorized as Orientation Radial and Orientation Non-radial.

**Crown Spread Orientation Non-radial** Where the crown extent is longer than it is wide, e.g. east/west or E/W. Further examples, north/south or N/S, and may be *Crown Form Codominant*, e.g. A or B, *Crown Form Intermediate* e.g. A, or *Crown Form Suppressed* e.g. B, and crown symmetry is symmetrical e.g. A, or asymmetrical e.g. B.

**Crown Spread Orientation Radial** Where the *crown spread* is generally an even distance in all directions from the trunk and often where a tree has *Crown Form Dominant* and is *symmetrical*.

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).

**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.

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*.

Tree Protection Zone (TPZ) Area around a tree set aside to protect the trunk, roots and crown during development works. This is to protect the tree physically and a sufficient proportion of its growing environment above and below ground to assist stability and prolong viability. The TPZ is often delineated by an enclosed fence and established prior to demolition or construction and maintained until the completion of works. The fenced-off area around the tree is usually located at a specific distance from the trunk determined as multiples of the trunk diameter, usually Diameter at breast height (DBH). Special protection or construction works may provide a TPZ without a fence having been erected, e.g. a barrier formed by site sheds located on piers. Such a protection area may form an exclusion zone for all works including the temporary or permanent location of utility services. Note: Any encroachment into the area would require additional tree protection specifications or works in consultation with the Project arborist.

**Encroachment** 1. The growth of branches, trunk or roots onto another property. 2. Any work within a *Tree Protection Zone* other than for the maintenance of the Tree Protection Zone.

#### **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.

Low Volume Deadwood Where <5 dead branches occur that may require removal.

Medium Volume Deadwood Where 5-10 dead branches occur that may require removal.

High Volume Deadwood High Volume Deadwood Where >10 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.

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

Medium Volume Dieback Where 10-50% of the crown cover has died.

High Volume Dieback Where >50% of the crown cover has died.

#### **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*.

Low Volume Epicormic Shoots Where <10% 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.

High Volume Epicormic Shoots Where >50% of the crown cover is comprised of live epicormic shoots.

#### **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)*.

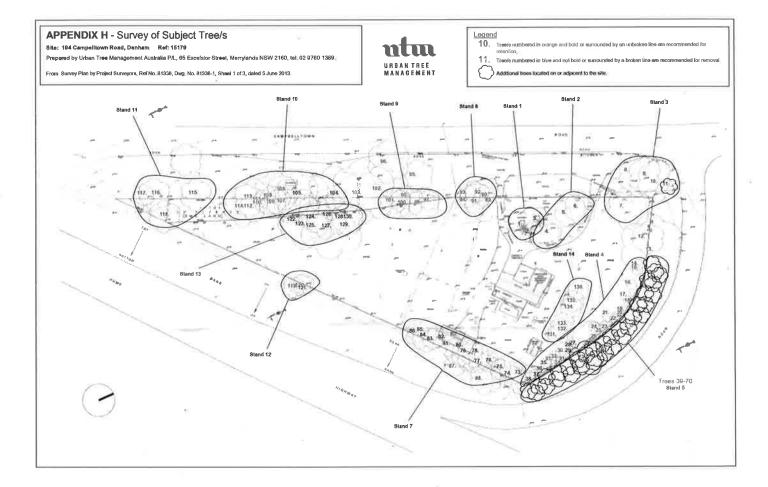
**Structural Roots** Roots supporting the infrastructure of the *root plate* providing strength and *stability* to the tree. Such roots may taper rapidly at short distances from the *root crown* or become large and woody as with gymnosperms and dicotyledonous angiosperms and are usually 1<sup>st</sup> and 2<sup>nd</sup> 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*.

## Appendices H & I

Appendix H — Survey of Subject Tree/s
Appendix I — Tree Protection Plan

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

UTM Tree No. / Stand No.	Genus and species	Common name	
1-3 Stand 1	Arecastrum romanzoffianum	Cocas Palm	
4-6 Stand 2	Eucalyptus moluccana	Grey Box	
7-11	Callistemon viminalis	Weeping Bottlebrush	
Stand 3	Corymbia maculata	Spotted Gum	
12	Eucalyptus moluccana	Grey Box	
13	Eucalyptus moluccana	Grey Box	
14-38 Stand 4	Eucalyptus moluccana	Grey Box	
39-70 Stand 5	Corymbia maculata	Spotted Gum	
71-72 Stand 6	Pinus pinea	Stone Pine	
73-88 Stand 7	Casuarina glauca	Swamp She-Oak	
89-94 Stand 8	Eucalyptus moluccana	Grey Box	
95	Eucalyptus moluccana	Grey Box	
96	Eucalyptus moluccana	Grey Box	
97-101 Stand 9	Eucalyptus moluccana	Grey Box	
102	Eucalyptus moluccana	Grey Box	
103	Eucalyptus tereticornis	Forest red Gum	
104-114 Stand 10	Eucalyptus moluccana	Grey Box	
115-118 Stand 11	Eucalyptus moluccana Eucalyptus sideroxylon	Grey Box Mugga Ironbark	
119-121 Stand 12	Casuarina glauca	Swamp She-Oak	
122-130 Stand 13	Eucalyptus moluccana	Grey Box	
131-136 Stand 14	Callistemon salignus	Willow Bottlebrush	



#### Appendix I - TREE PROTECTION PLAN

Site: 194 Campelliown Road, Denham Ref: 15179

Prepared by Urban Tree Management Australia PR., 65 Excelsior Street, Merrylanda NSW 2160, tel. 02 9760 1389.

From Site Plan, by Mosca Pserras Architects, Dwg. File: 12033 AP01, Issue A, dated 04(02)2013.

Tree Protection Zone (TPZ), fencing or trunk/branch protection as indicated or other protection measures or works as indicated.

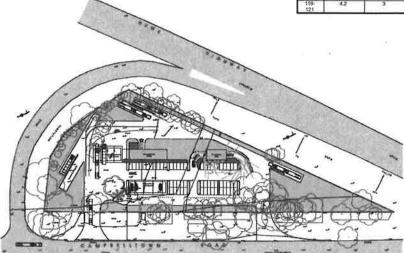
u u u i Tree Protection Zone, area of special protection measures

Trees numbered in orange and hold are recommended for retention.



I. UTIM Tree No. / UTIM Stand No.	Tree Protestion Zone (1PZ) = 12 x DBH <sub>5/4</sub> From center of trunk	Distance of fence with 1PZ subsuch reduced by 10% (m)
7-11	4.2	3
14-26	2	2
30-34	2	2
39-70	2	2
71-72	4.6	3.2
07-88	4.2	3
89-94	4.2	3
95	4.8	3.3
96	72	5
97-101	4.6	3.2
103	10.8	7.5
106-	4.6	3.2
115- 110	3,4	2.3
119-	4.2	3

Tree Protection Zone setbacks



#### Tree Protection Works - General

All retained trees: Existing levels are to be preserved and no excavation excapt by hand to protect structural roots is to be undertaken within the Tree Protection Zones. No out or fill filling is to be undertaken within any TPZ unless specified by the Project Arborist.

#### Tree Protection Works - Specific

#### During Demolition

Removal of Trees 1-6, 27-29, 35-38, 73-86, 102, 104, 105 and 122-136 should be undertaken only by culting down without damaging trees to be retained. Where damage is likely, removal should be undertaken manually by serial sectioning and lowering, and the grinding out of its stump.

Tree Protection Zones (TPZ) including fencing are to be installed around Trees 7-26, 30-34, 39-72, 87-101, 103 and 109-121 with setbacks as detailed in Table 3 and/or Appendix i-Tree Protection Plan, Works are to be certified by the Project Arborist.

- During Construction

  Maintain the Tree Protection Zone fences for the entire construction period.

  Within the Tree Protection Zone (TPZ) of Trees 68-94, 88-101 & 103 driveway constructions should be undertaken by concrete above the existing grade layed on top or plered/suspended in socilon. A gap graded aggregate is to be used to accommodate any level changes to maintain gaseous exchange, No excevation or compaction shell occur within the Tree Protection Zone, Soil levels are not to be disturbed or modified. Works are to be monitored and certified by the Project Arborist.

  If plere are used, the excevation is to be undertaken manually to 500mm deep to determine the location of structural roots. Further excevation can be undertaken mechanically, with the diameter of the hole to be smaller or the same as the hand excevated section to prevent root damage. The construction should be engineered to enable the location of plers to be flexible as to have a minimum clearance above or beside structural roots of 100mm, or further as required to allow for future and ongoing growth. Works are to be undertaken mechanically outside the setbacks provided only. Structural roots are to be protected and not severed except in consultation with the Project. Arborist as per AS4970 (2009).

  Where a situation occurs that a structural root (a root greater than >20 mm diameter) requires pruning or removal from a retained tree, the root is to be severed cleanly with a final cult oundemaged diseus. This will preven learning despet to the root so the series of the root of the recovery of the recove

- Tree Protection Zone fences should only be removed at completion of construction. Excavation for landecape plantings within the tree protection zones should be undertaken menually to prevent demage to structural roots. Existing soil grades should be meintained with plant confaien size restricted to a maximum size of 5 tibres. No more than 2 plants per square metre for 5 litre and 5 plants per square metre for 150 mm pot

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