URBAN TREE MANAGEMENT

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REPORT:

ARBORICULTURAL IMPACT ASSESSMENT

Gledswood Hills Public School
Lot 3
The Hermitage Estate
Gledswood Hills NSW

Prepared 25 May 2017
Reference 19073
Revision 2 – 5 June 2018

Contents

SUMMARY

This report considers 24 trees of remnant origin, located within the site of which 2 are to be retained and 22 removed. Retention/removal has been guided by the proposed design or are likely to support a level of risk (currently or in the future) which is considered unacceptable within school grounds. No hollows/cavities were detected which may provide habitat to local fauna.

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

Trees 19 & 24 (2x trees) are proposed to be retained. No encroachment by building/construction works is proposed within the Tree Protection Zone. The trees are expected to remain viable (TPZ) and stable (SRZ).

Tree sensitive vegetation clearing and landscape methods are recommended.

Trees 19 & 24 will require pruning – Deadwooding (AS4373 - Section 7.2.2).

Trees 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 20, 21, 22 & 23 are proposed to be removed as located within the location of the proposed building envelopes, or in areas of soil grading, or of a form that branch failure is expected or may increase by removal of adjacent trees, or support defects that cannot be mitigated and likely become an unacceptable risk in the future.

The trees are considered significant as form part of the original Cumberland Plain Woodland. Replacement planting is proposed.

For retained trees the impacts may be mitigated by the application of AS4970 Sec. 3.3.4 *TPZ Encroachment considerations (a) – (h)*, which will be considered and applied to each tree as required.

The general condition of tree/s and Schedule of works is listed below in Table 1.0.

Table 1.0 General condition of tree/s and Schedule of works. Tree described in greater detail in section 4.0.

UTM Tree No. / Stand No.	*Genus and species* Common name	Condition G = Good F = Fair P = Poor M = Moribund D = Dead	Description of work to be done
1	*Eucalyptus crebra* Narrow-leaved Red Ironbark	F	Remove and replace.
2	*Eucalyptus crebra* Narrow-leaved Red Ironbark	G	Remove and replace.
3	*Eucalyptus crebra* Narrow-leaved Red Ironbark	F	Remove and replace.
4	*Eucalyptus paniculata* Grey Ironbark	G	Remove and replace.
5	*Eucalyptus crebra* Narrow-leaved Red Ironbark	P	Remove and replace.
6	*Eucalyptus crebra* Narrow-leaved Red Ironbark	G	Remove and replace.
7	*Eucalyptus crebra* Narrow-leaved Red Ironbark	G	Remove and replace.

Table 1.0 Continues.

UTM Tree No. / Stand No.	*Genus and species* Common name	Condition G = Good F = Fair P = Poor M = Moribund D = Dead	Description of work to be done
8	*Eucalyptus crebra* Narrow-leaved Red Ironbark	F	Remove and replace.
9	*Eucalyptus crebra* Narrow-leaved Red Ironbark	G	Remove and replace.
10	*Eucalyptus crebra* Narrow-leaved Red Ironbark	G	Remove and replace.
11	*Eucalyptus crebra* Narrow-leaved Red Ironbark	G	Remove and replace.
12	*Eucalyptus tereticornis* Forest Red Gum	F	Remove and replace.
13	*Eucalyptus crebra* Narrow-leaved Red Ironbark	G	Remove and replace.
14	*Eucalyptus crebra* Narrow-leaved Red Ironbark	G	Remove and replace.
15	*Eucalyptus crebra* Narrow-leaved Red Ironbark	G	Remove and replace.
16	*Eucalyptus crebra* Narrow-leaved Red Ironbark	F	Remove and replace.
17	*Eucalyptus crebra* Narrow-leaved Red Ironbark	F	Remove and replace.
18	*Eucalyptus crebra* Narrow-leaved Red Ironbark	F	Remove and replace.
19	*Eucalyptus crebra* Narrow-leaved Red Ironbark	G	Retain and protect within a tree protection zone (Appendix G). Tree sensitive vegetation clearing and landscape methods are recommended within tree protection zone. Undertake deadwooding as detailed in Appendix G and in accordance with AS4373.
20	*Eucalyptus crebra* Narrow-leaved Red Ironbark	P	Remove and replace.
21	*Eucalyptus crebra* Narrow-leaved Red Ironbark	F	Remove and replace.
22	*Eucalyptus tereticornis* Forest Red Gum	P	Remove and replace.
23	*Eucalyptus crebra* Narrow-leaved Red Ironbark	G	Remove and replace.
24	*Eucalyptus crebra* Narrow-leaved Red Ironbark	G	Retain and protect within a tree protection zone (Appendix G). Tree sensitive vegetation clearing and landscape methods are recommended within tree protection zone. Undertake Deadwooding as detailed in Appendix G and in accordance with AS4373.

1.0 INTRODUCTION

Urban Tree Management © has prepared this report for Perumal Pedavoli Architects Pty Ltd, on behalf of NSW Government (*the applicant*).

All trees located on site are of remnant origin which remain as fragmented stands or isolated specimens of the original Cumberland Plain Woodland.

The Cumberland Plain Woodland is listed as an endangered ecological community under the Threatened Species Conservation Act 1995 No101.

The understory consists of a disturbed mix of native and exotic grasses, although predominantly of Kikuyu grass which has been grazed for many years.

It is proposed to construct Gledswood Hills Public School, incorporating buildings and associated infrastructure works, with significant grading of existing levels.

Laurie Dorfer (*the author*) attended Lot 3 The Hermitage Estate, Gledswood Hills (*the site*) on Tuesday 23 May 2017 and *the trees* and their growing environments were examined by a Visual Tree Assessment (VTA) (Mattheck & Breloer, 1994) conducted from the ground.

The Survey of subject Tree/s (Appendix F) and Tree Protection Plan (Appendix G) are to be included into and used in conjunction with the set of plans for the site.

The aims and objectives of this report are to detail and comply with the tree protection requirements specified in AS4970 (2009) *Protection of trees on development sites*, after the undertaking of the Preliminary Tree Assessment AS4970 sec. 2.3.2, and Preliminary Arboricultural Report AS4970 sec. 2.3.3 (which may be combined); Development Design and Review Report AS4970 sec. 2.3.4, prior to the undertaking of an Arboricultural Impact Assessment (AIA) Report AS4970 sec. 2.3.5. Where the other reports have not been undertaken the AIA Report will broadly endeavour to identify and assesses the condition of the subject tree/s; determine the 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, and provide recommendations for replacement tree/s where appropriate. The information in this extensive report is intended to provided tree management and protection through all stages of development.

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

- Ground Floor Site Plan, by Perumal Pedavoli Architects, Preliminary, Ref. 01_002, dated May 2017.
- Lower Ground Floor Site Plan, by Perumal Pedavoli Architects, Preliminary, Ref. 01_001, , dated May 2017.
- First Floor Site Plan, by Perumal Pedavoli Architects, Preliminary, Ref. 01_003, dated May 2017.
- Second Floor Site Plan, by Perumal Pedavoli Architects, Preliminary, Ref. 01_004, dated May 2017.
- Survey Plan, by Frankham Engineering, Sheet 1 & 2, Dwg. No. 217046, dated 21 & 22 March 2017.

2.0 METHODOLOGY

Note: Individual methodologies applied as applicable.

2.1 The method of assessment of tree/s applied is adapted from the principles of Visual Tree Assessment (VTA) (Mattheck & Breloer, 1994), undertaken from the ground, which considers and includes:

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) ©

2.2 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.

2.3 Any dimensions recorded as averages, or by approximation are noted accordingly.

2.4 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 center 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,
7. Engineering e.g. techniques to ameliorate impact on trees such as structural soil, gap graded fill, lateral boring,
8. Construction e.g. techniques to ameliorate impact on trees such as pier and beam, bridge footings, suspended slabs,
9. Root mapping,
10. Physical limitations - existing modifications to the environment and any impact to tree/s by development e.g. property boundaries, built structures, houses, swimming pools, road reserves, utility services easements, previous impact by excavation, or construction in other directions, soil level changes by cutting or filling, existing landscaping works within close proximity, modified drainage patterns,
11. Extraneous factors e.g. potential future impacts from development on adjoining land when the tree is located on or near to a property boundary.

2.5 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.

2.6 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.

2.7 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 E.

3.0 PRUNING STANDARDS

3.1 Any pruning recommended in this report is to be to the Australian Standard® AS4373 *Pruning of amenity trees*, and conducted in accordance with the *Guide to Managing Risks of Tree Trimming and Removal Work*, July 2016, Safe Work Australia.

3.2 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).

3.3 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.

4.0 TREE ASSESSMENT

4.1 Assessment of tree/s or stand/s of trees.

UTM Tree No. / Stand No.	Genus & species / Common Name	Condition G = Good F = Fair P = Poor M = Moribund D = Dead	Age Y = Young M = Mature O = Overmature	Crown Form D = Dominant C = Co-dominant I = Intermediate S = Suppressed F = Forest E = Emergent	Ht. Approx. metres	Crown spread approx. metres / Orientation R = Radial, or other	Crown Symmetry 1 = symmetrical 2 = asymmetrical / Orientation	Crown cover / Crown density % / D = dormant	DBH in mm @ 1.4m, or other, as indicated and trunk orientation other than R = radial, e.g. N/S / DARB Diameter above root buttress	Trunk Lean 1 = Upright-Slight 2 = Moderate 3 = Severe 4 = Critical 5 = Acaulescent / Orientation / ST = Static P = Progressive Sc = Self-correcting	Roots evident @ root crown 1. = None 2. = Adventitious 3. = Basal Flare 4. = Buttresses 5. = First Order Roots (FOR), No. & distribution e.g. R = radial, or one each to N, S, E, NE and W	Pests & diseases 1 = No or 2 = Yes (If 2. see comments)	Branch Bark included 1 = No or 2 = Yes or 3 = N/A	Vigour 1 = Good Vigour 2 = Low Vigour	Form 1 = Good form 2 = Poor form	SRIV Age, Vigour, Condition / Index Rating www.iaca.org.au / ESTIMATED LIFE EXPECTANCY 1. Long 2. Medium 3. Short	Significance scale STARS www.iaca.org.au 1=High 2=Medium 3=Low / Retention Value 1=High 2=Medium 3=Low 4=Remove
1	*Eucalyptus crebra*	F	M	C	18	17x14	2	85	620	1	-	1	1	1	2	MGVF – 9	3
	Narrow-leaved Red Ironbark					E/W	E	85	700							3	3
2	*Eucalyptus crebra*	G	M	C	18	17X12	2	90	630	1	5. 5x R	1	1	1	1	MGVG – 10	1
	Narrow-leaved Red Ironbark					N/S	NW	90	700							1	1
3	*Eucalyptus crebra*	G	M	C	18	16x8	1	85	580	1	3.	1	1	1	1	MGVF – 9	2
	Narrow-leaved Red Ironbark					N/S		90	620							2	2
4	*Eucalyptus paniculata*	G	M	C	16	10X10	2	90	600	1	5. 3X N, W, SW	1	1	1	1	MGVG - 10	1
	Grey Ironbark					R	NE	85	640							1	1
5	*Eucalyptus crebra*	P	M	C	17	16X14	2	65	680	1	5. 4X R	1	2	1	1	MGVP - 6	3
	Narrow-leaved Red Ironbark					N/S	NE	90	720							3	3
6	*Eucalyptus crebra*	G	M	D	16	10X10	1	90	480	1	1	1	1	1	1	MGVG - 10	1
	Narrow-leaved Red Ironbark					R		90	520							1	1
7	*Eucalyptus crebra*	G	M	D	16	17X17	1	90	700	1	1	1	1	1	1	MGVG - 10	1
	Narrow-leaved Red Ironbark					R		90	740							1	1
8	*Eucalyptus crebra*	F	M	D	17	12X12	1	85	580	1	-	1	1	1	1	MGVF - 9	1
	Narrow-leaved Red Ironbark					R		90	620							1	1
9	*Eucalyptus crebra*	G	M	D	22	16X16	2 SLIGHT	90	680	1	-	1	1	1	1	MGVG - 10	1
	Narrow-leaved Red Ironbark					R	N	90	720							1	1
10	*Eucalyptus crebra*	G	M	D	21	16X14	1	90	720	1	5. 3X N, SE, SW	1	1	1	1	MGVG - 10	1
	Narrow-leaved Red Ironbark					N/S		90	750							1	1

No.	Comments
1	Trunk bifurcates at 4-5m, leader to NW previously failed – been pruned to junction, split down remaining trunk section. Low volume large deadwood throughout crown reaching 100mmØ and 4m in length.
2	Branches damaged/removed/torn off at lower and mid crown to NW by machinery. Evidence of past branch failure at mid crown to N – 140mmØ. Low volume large deadwood throughout crown reaching 60mmØ and 3m in length.
3	Evidence of past branch failures at lower and mid crown, some structural branches – 160mmØ.
4	Low volume large deadwood throughout crown reaching 50mmØ and 2m in length.
5	Trunk bifurcates at 3m, once included at junction, round-edge ribs now present and currently stable, leader to NW 50% dead. Excavated liner trench to NW, approx. 1.5m from EOT, depth to 1m – unable to view for root damage.
6	Low volume large deadwood throughout crown reaching 40mmØ and 1.5m in length.
7	Low volume large deadwood throughout crown reaching 60mmØ and 2m in length.
8	Crossing structural branches at lower crown to NW. 2x detached branches at lower crown to W and SW – 70mmØ and 3m in length. Evidence of past branch failures at mid/upper crown – 160mmØ.
9	Low volume large deadwood throughout crown reaching 40mmØ and 1.5m in length.
10	Low volume large deadwood at lower and mid crown reaching 100mmØ and 2.5m in length.

4.0 TREE ASSESSMENT

4.1 Assessment of tree/s or stand/s of trees.

UTM Tree No. / Stand No.	Genus & species / Common Name	Condition G = Good F = Fair P = Poor M = Moribund D = Dead	Age Y = Young M = Mature O = Overmature	Crown Form D = Dominant C = Co-dominant I = Intermediate S = Suppressed F = Forest E = Emergent	Ht. Approx. metres	Crown spread approx. metres / Orientation R = Radial, or other	Crown Symmetry 1 = symmetrical 2 = asymmetrical / Orientation	Crown cover / Crown density % / D = dormant	DBH in mm @ 1.4m, or other, as indicated and trunk orientation other than R = radial, e.g. N/S / DARB Diameter above root buttress	Trunk Lean 1 = Upright-Slight 2 = Moderate 3 = Severe 4 = Critical 5 = Acaulescent / Orientation / ST = Static P = Progressive Sc = Self-correcting	Roots evident @ root crown 1. = None 2. = Adventitious 3. = Basal Flare 4. = Buttresses 5. = First Order Roots (FOR), No. & distribution e.g. R = radial, or one each to N, S, E, NE and W	Pests & diseases 1 = No or 2 = Yes (If 2. see comments)	Branch Bark included 1 = No or 2 = Yes or 3 = N/A	Vigour 1 = Good Vigour 2 = Low Vigour	Form 1 = Good form 2 = Poor form	SRIV Age, Vigour, Condition / Index Rating www.iaca.org.au / ESTIMATED LIFE EXPECTANCY 1. Long 2. Medium 3. Short	Significance scale STARS www.iaca.org.au 1=High 2=Medium 3=Low / Retention Value 1=High 2=Medium 3=Low 4=Remove
11	*Eucalyptus crebra*	G	M	C	17	12X10	2	90	450	1	5. 1X SW	1	1	1	1	MGVG – 10	1
	Narrow-leaved Red Ironbark					NW/SE	SW	90	480							1	1
12	*Eucalyptus tereticornis*	P	M	D	22	16X16	1	80	740	1	5. 4x R	2	1	1	1	MGVG – 5	3
	Forest Red Gum					R		90	780							3	4
13	*Eucalyptus crebra*	G	M	C	16	12X10	2	90	490	1	-	1	1	1	1	MGVG – 10	1
	Narrow-leaved Red Ironbark					NE/SW	NE	90	550							1	1
14	*Eucalyptus crebra*	G	M	I	18	12X12	2	90	420	1	1	1	1	1	1	MGVG - 10	1
	Narrow-leaved Red Ironbark					R	N	90	500							1	1
15	*Eucalyptus crebra*	G	M	D	18	15X15	2	85	510	1	1	2	2	1	1	MGVG – 10	2
	Narrow-leaved Red Ironbark					R	E	90	580							2	2
16	*Eucalyptus crebra*	F	M	D	16	10X10	2	85	520	1	1	1	1	1	1	MGVF - 9	2
	Narrow-leaved Red Ironbark					R	N	85	550							2	2
17	*Eucalyptus crebra*	F	M	F	20	12X10	1	90	680	1	1	1	1	1	1	MGVF - 9	2
	Narrow-leaved Red Ironbark					N/S		90	700							2	2
18	*Eucalyptus crebra*	F	M	C	22	16X12	2	85	620	1	-	1	1	1	2	MGVF - 9	2
	Narrow-leaved Red Ironbark					E/W	N	90	650							2	2
19	*Eucalyptus crebra*	G	M	D	18	12x12	2 SLIGHT	>90	640	1	5. 2x NE, SE	1	1	1	1	MGVG - 10	1
	Narrow-leaved Red Ironbark					R	N	>90	700							1	1
20	*Eucalyptus crebra*	P	M	C	15	8X5	2	40	460	1	-	1	1	2	2	MLVP - 2	3
	Narrow-leaved Red Ironbark					N/S	N	90	500							3	4

No.	Comments
11	Low volume large deadwood at lower and mid crown reaching 60mmØ and 1.5m in length.
12	Basal wound to S – 1800mm high x 250mm wide, wound margin depth to 140mm, sporophore and termite activity present, slight basal swelling to E. Numerous wounds at mid and upper trunk to N, cavity at base of trunk bifurcation (approx. 10m above g.l.) Medium volume dieback including structural branches at mid and upper crown – 120mm Ø and 5m in length. Internal diagnostic testing recommended.
13	Crown biased to NE – 80%. Low volume large deadwood at lower and mid crown – 100mm Ø and 2m in length.
14	Evidence of past branch failure at lower crown – 100mm Ø. Low volume large deadwood at mid crown – 60mm Ø and 2m in length.
15	Low volume large deadwood throughout crown – 60mm Ø and 2m in length. Kino exudation at mid trunk to S.
16	Medium volume epicormic growth throughout crown. Low volume dieback throughout – 50mmØ and 1.5m.
17	Trunk bifurcates at 10m, co-dominate with cockatoo damage at junction. Low volume large deadwood at lower and mid crown – 80mm Ø and 3m in length.
18	Entire crown biased to N. Numerous branches at mid and upper crown to failed/torn off by machinery. Fill material to NE, E & S below drip line. Abrasion wound at mid trunk to S. Atypical bark characteristics at mid trunk to W, adjacent to the superior first order structural branch (FOSB).
19	Minor basal wound to N – 350mm x 60mm, margin depth to 120mm, termite mud packing at margins. Low volume large deadwood + crossing branches at lower and mid crown. Round-edge rib at FOSB junction, stable, now exerted.
20	Mid and upper crown dead – characteristic of lighting.

4.0 TREE ASSESSMENT

4.1 Assessment of tree/s or stand/s of trees.

UTM Tree No. / Stand No.	Genus & species / Common Name	Condition G = Good F = Fair P = Poor M = Moribund D = Dead	Age Y = Young M = Mature O = Overmature	Crown Form D = Dominant C = Co-dominant I = Intermediate S = Suppressed F = Forest E = Emergent	Ht. Approx. metres	Crown spread approx. metres / Orientation R = Radial, or other	Crown Symmetry 1 = symmetrical 2 = asymmetrical / Orientation	Crown cover / Crown density % / D = dormant	DBH in mm @ 1.4m, or other, as indicated and trunk orientation other than R = radial, e.g. N/S / DARB Diameter above root buttress	Trunk Lean 1 = Upright-Slight 2 = Moderate 3 = Severe 4 = Critical 5 = Acaulescent / Orientation / ST = Static P = Progressive Sc = Self-correcting	Roots evident @ root crown 1. = None 2. = Adventitious 3. = Basal Flare 4. = Buttresses 5. = First Order Roots (FOR), No. & distribution e.g. R = radial, or one each to N, S, E, NE and W	Pests & diseases 1 = No or 2 = Yes (If 2. see comments)	Branch Bark included 1 = No or 2 = Yes or 3 = N/A	Vigour 1 = Good Vigour 2 = Low Vigour	Form 1 = Good form 2 = Poor form	SRIV Age, Vigour, Condition / Index Rating www.iaca.org.au / ESTIMATED LIFE EXPECTANCY 1. Long 2. Medium 3. Short	Significance scale STARS www.iaca.org.au 1=High 2=Medium 3=Low / Retention Value 1=High 2=Medium 3=Low 4=Remove
21	*Eucalyptus crebra* Narrow-leaved Red Ironbark	F	M	D	15	15X15 R	2 N	80 80	580 620	1	1	1	1	2	1	MLVF – 4 2	2 2
22	*Eucalyptus tereticornis* Forest Red Gum	P	M	D	21	22X16 N/S	2 N	65 80	780 800	1	5. 1x SE	2	1	2	1	MLVP – 2 3	3 3
23	*Eucalyptus crebra* Narrow-leaved Red Ironbark	G	M	I-S	17	12X6 NW/SE	2 NW	85 90	410 500	1	-	1	1	1	1	MGVG – 10 1	1 1
24	*Eucalyptus crebra* Narrow-leaved Red Ironbark	G	M	D	18	16X16 R	2 SLIGHT N	90 >90	790 790	1	1	1	1	1	1	MGVG - 10 1	1 1

No.	Comments
21	Localised dieback at lower and mid crown to S. Med volume large and small deadwood throughout crown – 100mm Ø and 4m in length. Low volume epicormic growth throughout crown.
22	Medium volume borer activity at trunk to W. Localized dieback at lower and upper crown to structural branches. High volume large deadwood at throughout crown – 160mm Ø and 8m in length. Low volume epicormic growth throughout crown.
23	Medium volume epicormic growth throughout crown. Low volume large deadwood at lower and mid crown – 80mm Ø and 2m in length.
24	Low volume large deadwood throughout crown – 50mm Ø and 2m in length.

Observations

4.2 All trees are locally indigenous and of remnant origin. No hollows/cavities were detected which may provide habitat to local fauna (see Tree Assessment). However, the trees are likely to provide a level of habitat value for food and shelter to remaining local wildlife - estimating habitat value is beyond the expertise of the author. Due to the fragmentation and isolation of individual trees and large reduction of tree stands in the local area, it would be reasonable to assume habitat use would be reduced due to a reduction in local fauna.

4.3 *Tree Significance*

Determined by using the Tree Significance - Assessment Criteria of the *IACA Significance of a Tree, Assessment Rating System* (STARS)© (IACA, 2010), Appendix A.

Table 2.0 Significance Scale

1 – **High**
2 – **Medium**
3 – **Low**

Significance Scale	1	2	3
UTM Tree No. / Stand No.	2, 4, 6, 7, 8, 9, 10, 11, 13, 14, 19, 23, 24	3, 15, 16, 17, 18, 21	1, 5, 12, 20, 22

Tree Retention Value

4.4 Determined by using the Retention Value - Priority Matrix of the *IACA Significance of a Tree, Assessment Rating System* (STARS) © (IACA, 2010), Appendix A.

Table 3.0 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.	2, 4, 6, 7, 8, 9, 10, 11, 13, 14, 19, 23, 24	3, 15, 16, 17, 18, 21	1, 5, 22	12, 20,

Discussion

4.5 AS4970 (2009) section 3 requires a radial 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 as per AS4970 (2009) section 3, 3.3.3. This 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.

4.6 The proposed design will facilitate the protection and retention of Trees 19 & 24. Adjacent and nearby trees, which may possibly be retained also by the design are recommended for removal due to their current condition or risk of failure in the future considered unacceptable within school grounds. Removal of trees will also further expose retained trees to greater wind loads, increasing the likelihood of failure, thus risk, therefore crown form has also assisted in such determinations.

Table 4.0 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 building construction works e.g. excavation (see explanatory notes below). Tree Protection Zone fences and setbacks where applicable are indicated in Appendix G.

Explanatory notes for Table 4.0.

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 Appendix G for further explanation of modifications to these setbacks.

Table 4.0 Tree Protection Zone setbacks

1. UTM Tree No. / Stand No.	2. **T**runk **D**iameter at **B**reast **H**eight **DBH** 1.4 m above ground, AS4970 (2009), or mm or m above ground where indicated. # = average. (mm)	3. **S**tructural **R**oot **Z**one **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. **T**ree **P**rotection **Z**one (TPZ) = **12 x DBH** From centre of trunk (COT) in metres AS4970 (2009) Section 3 (see Appendix B) (m)	5. Distance of fence with TPZ setback **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 building construction in metres **From centre of trunk (COT)**, (m) R = root plate C = crown
19	640 Av	2.8	7.7	5.4	8 [10]
24	790 Av	3	9.5	6.6	10 [10]

Descriptors for modified setbacks in columns above.

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

4.6 Trees 19 & 24 (2x trees) will be subject no encroachment within the Tree Protection Zone (TPZ). The trees are expected to remain viable (TPZ) and stable (SRZ).

4.7 Tree sensitive vegetation clearing and landscape methods are recommended to remain viable (TPZ) and stable (SRZ) as prescribed in the Appendix G - Tree Protection Plan.

4.8 Trees 19 & 24 will require Deadwooding as detailed in Appendix G – Tree Protection Plan.

5.0 RECOMMENDATIONS

5.1 Trees 19 & 24 are to be retained and protected within a Tree Protection Zone. These are to be maintained and special protection works undertaken as detailed in Appendix G – Tree Protection Plan.

5.2 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.

5.3 Trees 19 & 24 are to be pruned by Deadwooding and Trees 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 20, 21, 22 & 23 are to be removed as detailed in Appendix G – Tree Protection Plan and undertaken in accordance with 3.0 Pruning Standard.

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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 or risks from being eliminated or mitigated or managed to reduce harm or damage, 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.

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.

Estimated Life Expectancy	Significance				
	1. High	**2.** Medium	**3.** Low		
	Significance in Landscape	Significance in Landscape	Significance in Landscape	Environmental Pest / Noxious Weed Species	Hazardous / Irreversible Decline
1. Long **>40 years**					
2. Medium **15-40 Years**					
3. Short **<1-15 Years**					
Dead					

Legend for Matrix Assessment

	Priority for Retention (High) - These trees are considered important for retention and should be retained and protected. Design modification or re-location of building/s should be considered to accommodate the setbacks as prescribed by the Australian Standard AS4970 *Protection of trees on development sites*. Tree sensitive construction measures must be implemented e.g. pier and beam etc if works are to proceed within the Tree Protection Zone.
	Consider for Retention (Medium) - 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.
	Consider for Removal (Low) - These trees are not considered important for retention, nor require special works or design modification to be implemented for their retention.
	Priority for Removal - These trees are considered hazardous, or in irreversible decline, or weeds and should be removed irrespective of development.

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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.

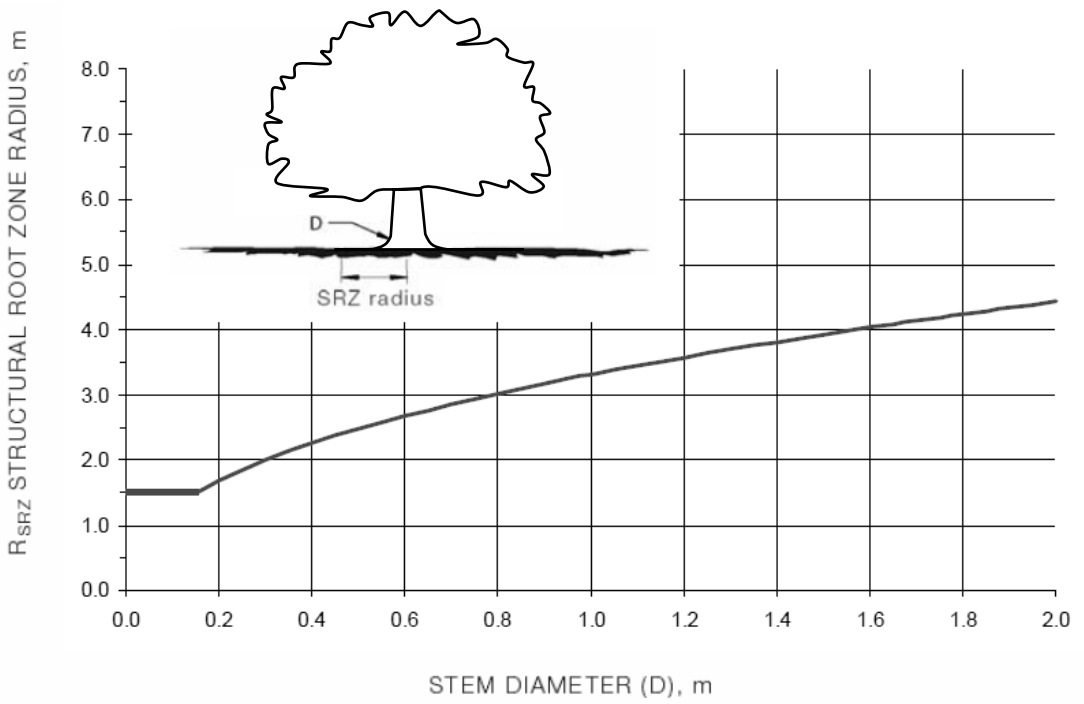


FIGURE 1 STRUCTURAL ROOT ZONE CALCULATION

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

NOTES:

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

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

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

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

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

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.

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

Appendix E

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*.

Condition of Trees

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

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

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

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

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^{O}-15^{O} from upright.

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

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

Critically Leaning A leaning tree where the trunk is growing at an angle greater than $>45^{O}$ from upright.

Progressively Leaning A tree where the degree of *leaning* appears to be increasing over time.

Static Leaning A leaning tree whose lean appears to have stabilized over time.

Form of Trees

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

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

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

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

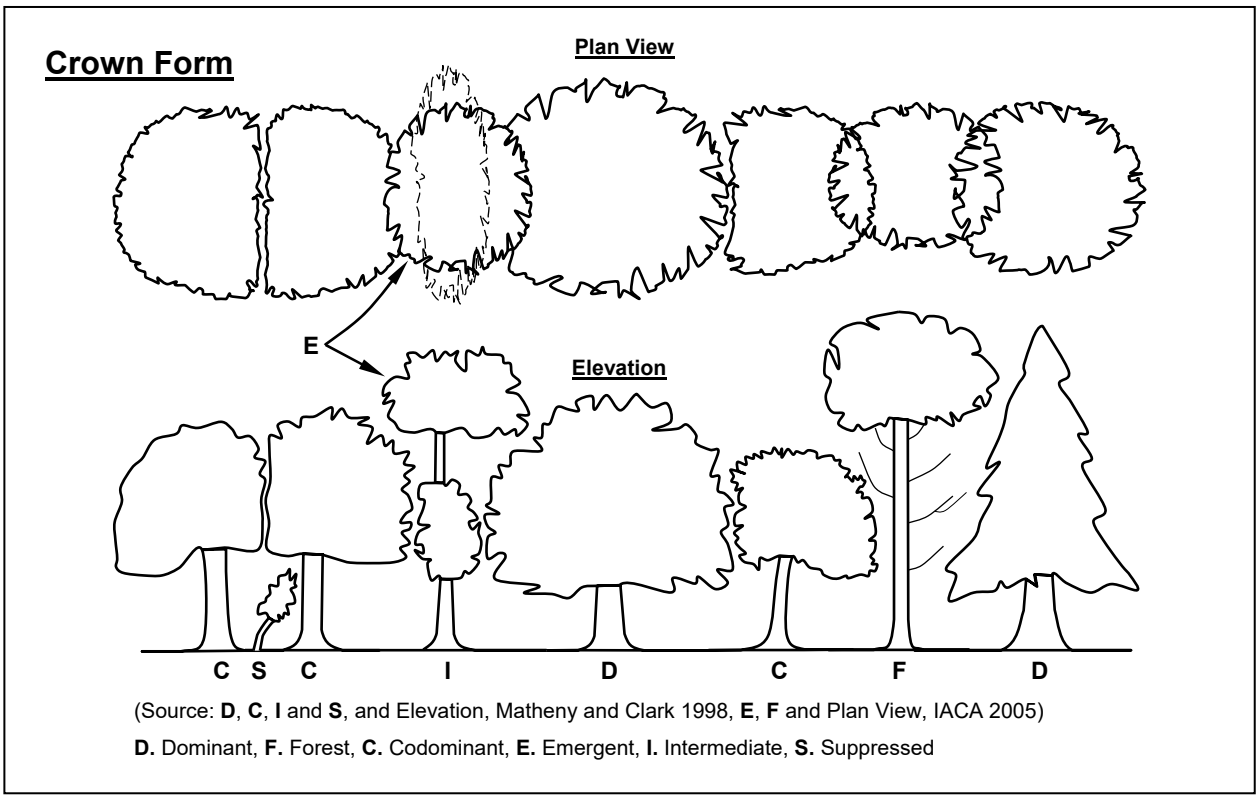
Crown Form Dominant Crowns of trees generally not restricted for space and light receiving light from above and all sides.

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

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

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

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



(Source: **D**, **C**, **I** and **S**, and Elevation, Matheny and Clark 1998, **E**, **F** and Plan View, IACA 2005)

D. Dominant, **F.** Forest, **C.** Codominant, **E.** Emergent, **I.** Intermediate, **S.** Suppressed

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 c*rown 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, s*oil 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 1st and 2nd order roots, or form an *adventitious root mass* in monocotyledonous angiosperms (palms). Such roots may be crossed and grafted and are usually contained within the area of *crown projection* or extend just beyond the *dripline*.

Appendices F and G

Appendix F – Survey of Subject Tree/s
Appendix G – Tree Protection Plan including Tree Protection Plan

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

UTM Tree No. / Stand No.	*Genus and species* Common name
1	*Eucalyptus crebra* Narrow-leaved Red Ironbark
2	*Eucalyptus crebra* Narrow-leaved Red Ironbark
3	*Eucalyptus crebra* Narrow-leaved Red Ironbark
4	*Eucalyptus paniculata* Grey Ironbark
5	*Eucalyptus crebra* Narrow-leaved Red Ironbark
6	*Eucalyptus crebra* Narrow-leaved Red Ironbark
7	*Eucalyptus crebra* Narrow-leaved Red Ironbark
8	*Eucalyptus crebra* Narrow-leaved Red Ironbark
9	*Eucalyptus crebra* Narrow-leaved Red Ironbark
10	*Eucalyptus crebra* Narrow-leaved Red Ironbark
11	*Eucalyptus crebra* Narrow-leaved Red Ironbark
12	*Eucalyptus tereticornis* Forest Red Gum
13	*Eucalyptus crebra* Narrow-leaved Red Ironbark
14	*Eucalyptus crebra* Narrow-leaved Red Ironbark
15	*Eucalyptus crebra* Narrow-leaved Red Ironbark
16	*Eucalyptus crebra* Narrow-leaved Red Ironbark
17	*Eucalyptus crebra* Narrow-leaved Red Ironbark
18	*Eucalyptus crebra* Narrow-leaved Red Ironbark
19	*Eucalyptus crebra* Narrow-leaved Red Ironbark
20	*Eucalyptus crebra* Narrow-leaved Red Ironbark

Survey of Subject Tree/s – Continues

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

UTM Tree No. / Stand No.	*Genus and species* Common name
21	*Eucalyptus crebra* Narrow-leaved Red Ironbark
22	*Eucalyptus tereticornis* Forest Red Gum
23	*Eucalyptus crebra* Narrow-leaved Red Ironbark
24	*Eucalyptus crebra* Narrow-leaved Red Ironbark

APPENDIX F – Survey of Subject Tree/s

Lot 3 The Hermitage Estate, Gledswood Hills, NSW **Ref: 19073**

Prepared by Urban Tree Management Australia P/L, 65 Excelsior Street, Merrylands NSW 2160, tel. 02 9760 1389.

From Survey Plan, by Frankham Engineering, Sheet 1 & 2, Dwg. No. 217046, dated 21 & 22 March 2017.

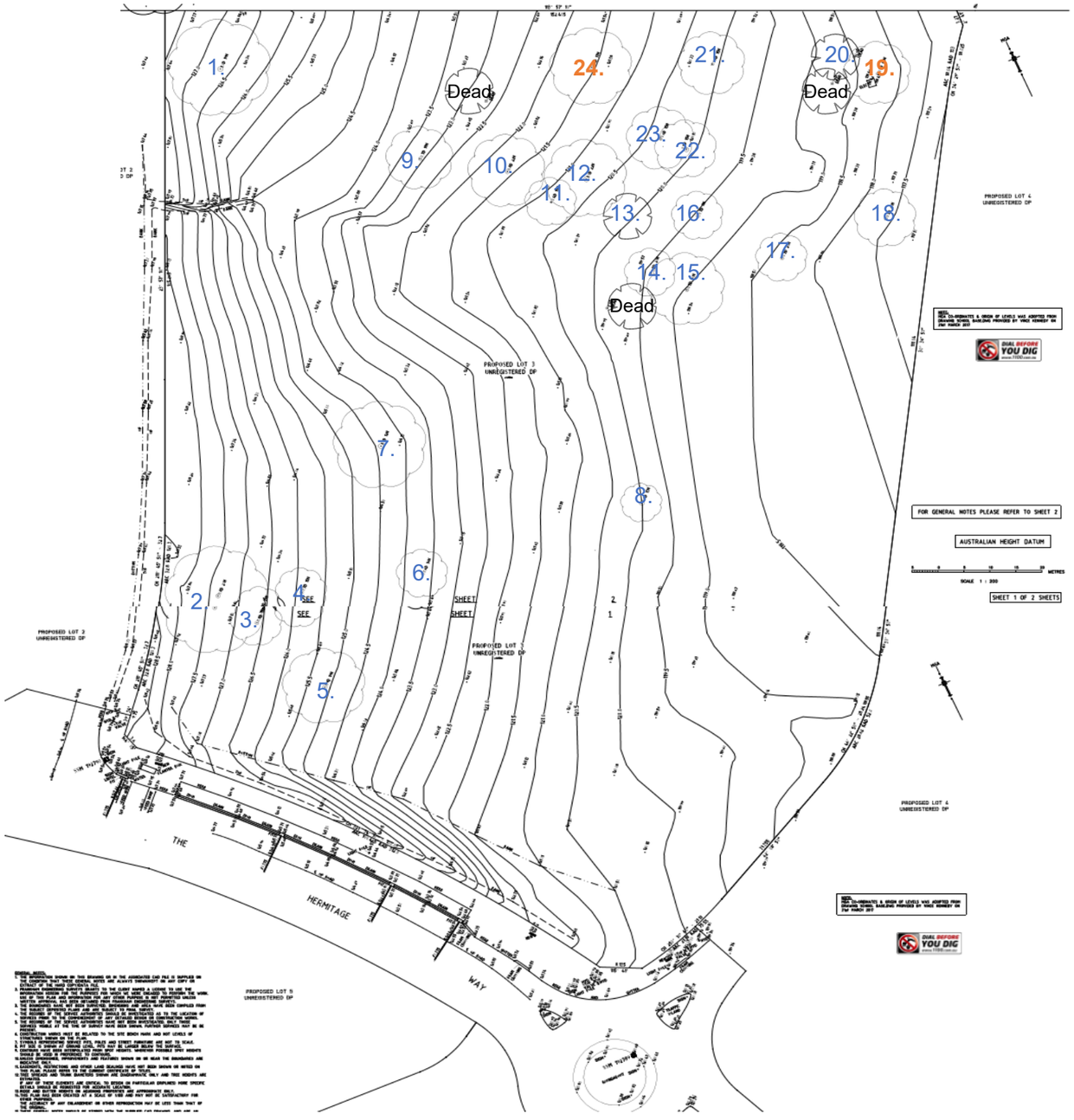
Legend

10. Tree/s or stands of trees numbered in orange and bold or surrounded by an unbroken line are recommended for retention.

11. Tree/s or stands of trees numbered in blue and not bold or surrounded by a broken line are recommended for removal.

Note: trees indicated, unnumbered are either shrubs, or trees of species, or dimensions, or condition class not protected by the Tree Preservation Order or trees not affected by the proposed works or were already removed.

URBAN TREE MANAGEMENT



APPENDIX G – TREE PROTECTION PLAN 1 of 3 - Tree Protection Zones - Standard Procedure

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 measures, Figure 3 Protective 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 the TPZ.
4 Bracing is permissible within the TPZ. Installation of supports should avoid damaging roots. "

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-

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

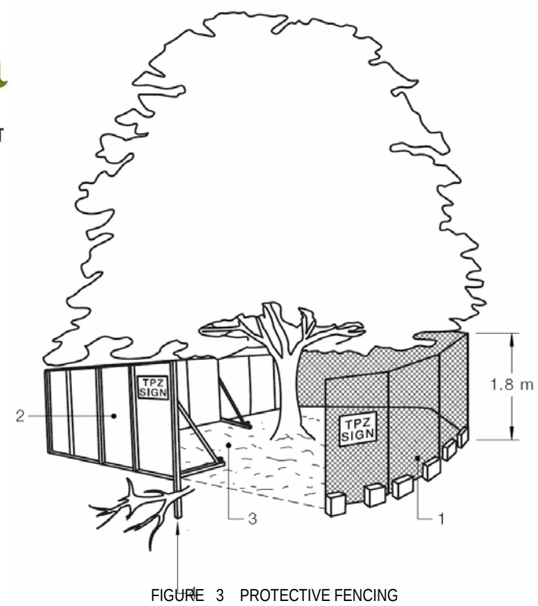


FIGURE 3 PROTECTIVE FENCING

FIGURE C1 TREE PROTECTION ZONE SIGN

FIGURE C1 TREE PROTECTION ZONE SIGN

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 Figure C1 (as shown) and lettering to comply with AS1319.

Where a tree is to be retained and a *Tree Protection Zone* cannot be adequately established due to restricted access e.g. 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 as lower branches 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).

Trunk/Branch and root protection 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.

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.

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).

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).

Scaffolding *"Where scaffolding is required it should be erected outside the TPZ. Where it is essential for scaffolding to be erected within the TPZ, branch removal should be minimized. This can be achieved by designing scaffolding to avoid branches or tying back branches. Where pruning is unavoidable it must be specified by the project arborist in accordance with AS4373. 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 soil contamination. The boarding should be left in place until the scaffolding is removed."* (Standards Australia 2009, p. 18).

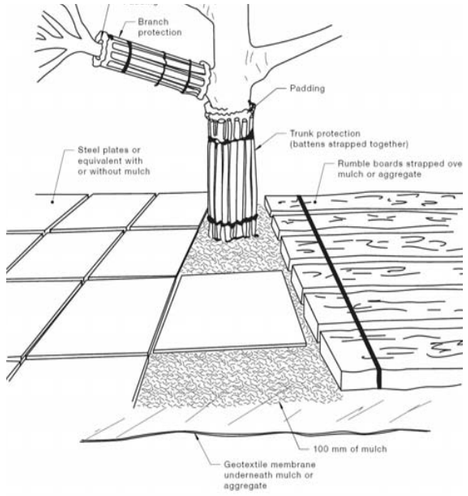


FIGURE 4 EXAMPLES OF TRUNK, BRANCH AND GROUND PRO˜

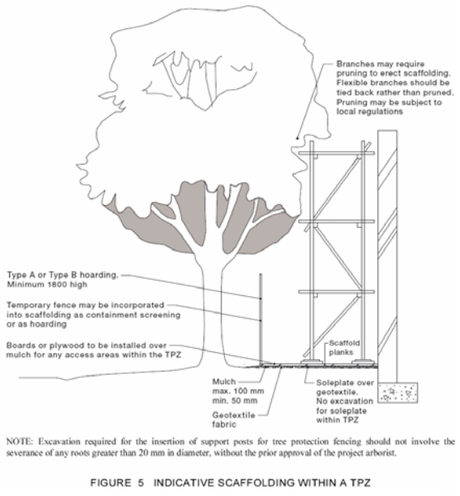


FIGURE 5 INDICATIVE SCAFFOLDING WITHIN A TPZ

FIGURE 5 INDICATIVE SCAFFOLDING WITHIN A TPZ

APPENDIX G - TREE PROTECTION PLAN 2 of 3

Lot 3 The Hermitage Estate, Gledswood Hills, NSW **Ref: 19073**

Prepared by Urban Tree Management Australia P/L, 65 Excelsior Street, Merrylands NSW 2160, tel. 02 9760 1389.

Tree Protection Works – General

All retained tree/s Existing levels are to be preserved and no excavation except by hand to protect structural roots is to be undertaken within the Tree Protection Zones unless specified by the Project Arborist.. No cutting or filling is to be undertaken within any TPZ, again unless specified by the Project Arborist.

Induction for Tree Protection All workers entering the site involved in construction must be advised of the tree protection measures and specifications outlined within this report during the site induction. This is to be verbally acknowledged and signed off before commencement of work.

Tree Protection Works - Specific

During Vegetation Clearing

Tree Removal – Tree 1, 2, 3, 4, 5, 6, 7 ,8 , 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 20, 21, 22 & 23 Works to be undertaken prior to construction works and their stumps removed or ground to 300 mm below grade. Crowns of trees to be retained are to be protected. Any tree located within the TPZ of retained trees are to be removed manually, by climbing and sectioning. Any plant equipment is to work from outside of the TPZ reaching into the TPZ to minimise damage to overhanging branches and to protect roots.

Pruning – Tree 19 & 24 Deadwooding (AS4973 2007, p. 13). Remove all large deadwood i.e. >20mm diameter and usually >2 metres long, which is generally considered of high risk potential.

Within TPZ's, landscape structures are to be removed manually.

Prior to Construction

TPZ Fencing Trees 19 & 24 The trees are to be enclosed within Tree Protection Zone fencing and maintained and retained until the completion of all building works and commencement of landscaping. Set-backs as detailed in Table 3 or Tree Protection Plan

During Construction

Root Protection - Tree 19 & 24 Prevention of root damage & soil compaction is essential within the TPZ's. No plant equipment is to enter the TPZ's.

Location of underground utilities within a Tree Protection Zone – all retained trees Utility services should not be located within the Tree Protection Zone. Alternatively, within the TPZ, 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 with an air knife or water knife and vacuum truck or with directional drilling with minimum depth to top of bore of 600 mm, to prevent soil compaction and root damage and works are to be monitored and certified by the Project Arborist.

Post Construction – Landscaping

Existing levels are to be maintained with the TPZ of retained trees.

Replacement trees should be considered to maintain the urban forest. Mindful of the space limitations of the new use of the site the trees should be located within the proposed landscaping areas where they may grow to maturity unhindered and will not conflict with built structures or utility services.

Excavation for landscape plantings within the tree protection zones This should be undertaken manually, to prevent damage to structural roots. Plant container size should be 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.

APPENDIX G – TREE PROTECTION PLAN 3 of 3

Lot 3 The Hermitage Estate, Gledswood Hills, NSW **Ref: 19073**

Prepared by Urban Tree Management Australia P/L, 65 Excelsior Street, Merrylands NSW 2160, tel. 02 9760 1389.

From First Floor Site Plan, by Perumal Pedavoli Architects, Preliminary, Ref. 01_003, dated May 2017.

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Legend

10. Trees numbered in **orange and bold** are recommended for **retention**.

11. Trees numbered in blue and not bold are recommended for removal.

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

Tree Protection Zone, within the site, area of special protection measures or works outside of or instead of a fenced area.

TPZ

Structural root Zone (SRZ)

Reduced by 10%

URBAN TREE MANAGEMENT

Tree Protection Zone setbacks
extract from Table 4.0 and Appendix B.

1. UTM Tree No. / UTM Stand No.	2. 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)	3. **T**ree **P**rotection **Z**one (TPZ) = **12 x DBH** (m) From centre of trunk (COT) in metres AS4970 (2009) Section 3 (see Appendix B)	4. Distance of fence with TPZ setback **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 (mm)	5. Proposed distance of works on the side closest to building construction in metres From centre of trunk (COT), (m)
19	2.8	7.7	5.4	8
24	3	9.5	6.6	10