URBAN FORESTRY AUSTRALIA

TREE MANAGEMENT CONSULTING ARBORICULTURISTS

ARBORICULTURAL IMPACT ASSESSMENT

for

Katherine Shallvey
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Suite 2301, Quattro Building 2, Level 3
4 Daydream Street
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SITE ADDRESS

57 NANDI AVENUE
FRENCHS FOREST

SEPTEMBER 2019

Prepared by
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1 INTRODUCTION

1.1 This Arboricultural Impact Assessment (AIA) prepared by Urban Forestry Australia (UFA) was commissioned by Turnbull Planning International Pty Limited, on behalf of the owners of the subject site. "The site" is identified as Lot 58 in D.P. 221359 and known as 57 Nandi Avenue, Frenchs Forest, New South Wales.

1.2 This AIA is to accompany a development application to Northern Beaches Council for the proposed alterations and additions to an existing dwelling on the site.

1.3 The purpose of this report is to assess the *vigour* and *condition* of the surveyed trees, and identify the potential impacts the proposed development may have on those trees to be retained in proximity to the works.

1.4 This report gives recommendations for tree retention or removal, and provides guidelines for tree protection and maintenance.

1.5 Care has been taken to obtain all information from reliable sources. All data has been verified as far as possible; however, I can neither guarantee nor be responsible for the accuracy of information provided by others.

1.6 This AIA is not intended as an assessment of any impacts on trees by any proposed future development of the site, other than the current development application.

1.7 This report is not intended to be a comprehensive tree *risk* assessment; however, the report may make recommendations, where appropriate, for further assessment, treatment or testing of trees where potential structural problems have been identified, or where below ground investigation may be required.

2 METHODOLOGY

2.1 In preparation for this report, ground level, *visual tree assessments*[1] of seven (7) trees or tree groups, including trees on adjoining properties, were undertaken by Catriona Mackenzie and Mark Jamieson of Urban Forestry Australia, on 3rd and 20th July, 2019. Inspection details of these trees are provided in Appendix E—*Schedule of Assessed Trees.*

2.2 This AIA takes account of prescribed trees pursuant to Warringah Development Control Plan 2011– Section E1 *Preservation of Trees or Bushland Vegetation.*

2.3 Tree heights and canopy spreads were visually estimated or measured using a Nikon ForestryPro Laser measurer. Unless otherwise noted in Appendix E, all trunk diameters were measured at approximately 1.4 metres above ground level ("the DBH"), using a Yamiyo diameter tape.

2.4 Field observations were written down, and photographs of the site and trees were taken using an iphone 6 and/or Canon EOS SLR digital camera.

2.5 No *aerial inspections*, *root mapping* or woody tissue testing were undertaken as part of this tree assessment. Information contained in this tree report covers only the trees that were examined and reflects the condition of those trees at the time of inspection.

2.6 Plans and documents referenced for the preparation of this report include:

- Survey Plan, Ref. No. 190553_A, dated 08/03/2019, prepared by Total Surveying Solutions.
- Site, Floor & Roof Plans A101 – A103, A107 – A109 & A12, dated 29/08/2019, prepared by Blue Sky Building Designs.
- Schedule 5 Environmental Heritage of the Warringah Local Environment Plan 2011.
- AS4970-2009 *Protection of trees on development sites*, Standards Australia.

2.7 No hydraulic service or landscape plans have been reviewed in preparation of this report.

2.8 The subject trees are shown on a marked-up excerpt of the survey plan. This marked-up plan is attached as Appendix F—Tree Location Plan.

[1] Visual Tree Assessment (VTA) is a procedure of defect analysis developed by Mattheck and Breloer (1994) that uses the growth response and form of trees to detect defects.

3 OBSERVATIONS AND DISCUSSION

3.1 Assessed Trees

3.1.1 Seven (7) trees (prescribed and non-prescribed) were assessed or identified and are included in this report. Details of these are included in the Schedule of Assessed Trees—Appendix E.

3.1.2 Several palm trees are located on the site. None of the palm species are prescribed under the DCP and are therefore exempt from authority approval for removal. These palms are not individually assessed (other than to identify their species), but their positions are shown on the tree location plan at Appendix E.

3.1.3 Tree numbers—of the 7 assessed trees, the following is noted:

- Three (3) trees are located on adjoining properties—Trees 1, 3 and 7.
- Four (5) prescribed trees are located within the subject site—Trees 2, 4, 5 and 6.

3.1.4 Species assemblage—of the 8 prescribed, assessed trees, the following is noted:

- Three (3) trees are of locally indigenous species—Trees 2, 4 and 5.
- Four (4) are introduced exotic species—Trees 1, 3, 6 and 7.

3.1.5 The assessed, prescribed and adjoining trees and their respective *Retention Value* (RV) are identified in Table 1, below. Note: Refer to Appendix B for the methodology used to assess the Retention Value of a tree.

Table 1—Tree Identification and Retention Value, where L = Low, M = Medium, H = High.
Trees proposed to be removed shown thus **00**

Tree No.	*Genus & species* **Common Name**	On-Site (Y/N)	RV	Tree N o.	*Genus & species* **Common Name**	On-Site (Y/N)	RV
1	*Ginkgo biloba* **Maidenhair Tree**	N	L	5	*Eucalyptus robusta* **Swamp Mahogany**	Y	L
2	*Eucalyptus robusta* **Swamp Mahogany**	Y	H	6	*Radermachera sinica* **China Doll**	Y	L
3	*Syagrus romanzoffianum* **Cocos Palm**	N	L	7	*Syagrus romanzoffianum* **Cocos Palm**	N	L
4	*Eucalyptus botryoides* **Bangalay**	Y	H				

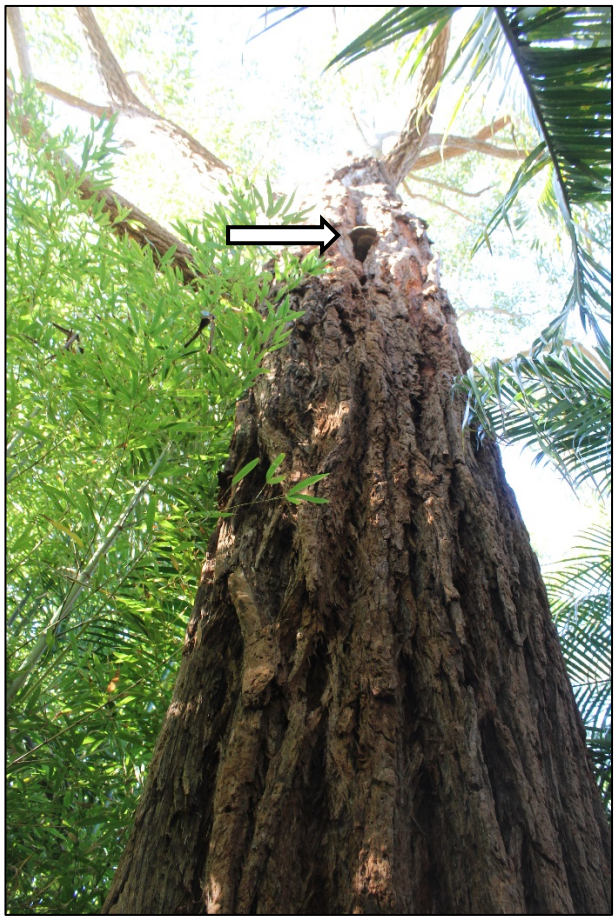
3.1.6 No species of assessed tree is subject to threatened conservation status under Australian and/or State Government legislation (i.e. NSW *Biodiversity Conservation Act* 2016, and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*).

3.1.7 During our inspection we noted Tree 5, a very large Swamp Mahogany in the rear yard, has an active fungal fruiting body at approximately 7m above ground, protruding from a large, long wound beginning approximately 6m above ground level and extending to approximately 11m above ground.

3.1.8 The fungus is typical of young *Phellinus* and is possibly *P. robustus*, a common fungal species found in the eucalypts of SE Australia. *Phellinus* causes a white rot of the heartwood of trees and is relatively slow growing. At the present time tree vigour is good and would be expected to assist in resisting the spread of the fungus affecting the wood tissue.

3.1.9 Without diagnostic testing it is difficult to confirm the extent of decay in the stem, however, it is fair to say the presence of the fungal body identifies the tree has established decay and the tree's Useful Life Expectancy (ULE) of the tree is dramatically shortened because of it.

3.1.10 Failure of the stem would most likely occur near the decaying area and, as there is approximately 19 – 20m of stem and crown above this point, the site and adjoining dwellings are located well within the fall zone and at risk of serious damage when this tree fails.



Plates 1 and 2—Arrows illustrate the location of the fruiting body (probably *Phellinus robustus*) emerging from a long, wound (canker) in the tree's main stem.

3.1.11 Large, woody surface roots extending several metres from the tree were also noted.

3.1.12 Running bamboo was observed around the property perimeters and the rhizomes of these were observed running across the rear yard for several metres in many directions.

3.1.13 At at the interface of the exposed water pipe inspection shaft and cover we found palm roots from the adjoining Cocos Palm (Tree 7) and two (2) woody roots belonging to Tree 6 (China Doll). It appears it could be any roots belonging to Trees 5, 6 and 7 interfering with the pipes.

3.1.14 It is not known whether the pipes are terracotta (which are usually old and prone to roots entering deteriorating joins or cracks), or PVC, which may or may not be damaged by tree roots. Often the joins on the pipes are poorly done and roots enter via tiny cracks or openings rather than causing the original damage.

3.2 Proposed Removal of Prescribed Trees

3.2.1 Two (2) prescribed site trees are proposed to be removed:

- Tree 5—Swamp Mahogany of Low RV. As discussed above, the tree has a disease that cause decay of the heartwood and will become increasingly at risk of failure over time. It is unfortunate, but our considered opinion is this large old tree would be better removed in the short-term to remove the risk of tree failure and future property damage or personal injury.
- Tree 6— China Doll of Low RV. This small exotic tree stands within the footprint of the proposed master bedroom.

3.3 Proposed Tree Retention

3.3.1 Prescribed site trees 2 and 4 are to be retained and protected.

3.3.2 Adjoining assessed trees 1, 3 and 7 are to be retained and protected.

3.4 Potential Impacts on Trees Proposed for Retention

3.4.1 Under the Australian Standard 4970-2009 *Protection of trees on development sites* (AS4970), encroachments less than 10% of the Tree Protection Zone (TPZ)[2] are considered to be minor. No specifications are provided in AS4970 for potential impacts of 10% or greater. This 10% is interpreted as the threshold figure, and the trigger where arboricultural investigations into TPZ encroachments beyond this figure need to be considered.

3.4.2 The potential extent of root zone impacts to protected trees to be retained can be generally rated using the *Impact Level Rating* ("ILR") Table 2, below.

Table 2: Guideline to the rating of impacts on trees to be retained.
Based on discussions with executive members of the Institute of Australian Consulting Arboriculturists.

IMPACT LEVEL RATING	
0	0 – 0.9% of root zone impacted – **no** impact of significance
L	1 to 10% of root zone impacted – **low** (minor) level of impact
L - M	>10 to 15% of root zone impacted – **low** (minor) **to moderate** level of impact
M	>15 to 20% of root zone impacted – **moderate** level of impact
M – H	>20 to 25% of root zone impacted – **moderate to high** level of impact
H	>25 to 35% of root zone impacted – **high** level of impact
S	>35% of root zone impacted – **significant** level of impact

3.4.3 Disturbance within the *Structural Root Zone* (SRZ), and extent of encroachments into the notional TPZ's of protected site trees to be retained are summarised in Table 3, below.

Table 3: *Estimated encroachments into the SRZ and TPZ of trees proposed for retention*.
Note 1: These figures are based on the *notional* SRZ and TPZ's offsets of the trees as calculated under AS4970 and do not necessarily reflect the actual root zones of the trees. Existing at or below ground structures, site topography and soil hydrology will influence the presence, spread and direction of tree root growth.

Tree No.	Tree	Tree located on site	SRZ affected	TPZ area (m^2)	TPZ encroachment (approx. m^2)	TPZ encroachment (approx. %)	ILR
1	Maidenhair Tree	×	✓	14.0	0	0	0
2	Swamp Mahogany	✓	×	152.0	20.0	13	L-M
3	Cocos Palm	×	×	38.5	2.5	6.5	L
4	Swamp Mahogany	✓	×	366.0	24	6.5	L
7	Cocos Palm	×	×	50.0	7.5	15	M

[2] **Tree Protection Zone (TPZ)**. Refers to the radial distance in metres, measured from the centre of the tree stem which defines the *tree protection zone* for a tree to be retained. This is generally the minimum distance from the center of the tree trunk where protective fencing or barriers are to be installed to create an exclusion zone.

3.4.4 **Tree 1**—Maidenhair Tree (on adjoining land to the south)

Structural Root Zone impacts:

- No changes or new structures are indicated within the SRZ.

Tree Protection Zone impacts:

- No changes or new structures are indicated within the TPZ.

Pruning impacts:

- Pruning of the tree is unlikely, however, if required it may only be small material confined to the area over the existing driveway.

3.4.5 **Tree 2**—Swamp Mahogany

Structural Root Zone impacts:

- One or two isolated pad footings to support the elevated deck will be within the SRZ. Care will be required when removing the existing path and careful hand digging to determine the location of footings to avoid any structural tree roots that might be present.

Tree Protection Zone impacts:

- The tree already has much of its notional TPZ covered with the existing dwelling. However, the proposed addition is an elevated timber deck and entry foyer which will have a very minor impact on the tree.
- The calculated encroachment into the tree's notional TPZ (Table 3 and Figure 1) is in the low to moderate range, however as the proposed structures will be fully elevated, it is my opinion the anticipated encroachment will be in the low(minor) range and not expected to have any adverse effect on tree vigour and longevity.
- Rainwater will still run down the existing paved areas and will not be prevented form reaching the tree's rootzone.

Pruning impacts:

- Pruning of the tree for the construction of the deck and entry foyer is not required, however, removal of a dead limb projecting northeast, at approximately 5.5m above ground level, is recommended.

3.4.6 **Tree 3**—Cocos Palm (on adjoining land to the south)

Structural Root Zone impacts:

- Under AS4970, palms and other monocots (e.g. grass-like plants) the formula for calculating the SRZ of a tree does not apply.

Tree Protection Zone impacts:

- Although there is an encroachment on plan (see Figure 1), the elevated deck and entry is highly unlikely to have any adverse impact on the continued viability of the palm.

Pruning impacts:

- Nil required.

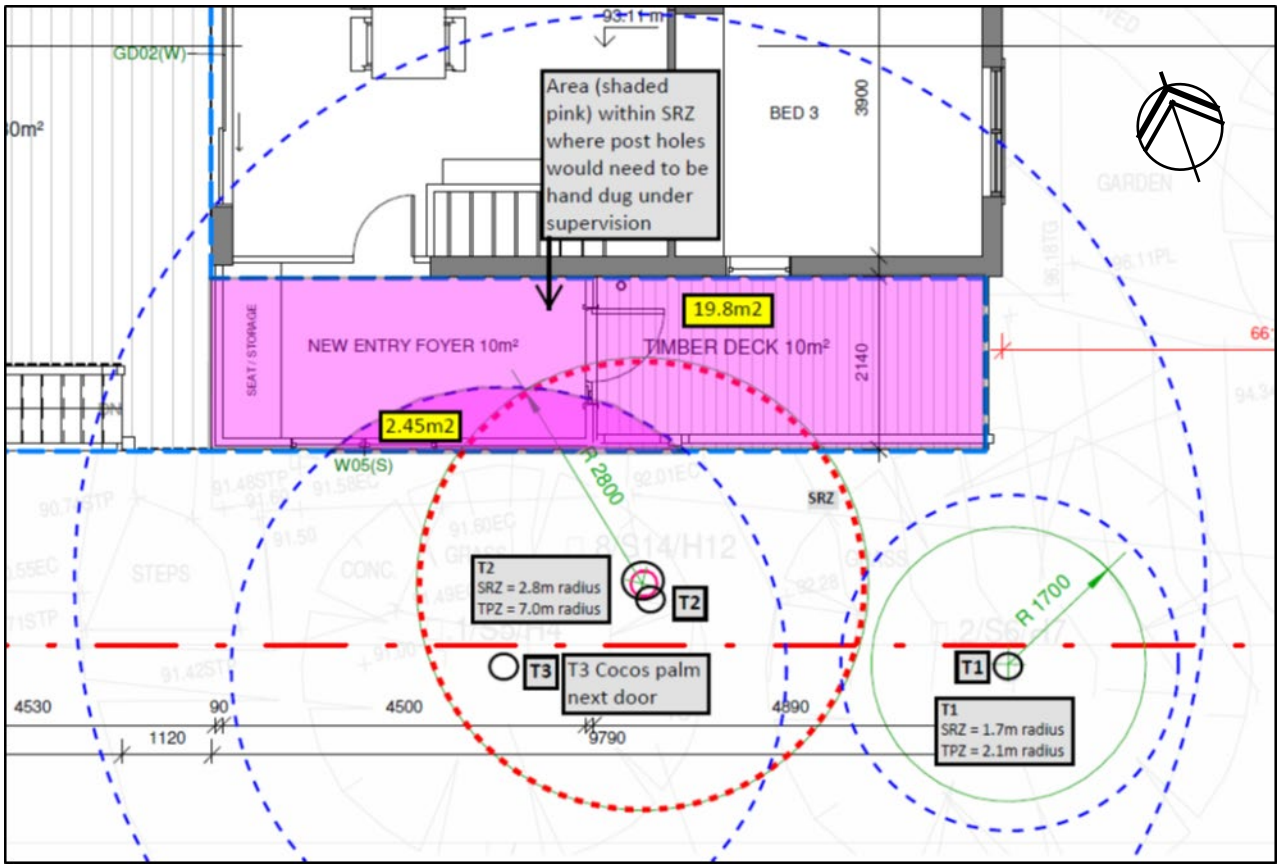


Figure 1
Illustrates the SRZ (dashed red circle) of Trees 2, and TPZ's (blue, outer dashed circles) of Tres 1 and 3 on the adjoining property, The pink shaded area depicts the notional TPZ encroachments from the proposed footprint.
Not to scale. Excerpt of Plan A103, marked up by C. Mackenzie.

3.4.7 **Tree 4**—Bangalay

Structural Root Zone impacts:

- No changes or new structures are indicated within the SRZ.

Tree Protection Zone impacts:

- At approximately 7m east of the tree, the proposed deck is within the tree's notional 10.8m TPZ. However, the deck will be fully elevated, with only one of two pad footings (deck and stairs) and the northern end of the deck will be attached to the existing dwelling.
- The impact of this new deck will be negligible.

Pruning impacts:

- Nil required.

3.4.8 **Tree 7**—Cocos Palm (on adjoining land to the north)

Structural Root Zone impacts:

- Under AS4970, palms and other monocots (e.g. grass-like plants) the formula for calculating the SRZ of a tree does not apply.

Tree Protection Zone impacts:

- Approximately 15% of the palm's notional TPZ is affected by the proposed master bedroom. However, the extension will be elevated and supported by isolated brick columns. The actual encroachment will be much less than calculated.

Pruning impacts:

- Nil required.

4 CONCLUSIONS

- A total of seven (7) trees are included in this Arboricultural Impact Assessment. Of these:
  - Three (3) trees are off-site and will be retained—Trees 1 (Maidenhair Tree), 3 and 7 (Cocos Palms).
  - Two (2) prescribed site trees will be retained and protected—Trees 3 (Swamp Mahogany) and Tree 4 (Bangalay).
  - Two (2) prescribed site trees are proposed for removal—Tree 5 (Swamp Mahogany), and Tree 6 (China Doll).
  - None of the proposed tree removals has been identified with a *High* Retention Rating (RV).
- No assessed tree on the site or on adjoining properties was identified as an endangered species.
- No assessed tree on the site or on adjoining properties was identified as, or associated with, a heritage item.
- Due to the nature of the works, which are fully elevated structures within the TPZ's of trees to be retained, the actual encroachments for all trees are considered to be minor, and I have no concerns with supporting the proposal. However, there will be isolated footings within the notional SRZ of Tree 2 (Swamp Mahogany) and consideration of the possibility of structural tree roots being in this SRZ offset must be considered.
- Provided the recommendations of this report are adopted, and a site arboriculturist provides appropriate supervision and management of the trees during development, adverse impacts on tree vigour and structural condition of trees to be retained will be managed as practically as possible and it is unlikely any tree decline or additional tree removal will result.

5 RECOMMENDATIONS

5.1 Tree Removal

5.1.1 Removal of prescribed site trees (Trees 5 and 6) is subject to authority review of this report, and approval is to be obtained (e.g. by Consent) before any trees are removed.

5.1.2 Tree 5 is a large and mature tree but with an identified active hazard affecting the strength of its stem. Failure of the tree's stem is likely in the future, but this could be years away. However, the probability that there will always be a dwelling and people located within the tree's fall zone means the risk is very high that the dwelling (and potentially the adjoining dwelling) would suffer severe damage and occupants may suffer serious injury. Given this degree of risk, the removal of the tree should be undertaken well before its time of failure to avoid significant damage and injury. Despite my client's original intention to retain the tree, I have advised my client the removal of the tree is inevitable due to risk, and that it my opinion its removal would be best undertaken prior to construction while reasonable access to the tree and working space is available

5.1.3 Tree removals are to be undertaken in accordance with the NSW WorkCover Code of Practice for the Amenity Tree Industry (1998).

5.2 Project Arboriculturist

5.2.1 A Project Arboriculturist (PA) shall be engaged prior to works commencing on the site. The PA must have a minimum Australian Qualification Framework Level 5 (AQF5) or above in Arboriculture.

5.2.2 Duties of the PA shall include, but not be limited to:

- Liaising with the Project Manager/Head Contractor/Site Manager to confirm the tree protection fencing locations, construction access, and other specific tree protection requirements prior to site works commencing.
- Inspection of Tree Protection Devices and supervision of works as recommended in this report or as specified in any Conditions of Consent associated with an approved development application.
- Provision of Compliance Certification as and when required.

5.3 Tree Protection – Specific Recommendations

5.3.1 The Tree Protection Plan (TPP) at Appendix D shall be adopted for the protection of trees to be retained.

5.3.2 Tree Protection Devices installed as specified in the TPP shall be inspected and certified in writing (supported by photographic evidence) as being 'fit-for-purpose' and compliant with the TPP and AS4970.

5.4 Tree Protection – General Recommendations

5.4.1 The Tree Protection is to be in accordance with the following:

- Tree Protection Devices (TPD) may include mulching, tree guards and other devices other than fencing.
- The TPD must be in place prior to any site works commencing, including clearing, demolition or grading.
- The most appropriate fencing for tree protection is 1.8m chainlink with 50mm metal pole supports. During installation, care must be taken to avoid damage to significant roots. The practicality of providing this fencing on this site must be addressed by the arboriculturist.
- Locate large primary roots by careful removal of soil within the fencing area. ***Do not drive any posts or pickets into tree roots.*** Replace soil back over tree roots.
- It is recommended that the arboriculturist provide written certification that the TPD is/are installed and will satisfy tree protection requirements.
- Nothing should occur inside the tree protection fenced areas, so therefore all access to personnel and machinery, storage of fuel, chemicals, cement or site sheds is prohibited.
- Signage should explain exclusion from the area defined by TPD and carry a contact name for access or advice (see Appendix E – Tree Protection Devices).
- The TPD cannot be removed, altered, or relocated without the project arborists' prior assessment and approval.

5.5 Arboricultural advice

5.5.1 <u>Tree and Root Pruning</u>

- Any pruning required is to be assessed and approved by the PA, prior to undertaking any of this type of work
- Pruning shall not be undertaken by unqualified site personnel at any time.
- Pruning of branches must be undertaken by a minimum AQF Level 3 arborist in accordance with the Australian Standard AS4373-2007 *Pruning of amenity trees*,
- Unless otherwise approved by the Conditions of Development Consent, or by separate application and approval by the consent authority, pruning is to be limited to cutting of limbs less than 80mm diameters, and no more than 10% total live material removed.

5.5.2 Stockpiling and location of site sheds

- The project arboriculturist must be consulted prior to placing any items within a tree's TPZ.
- Where stockpiling must be located within the TPZ offset of trees to be retained, the existing/undisturbed natural ground must be covered with thick, coarse mulch to a minimum 75-100mm thickness.
- Large, or bulky materials (non-contaminating) can be stacked on wooden pallets or boards placed over the mulch.
- Tarpaulins (or similar) placed on boards or pallets on top of mulch shall be used to prevent loose or potentially contaminating materials from moving into the soil profile within the TPZ of trees or within 10m upslope of trees.
- Where site sheds must be located within the TPZ offset of a tree/s, the shed must be fully elevated on all sides with a minimum 300m between existing ground and the floor/floor bearers. Isolated pad footings must be carefully dug by hand and not damage or sever any roots greater than 20mm diameters.
- Any conflict between footing locations and larger roots (i.e. 20mm Ø plus) must be brought to the attention of the project arboriculturist who is to provide practical alternatives that do not include unnecessary tree root removal.

5.5.3 Fill Material

- Placement of fill material within the TPZ of trees to be retained should be avoided where possible. Where placement of fill cannot be avoided, the material should be a coarse, gap graded material such as 20 — 50mm crushed basalt or equivalent to provide some aeration to the root zone. Note that roadbase or crushed sandstone or other material containing a high percentage of fines is unacceptable for this purpose.
- The fill material should be consolidated with a non-vibrating roller to minimise compaction of the underlying soil.
- Permeable geotextile may be used beneath the sub-base to prevent migration of the stone into the sub-grade. No fill material shall be placed in direct contact with the trunk.

5.5.4 Pavements

- Pavements should be avoided within the TPZ of trees to be retained where possible.
- Proposed paved areas within the TPZ of trees to be retained is to be placed above grade to minimise excavations within the root zone, avoiding root severance and damage.

5.5.5 Fencing and walls within the SRZ and TPZ of retained trees.

- Where fencing and/or masonry walls are to be constructed along site boundaries, they must provide for the presence of any living woody tree roots greater than 50mm diameter.
- Hand digging must occur within the SRZ of trees to be retained.
- For masonry walls/fences it may be acceptable to delete continuous concrete strip footings and replace with suspended in-fill panels (e.g. steel or timber pickets, lattice etc) fixed to pillars.

5.5.6 Landscaping within tree root zones.

- The level of introduced planting media into any proposed landscaped areas within the TPZ is not to be greater than 75mm depth, and be of a coarse, sandy material to avoid development of soil layers that may impede water infiltration.

- Appropriate container size of proposed plants within the SRZ of trees should be determined prior to purchase of plants. Otherwise, any proposed landscaping within the SRZ must consist of tubestock only. This is required to ensure that damage to tree roots is avoided.
- Mattocks and similar digging instruments must not be used within the TPZ of the trees. Planting holes should be dug carefully by hand with a garden trowel, or similar small tool.
- Where possible, do not plant canopy trees beneath, or within 6 - 8m of overhead lines.

5.5.7 Other

- No washing or rinsing of tools or other equipment, preparation of any mortars, cement mixing, or brick cutting is to occur within 8m upslope of any palms or trees to be retained.
- Regular monitoring of the trees during development works for unforeseen changes or decline will help maintain the trees in a healthy state.

Report prepared by Catriona Mackenzie

September, 2019

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APPENDIX A

TERMS AND DEFINITIONS

TERMS AND DEFINITIONS

The following relates to terms or abbreviations that may have been used in this report and provides the reader with a detailed explanation of those terms.

Aerial inspection Where the subject tree is climbed by a professional tree worker or arborist specifically to inspect and assess the upper stem and crown of the tree for signs or symptoms of defects, disease, etc.

Age classes

- **Y** *Young* refers to a well-established but juvenile tree
- **SM** *Semi-mature* refers to a tree at growth stages between immaturity and full size
- **EM** *Early-mature* refers to a tree that is more or less full sized and vigourously growing.
- **M** *Mature* refers to a full sized tree with some capacity for further growth
- **LM** *Late Mature* refers to a full sized tree with little capacity for growth, not yet about to enter decline
- **OM** *Over-mature* refers to a tree about to enter decline or already declining.

Buttress A flange of adaptive wood occurring at a junction of a trunk and root or trunk and branch in response to loading.

Condition refers to the tree's form and growth habit, as modified by its environment (aspect, suppression by other trees, soils) and the state of the scaffold (i.e. trunk and major branches), including structural defects such as cavities, crooked trunks or weak trunk/branch junctions. These are not directly connected with health and it is possible for a tree to be healthy but in poor condition.

Crown All the parts of a tree arising above the trunk where it terminates by its division forming branches, e.g. the branches, leaves, flowers and fruit: or the total amount of foliage supported by branches.

Crown raise pruning Pruning technique where lower limbs are removed, thereby lifting the overall crown above the ground.

Deadwood refers to any whole limb that no longer contains living tissues (e.g. live leaves and/or bark). Some dead wood is common in a number of tree species.

Diameter at Breast Height (DBH) refers to the tree trunk diameter at breast height, i.e. measured at 1.4 m above ground level.

Dieback Death of growth tips/shoots and partial limbs, generally from tip to base. Dieback is often an indicator of stress and tree health.

Form refers to the crown shape of the tree as influenced by the availability or restriction of space and light, or other contributing factors within its environment. Crown form may be determined by tree shape, species and habit and described as Dominant, Codominant, Intermediate, Emergent, Forest and Suppressed, as well as Forest Form or Open Grown. May also be described qualitatively as Good Form or Poor Form.

Growth crack / split Longitudinal crack/split that may develop as a rupture in the bark from normal growth. Longitudinal crack/split that may develop in the trunk of some fast growing palms.

Habit The shape of a tree when its growth is unencumbered by constraints for space and light, e.g. idealized by an isolated field grown specimen with consideration of the species and the type of environment in which it evolved e.g. rainforest, open forest, etc.

Habitat A habitat is an ecological or environmental area that is inhabited by a particular species of animal, plant or other type of organism. It is the natural environment in which an organism lives, or the physical environment that

surrounds (influences and is utilised by) a species population. In restoration ecology of native plant communities or habitats, some invasive species create monotypic stands that replace and/or prevent other species, especially indigenous ones, from growing there.

Health (syn. vigour) refers to the tree's vigour as exhibited by the crown density, leaf colour, presence of epicormic shoots, ability to withstand disease invasion, and the degree of dieback.

Inclusion - the pattern of development at branch or stem junctions where bark is turned inward rather than pushed out. This fault is located at the point where the stems/branches meet. This is normally a genetic fault and potentially a weak point of attachment as the bark obstructs healthy tissue from joining together to strengthen the joint.

Indigenous Native to an area, and not introduced.

Impact Level Rating (ILR) refers to the estimated percentage of the Tree Protection Zone (TPZ) affected by development impacts. These figures may vary due to the specific conditions and constraints on a particular site, tree species tolerance to impacts, age, vigour, condition of the tree, etc.

IMPACT LEVEL RATING	
0	0 – 0.9% of root zone impacted – **no** impact of significance
L	1 to 10% of root zone impacted – **low** (minor) level of impact
L - M	>10 to 15% of root zone impacted – **low** (minor) **to moderate** level of impact
M	>15 to 20% of root zone impacted – **moderate** level of impact
M – H	>20 to 25% of root zone impacted – **moderate to high** level of impact
H	>25 to 35% of root zone impacted – **high** level of impact
S	>35% of root zone impacted – **significant** level of impact

Note: This is a general guide only. These figures may vary due to the specific conditions and constraints on a particular site, tree species tolerance to impacts, age, vigour, condition of the tree, etc.

Lopping Cutting between branch unions (not to branch collars), or at internodes on a tree, with the final cut leaving a stub. Lopping may result in dieback of the stub and can create infection courts for disease or pest attack.

Root Mapping The exploratory process of recording the location of roots usually in reference to a datum point where depth, root diameter, root orientation and distance from trunk to existing or proposed structures are measured. It may be slightly invasive (disturbs or displaces soil to locate but not damage roots, e.g. hand excavation, or use of air or water knife), or non-invasive (does not disturb soil, e.g. ground penetrating radar).

Scaffold branch/root A primary structural branch of the crown or primary structural root of the tree.

Structural Root Zone (SRZ) Refers to the radial distance in metres, measured from the centre of the tree stem, which defines the critical area required to maintain stability of the tree. Only thorough investigation into the location of structural roots within this area can identify whether any minor incursions into this protection zone are feasible. Note: The SRZ is calculated on the diameter measured immediately above the root/stem buttress (DAB). Where this measurement is not taken in the field, it is calculated by adding 12.5% to the stem diameter at breast height (DBH). Note: The SRZ may not be symmetrical in shape/area where there is existing obstruction or confinement to lateral root growth, e.g. structures such as walls, rocky outcrops, etc).

Snub-nosed rib Adaptive wood formed over a crack, included bark or enclosed bark and may be a round edged (snub-nosed) rib where a broad convex swelling is formed over the crack by the addition of new growth increments, and the cracking is slowed or prevented from developing further (Or, may be a sharp-edged rib as an elongated protuberance where a crack continues to develop).

Suppressed In crown class, trees which have been overtopped, whose crown development is restricted from above.

Sweep A curve in the trunk, generally near the ground. This usually occurs when a tree is partially wind thrown when young, but then stabilises itself and straightens due to reaction wood. Stem sweep can also be a naturally developed feature of some tree species. e.g. *Araucaria columnaris* (Cook Pine), that has no relationship to a defect or partial windthrow.

Tree Protection Zone (TPZ). Refers to the radial distance in metres, measured from the centre of the tree stem which defines the *tree protection zone* for a tree to be retained. This is generally the minimum distance from the center of the tree trunk where protective fencing or barriers are to be installed to create an exclusion zone. The **TPZ** surrounding a tree aids the tree's ability to cope with disturbances associated with construction works. Tree protection involves minimising root damage that is caused by activities such as construction. Tree protection also reduces the chance of a tree's decline in health or death and the possibly damage to structural stability of the tree from root damage.
To limit damage to the tree, protection within a specified distance of the tree's trunk must be maintained throughout the proposed development works. No excavation, stockpiling of building materials or the use of machinery is permitted within the TPZ. Note: In many circumstances the tree root zone does not occupy a symmetrically radial area from the trunk, but may be an irregular area due to the presence of obstructions to root spread or inhospitable growing conditions.

Tree Risk Assessment is the systematic process to identify, analyze, and evaluate tree risk. A tree risk rating of Low, Moderate, High or Extreme is derived by categorising or quantifying both the *likelihood* (probability) of tree or tree part(s) failure and impact on a target(s) and the severity of consequences of the impact on the target(s).

USEFUL LIFE EXPECTANCY (ULE) In a planning context, the time a tree can expect to be usefully retained is the most important long-term consideration. ULE i.e. a system designed to classify trees into a number of categories so that information regarding tree retention can be concisely communicated in a non-technical manner. ULE categories are easily verifiable by experienced personnel without great disparity. A tree's ULE category is the life expectancy of the tree modified first by its age, health, condition, safety and location (to give the life expectancy); then by economics (i.e. cost of maintenance - retaining trees at an excessive management cost is not normally acceptable); and finally, effects on better trees, and sustained amenity (i.e. establishing a range of age classes in a local population). ULE assessments are not static but may be modified as dictated by changes in tree health and environment. Trees with a short ULE may at present be making a contribution to the landscape, but their value to the local amenity will decrease rapidly towards the end of this period, prior to them being removed for safety or aesthetic reasons. For details of ULE categories see Appendix B, modified from Barrell 2001.

Vigour (syn. health) refers to the tree's health as exhibited by the crown density, leaf colour, presence of epicormic shoots, ability to withstand disease invasion, and the degree of dieback.

Woody roots usually used in reference to the first order roots i.e. structural (anchor) roots and woody lateral roots within the Structural Root Zone. Damage, disturbance to, or severing of these roots can compromise the stability of the tree.

APPENDIX B

TREE RETENTION VALUE ASSESSMENT

APPENDIX B—TREE RETENTION VALUE ASSESSMENT

Part 1 of 3—Useful Life Expectancy (ULE)

In a planning context, the time a tree can expect to be usefully retained is the most important long-term consideration. ULE i.e. a system designed to classify trees into a number of categories so that information regarding tree retention can be concisely communicated in a non-technical manner. ULE categories are easily verifiable by experienced personnel without great disparity.
A tree's ULE category is the life expectancy of the tree modified first by its age, health, condition, safety and location (to give the life expectancy); then by economics (i.e. cost of maintenance - retaining trees at an excessive management cost is not normally acceptable); and finally, effects on better trees, and sustained amenity (i.e. establishing a range of age classes in a local population). ULE assessments are not static but may be modified as dictated by changes in tree health and environment. Trees with a short ULE may at present be making a contribution to the landscape, but their value to the local amenity will decrease rapidly towards the end of this period, prior to them being removed for safety or aesthetic reasons.

ULE categories (modified from Barrell 2001) The five categories and their sub-groups are as follows:

1. Long ULE - tree appeared retainable at the time of assessment for over 40 years with an acceptable degree of risk, assuming reasonable maintenance:

A. structurally sound trees located in positions that can accommodate future growth
B. trees which could be made suitable for long term retention by remedial care
C. trees of special significance which would warrant extraordinary efforts to secure their long term retention

2. Medium ULE - tree appeared to be retainable at the time of assessment for 15 to 40 years with an acceptable degree of risk, assuming reasonable maintenance:

A. trees which may only live from 15 to 40 years
B. trees which may live for more than 40 years but would be removed for safety or nuisance reasons
C. trees which may live for more than 15 years but would be removed to prevent interference with more suitable individuals or to provide space for new planting
D. trees which could be made suitable for retention in the medium term by remedial care

3. Short ULE - tree appeared to be retainable at the time of assessment for 5 to 15 years with an acceptable degree of risk, assuming reasonable maintenance:

A. trees which may only live from 5 to 15 years
B. trees which may live for more than 15 years but would be removed for safety or nuisance reasons
C. trees which may live for more than 15 years but would be removed to prevent interference with more suitable individuals or to provide space for new planting
D. trees which require substantial remediation and are only suitable for retention in the short term

4. Removal - trees which should be removed within the next 5 years.

A. dead, dying, suppressed or declining trees because of disease or inhospitable conditions.
B. dangerous trees through instability or recent loss of adjacent trees
C. dangerous trees because of structural defects including cavities, decay, included bark, wounds or poor form.
D. damaged trees that are clearly not safe to retain.
E. trees which may live for more than 5 years but would be removed to prevent interference with more suitable individuals or to provide space for new planting.
F. trees which are damaging or may cause damage to existing structures within the next 5 years.
G. trees that will become dangerous after removal of other trees for the reasons given in (a) to (f).
H. trees in categories (a) to (g) that have a high wildlife habitat value and, with appropriate treatment, could be retained subject to regular review.

5. Small, young or regularly pruned - Trees that can be reliably moved or replaced.

A. small trees less than 5m in height.
B. young trees less than 15 years old but over 5m in height.
C. formal hedges and trees intended for regular pruning to artificially control growth

Part 2 of 3—IACA Significance of a Tree, Assessment Rating System (STARS)©

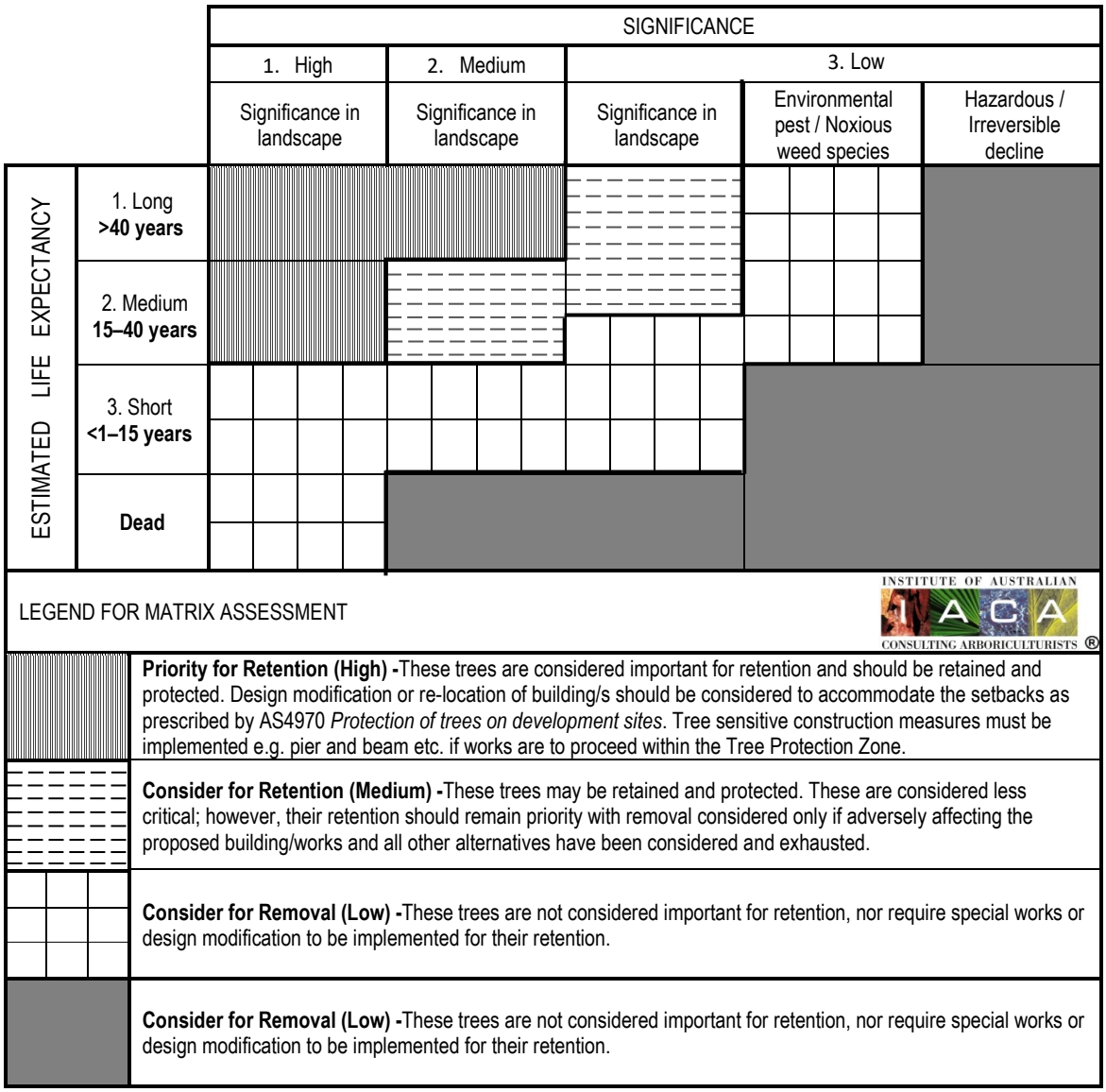
The landscape significance of a tree is an essential criterion to establish the importance that a particular tree may have on a site. However, rating the significance of a tree becomes subjective and difficult to ascertain in a consistent and repetitive fashion due to assessor bias. It is therefore necessary 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.
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 a form typical or atypical for the species
The tree is a planted locally indigenous or a common species with its taxa commonly planted in the 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 and/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 a form atypical for 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.
The assessment criteria are for individual trees only, however, can be applied to a monocultural stand in its entirety e.g. hedge.
In the development of this document IACA acknowledges the contribution and original concept of the Tree Significance & Retention Value Matrix, developed by Footprint Green Pty Ltd and Andrew Morton in June 2001.

Part 3 of 3—Tree Retention Value Priority Matrix



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REFERENCES

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

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 C

TREE PROTECTION DEVICES

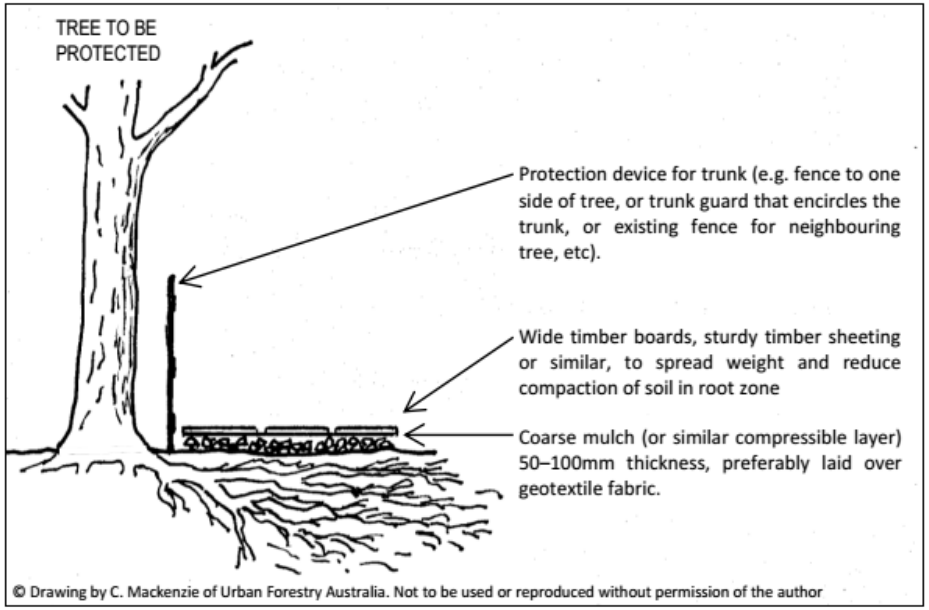


Figure 1
A method of reducing risk of root damage and soil compaction within the tree's Structural Root Zone.

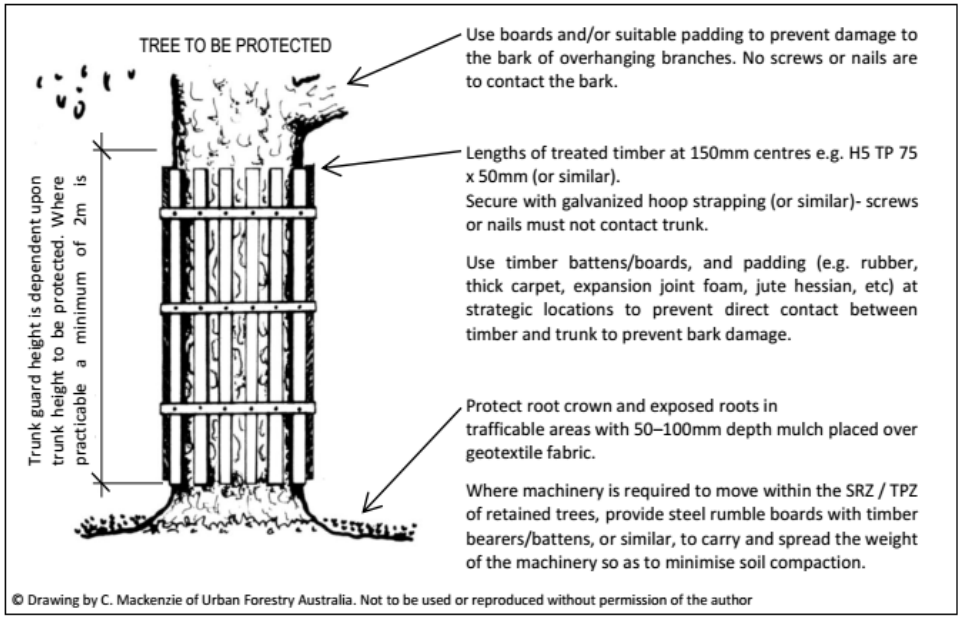


Figure 2
Example of tree trunk and tree branch protection.

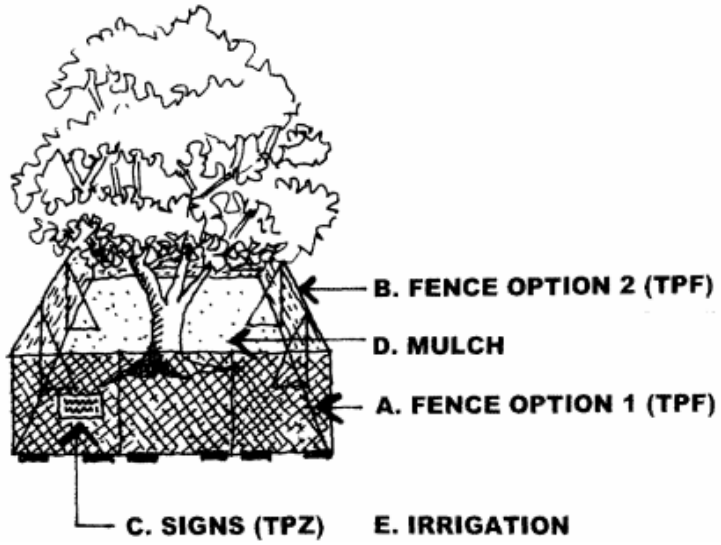
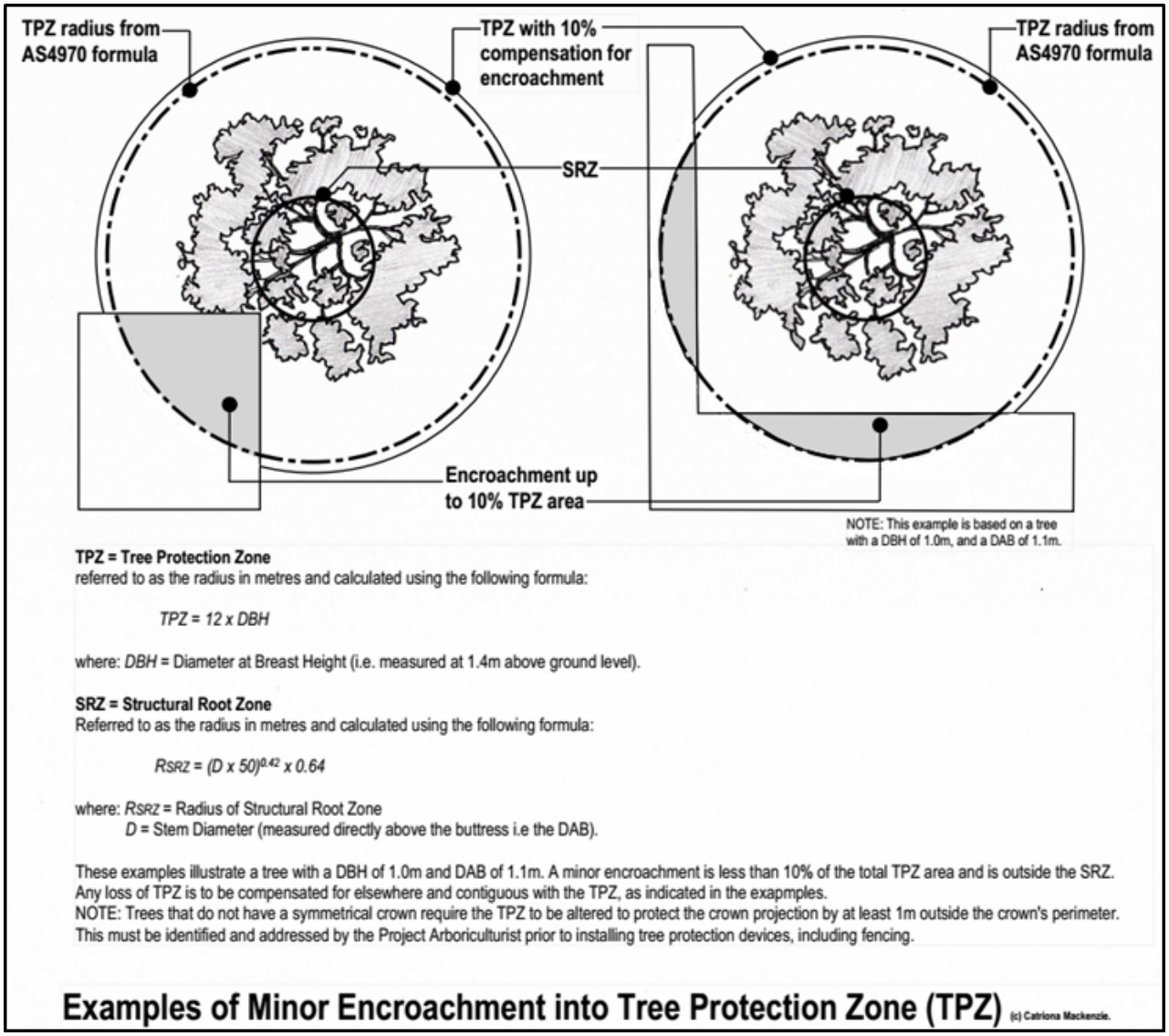


Figure 3
TREE PROTECTIVE FENCING (TPF)
A. Fence Option 1 (TPF)
1.8 metre high chain wire mesh panels with shade cloth attached if required, to be held in place with concrete blocks.
B. Fence Option 2 (TPF)
1.8 metre high plywood or wooden panel/paling fence (prevents soil or building contaminants from coming under fence when panels are laid flush to ground).
C. Signs (TPZ)
Tree Protection Zone Signs
D. Mulch
50mm to 100mm thick layer of organic mulch, or aggregate, installed across surface area of TPZ.
E. Irrigation
Irrigation to arborist's advice.
© Drawing by Selena Hannan. Used with permission.

TREE PROTECTION ZONE SIGNAGE

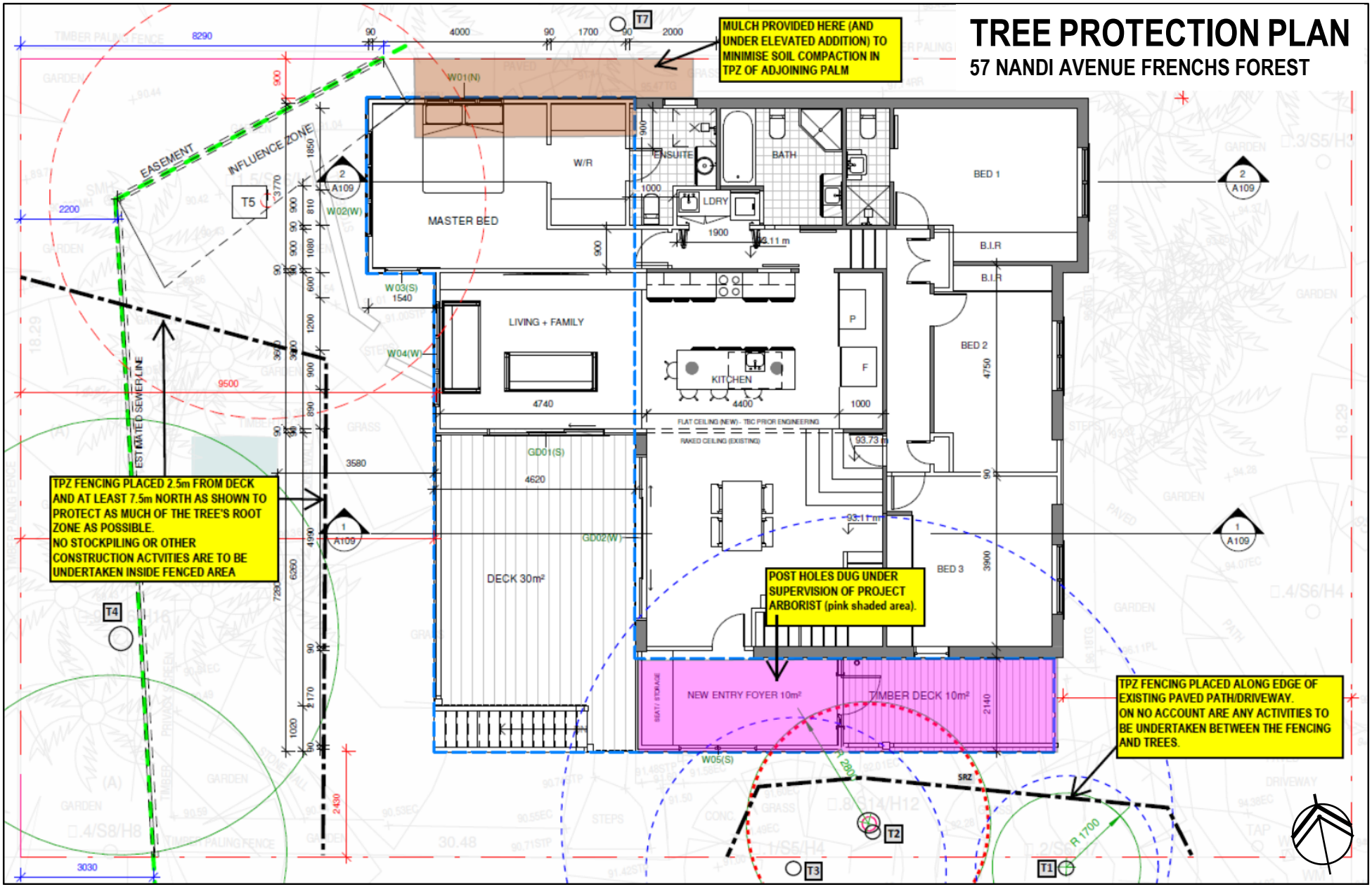
Size: Approximate dimensions 225 x 300mm.
Material: Polypropylene or colourbond steel.



Include the Project Arboriculturist's details in the 'Contact' panel.

APPENDIX D

TREE PROTECTION PLAN


TREE PROTECTION PLAN
57 NANDI AVENUE FRENCHS FOREST
MULCH PROVIDED HERE (AND UNDER ELEVATED ADDITION) TO MINIMISE SOIL COMPACTION IN TPZ OF ADJOINING PALM
TPZ FENCING PLACED 2.5m FROM DECK AND AT LEAST 7.5m NORTH AS SHOWN TO PROTECT AS MUCH OF THE TREE'S ROOT ZONE AS POSSIBLE.
NO STOCKPILING OR OTHER CONSTRUCTION ACTVITIES ARE TO BE UNDERTAKEN INSIDE FENCED AREA
POST HOLES DUG UNDER SUPERVISION OF PROJECT ARBORIST (pink shaded area).
TPZ FENCING PLACED ALONG EDGE OF EXISTING PAVED PATH/DRIVEWAY.
ON NO ACCOUNT ARE ANY ACTIVITIES TO BE UNDERTAKEN BETWEEN THE FENCING AND TREES.
EASEMENT
INFLUENCE ZONE
EST MAINS SEWER LINE
MASTER BED
W/R
ENSUITE
BATH
LDRY
BED 1
B.I.R
B.I.R
LIVING + FAMILY
KITCHEN
BED 2
BED 3
DECK 30m²
NEW ENTRY FOYER 10m²
TIMBER DECK 10m²
SEAT/ STORAGE
T1
T2
T3
T4
T5
T7
SRZ
R 2600
R 1700

APPENDIX E

SCHEDULE OF ASSESSED TREES

Schedule of Assessed Trees—57 Nandi Road, Frenchs Forest—20 July 2019

Tree No.	*Genus & species* **Common Name**	Ht (m)	Sp (m)	DBH (mm)	Age	V	C	Comments	ULE	TSR	RV	SRZ (m)	TPZ (m)	TP-Z (area)
1	*Ginkgo biloba* **Maidenhair Tree**	8	6	*175	SM	G	F?	Neighbour's tree. Introduced exotic species. Small tree with poor branch development; acute angle inclusion, crossing branches.	2D?	M	L	1.7	2.1	14.0
2	*Eucalyptus robusta* **Swamp Mahogany**	21-22	12	375 + 450 (575)	M	G	F	Locally indigenous species. Codominant stems @ 600 AGL. Large, heavy chain embedded in junction. Tre has fully occluded this area. Long deadwood to 100mm Ø. Pavement <1m N of base.	2D	H	H	2.8	7.0	152.0
3	*Syagrus romanzoffianum* **Cocos Palm**	6	5	*200	SM	G	G	Neighbour's tree. Introduced exotic palm species. Crown caught up with T2.	2B	L	L	NA	3.5	38.5
4	*Eucalyptus botryoides* **Bangalay**	26	14 Av.	900	LM	G	G?	Locally indigenous species. Deadwood to 50mm Ø over open space. Bamboo and vegetation obscuring detailed inspection. Minor tip dieback to S & E.	2D?	H	H?	3.2	10.8	366.0
5	*Eucalyptus robusta* **Swamp Mahogany**	26	14 Av.	1050	LM	F-G	F-P	Locally indigenous species. Excessively pruned to N. Large, old tree with fruiting fungal bracket and extensive, longitudinal wound W side. Past crown dieback. Deadwood to 100+mm Ø. Decline of crown's structural architecture.	3-4	H	L	3.4	12.6	499.0
6	*Radermachera sinica* **China Doll**	13	6	350 DGL (300)	M	G	G	Introduced exotic species. Typical habit and form. Approx. 1.5m from dwelling and exempt from protection under Council controls. https://www.northernbeaches.nsw.gov.au/planning-development/tree-management/private-land	2D	M	L	2.2	3.6	41.0
7	*Syagrus romanzoffianum* **Cocos Palm**	13	6	*250	M	G	G?	Neighbour's tree. Introduced exotic palm species. No special problems observed at time of inspection.	2B	M	L	NA	4.0	50.0

KEY

Prescribed trees to be retained

Prescribed trees proposed to be removed.

Non-prescribed trees exempt from preservation controls under Pittwater DCP and may be removed without authority approval (unless specifically identified for retention in any development consent).

L	LOW Retention Value-These trees are not considered important for retention.	M	MEDIUM Retention Value-These trees may be retained and protected.	H	HIGH Retention Value -These trees are considered important for retention and should be retained and protected.

DETAILS FOR HEADINGS AND SYMBOLS USED IN TREE SCHEDULE

***** Denotes situations where the tree's Diameter at Breast Height (DBH) has been *visually* estimated (usually adjoining trees or those that are difficult to access and/or physically measure).

( ) The numerical figure in parentheses is the calculated DBH for a multiple stemmed tree, using the AS4970 formula, *or,* is the calculated DBH where the measurement cannot be made at the standard 1.4m above ground level, e.g. where the diameter of the stem is measured at ground level (DGL) or above the buttress (DAB). All calculated figures are rounded up to the nearest 25mm to determine the tree's TPZ offsets.

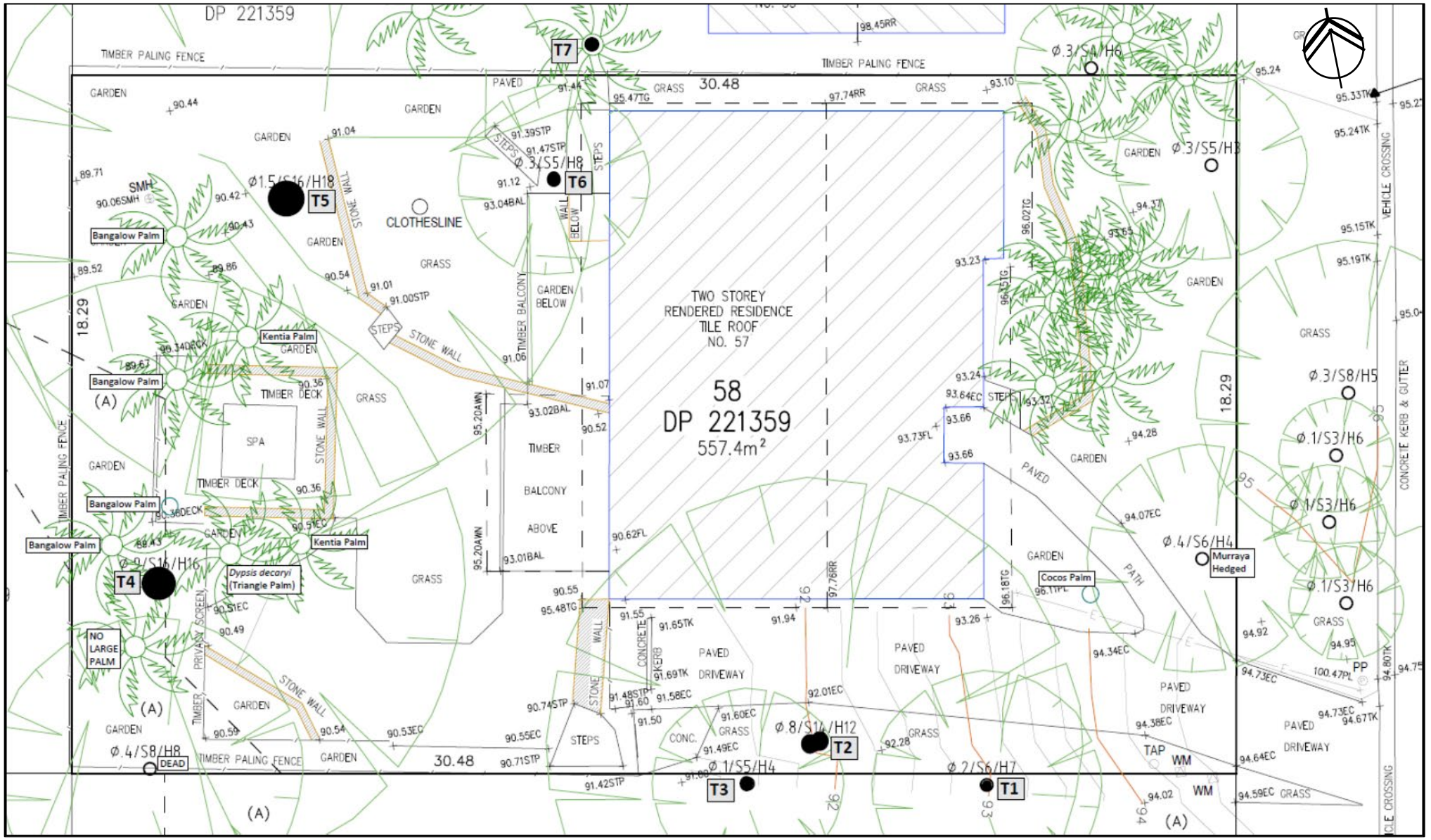
NOTE: According to clause 3.2 of AS4970, the TPZ of palms, other monocots, cycads and tree ferns should not be less than 1m outside the crown projection. The Tree Protection Zone is not based on the palm's trunk diameter. The AS4970 formula for calculating the SRZ of a tree does not apply to palms, other monocots, cycads and tree ferns.

DAB—The trunk/stem diameter measured *above the buttress* (i.e. root and trunk confluence), using a diameter tape
DGL—The trunk/stem diameter measured *at ground level*, using a diameter tape.
AGL—*above* ground level.
GL—*at* ground level.
? —a tentative result due to inspection limitations, e.g. limited visual access to an adjoining tree, very dense vegetation obscuring tree parts or preventing visual access, or a tree that requires more detailed assessment, such as an aerial inspection, decay diagnostic tests, pathology tests, etc.
sp. indet. = species indeterminate (not determined).

H refers to the approximate height of a tree in metres, from base of stem to top of tree crown.
Sp refers to the approximate and/or average diameter spread in metres of branches/canopy (the 'crown') of a tree.
DBH refers to the approximate diameter of tree stem at breast height i.e. 1.4 metres above ground (unless otherwise noted) and expressed in millimetres.
Age refer to Appendix A -Terms and Definitions for more detail.
V refers to the tree's vigour (health) Refer to Appendix A -Terms and Definitions for more detail.
C refers to the tree's structural condition. Refer to Appendix A -Terms and Definitions for more detail.
ULE refers to the estimated *Useful Life Expectancy* of a tree. Refer to Appendices A and B for details.
TSR The *Tree Significance Rating* considers the importance of the tree as a result of its prominence in the landscape and its amenity value, from the point of public benefit. Refer to Appendix B – Significance of a Tree Assessment Rating for more detail.
RV Refers to the retention value of a tree, based on the tree's ULE *and* Tree Significance. Refer to Appendix B – Significance of a Tree Assessment Rating for more detail.
SRZ Structural Root Zone (SRZ) refers to the critical area required to maintain stability of the tree. Refer to Appendix A -Terms and Definitions for more detail.
TPZ Tree Protection Zone (TPZ) refers to the *tree protection zones* for trees to be retained. Refer to Appendix A -Terms and Definitions for more detail.
TPZ area the calculated area within the TPZ radius.
ILR Impact Level rating. Refer to Appendix A -Terms and Definitions for more detail.

APPENDIX G

TREE LOCATION PLAN



TREE LOCATION PLAN Not to scale (Excerpt of site survey by Total Surveying Solutions, marked up by C. Mackenzie)