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Arboricultural Impact Assessment Report

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1. INTRODUCTION

- 1.1 This report has been commissioned by the client and landowners T&D Cvijetic to provide an Arboricultural Impact Assessment Report for trees located on and adjoining the site that may be impacted by a proposed development.
- 1.2 One site inspection was carried out on 20th April 2022 to collect tree data. The weather at the time of the assessments was clear with average visibility.

Table 1: documents provided for the assessment.

Title	Author	Date	Reference on document
Site Survey	SCS	20/4/2021	13059-DET-01
Architectural Plans	ArtyCad	4/2/2022	2114/A-01 Rev B
Stormwater Concept Plan	ArtyCad	4/2/2022	2114/SW01 Rev B

2. SCOPE OF THE REPORT

- 2.1 **This report has been undertaken to meet the following objectives.**
 - 2.1.1 Conduct a visual assessment from ground level of trees located on and adjoining the site within five metres of the development works.
 - 2.1.2 For the purpose of this report, a 'tree' is taken to have height greater than 5 metres.
 - 2.1.3 Determine the trees estimated contribution years and remaining, useful life expectancy and award the trees a retention value.
 - 2.1.4 Provide an assessment of the potential impact the proposed development is likely to cause to the condition of the subject trees in accordance with AS4970 Protection of trees on development sites (2009).
 - 2.1.5 Provide pragmatic recommendations for the management of trees and mitigation of construction impacts on retained trees.
 - 2.1.6 Specify tree protection measures for trees to be retained in accordance with AS 4970-2009.

3. LIMITATIONS

- 3.1 The findings of this report are based on the observations and site conditions at the time of inspection.
- 3.2 Where access was limited, measurements have been estimated.
- 3.3 All of the observations were carried out from ground level. The accuracy of the assessment of the subject trees structural condition and health is limited to the visibility of the tree at the time of inspection.
- 3.4 The tree inspections were visual from ground level only. No soil or tissue testing was carried out as part of the tree inspection. None of the surrounding surfaces adjacent to trees were lifted or removed during the tree inspections.
- 3.5 Root decay can sometimes be present with no visual indication above ground. It is also impossible to know the extent of any root damage caused by mechanical damage such as underground root cutting during the installation of services without undertaking detailed root investigation. Any form of tree failure due to these activities is beyond the scope of this assessment.
- 3.6 The report reflects the subject tree(s) as found on the day of inspection. Any changes to the growing environment of the subject tree, or tree management works beyond those recommended in this report may alter the findings of the report. There is no warranty, expressed or implied, that problems or deficiencies relating to the subject tree, or subject site may not arise in the future.
- 3.7 Tree identification is based on accessible visual characteristics at the time of inspection. As key identifying features are not always available the accuracy of identification is not guaranteed. Where tree species is unknown, it is indicated with a spp.
- 3.8 All diagrams, plans and photographs included in this report are visual aids only and are not to scale unless otherwise indicated.
- 3.9 Hugh The Arborist neither guarantees, nor is responsible for, the accuracy of information provided by others that is contained within this report.
- 3.10 While an assessment of the subject trees estimated useful life expectancy is included in this report, no specific tree risk assessment has been undertaken for any of trees at the site.
- 3.11 The ultimate safety of any tree cannot be categorically guaranteed. Even trees apparently free of defects can collapse or partially collapse in extreme weather conditions. Trees are dynamic, biological entities subject to changes in their environment, the presence of pathogens and the effects of ageing. These factors reinforce the need for regular inspections. It is generally accepted that hazards can only be identified from distinct defects or from other failure-prone characteristics of a tree or its locality.

3.12 Alteration of this report invalidates the entire report.

4. METHODOLOGY

4.1 The following information was collected during the assessment of the subject tree(s).

4.1.1 Tree common name

4.1.2 Tree botanical name

4.1.3 Tree age class

4.1.4 DBH (Trunk/Stem diameter at breast height/1.4m above ground level) - millimetres.

4.1.5 Estimated height - metres.

4.1.6 Estimated crown spread (Radius of crown) - metres.

4.1.7 Health

4.1.8 Structural condition

4.1.9 Amenity value

4.1.10 Estimated remaining contribution years (SULE)¹

4.1.11 Retention value (Tree AZ)²

4.1.12 Notes/comments

4.2 An assessment of the trees condition was made using the visual tree assessment (VTA) model (Mattheck & Breloer, 1994).³

4.3 Tree diameter was measured using a DBH tape or in some cases estimated. All other measurements were estimations unless otherwise stated. The other tools used during the assessment were an iPhone camera, Japanese made 170mm blade digging knife and a Leica DistoD410 digital laser tape.

4.4 All DBH measurements, tree protection zones, and structural root zones were calculated in accordance with methods set out in AS4970 Protection of trees on development sites (2009). See appendices for more information.

4.5 Details of how the observations in this report have been assessed are listed in the appendices.

¹ Barrell Tree Consultancy, *SULE: Its use and status into the New Millennium*, TreeAZ/03/2001, <http://www.treeaz.com/>.

² Barrell Tree Consultancy, *Tree AZ version 10.10-ANZ*, <http://www.treeaz.com/>.

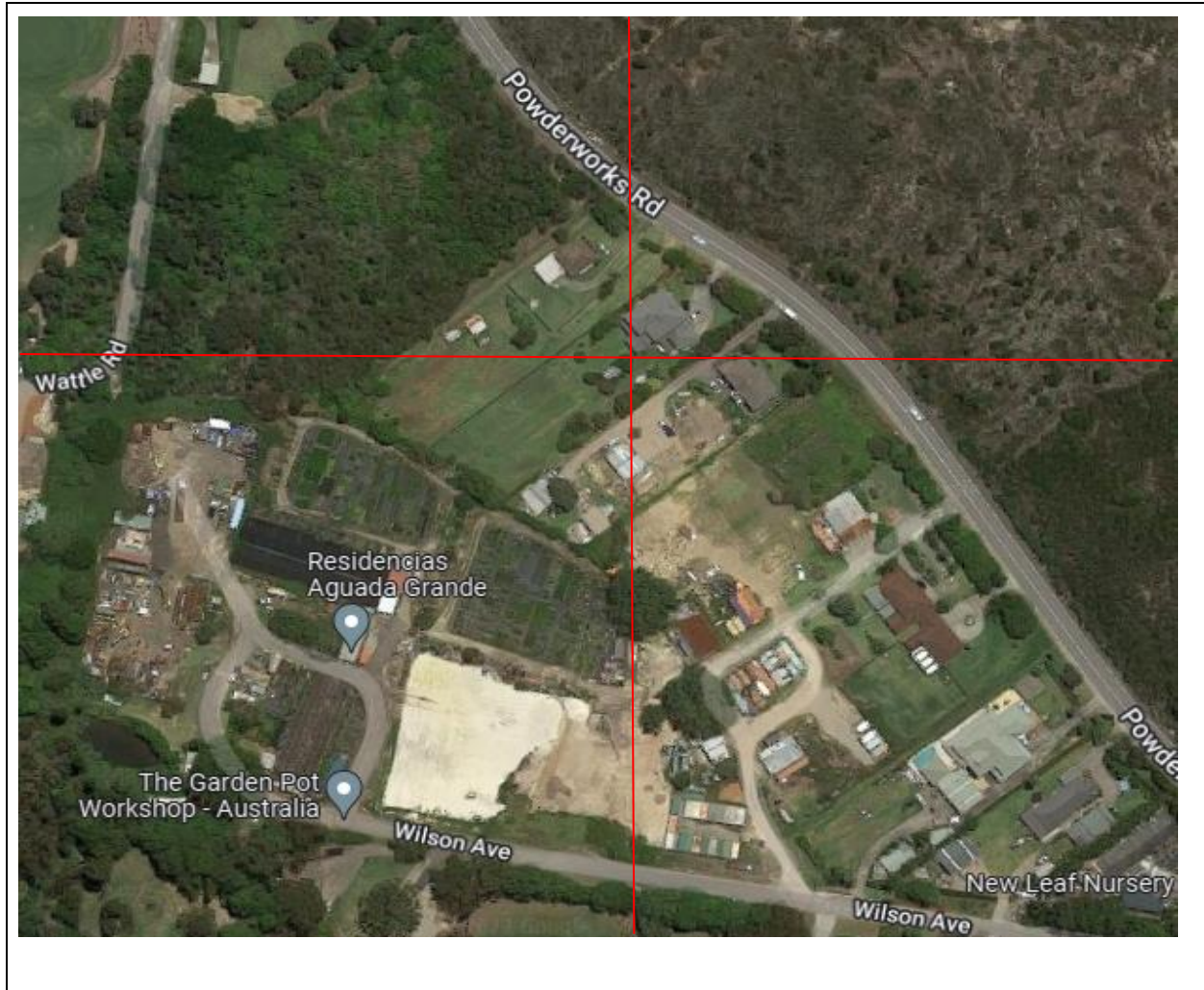
³ Mattheck, C. & Breloer, H., *The body language of trees - A handbook for failure analysis*, The Stationary Office, London, England (1994).

5. SITE LOCATION AND BRIEF DESCRIPTION OF THE PROPOSAL

- 5.1 The site is located in the in the Northern Beaches Council suburb of Ingleside. All trees at the site are managed under the following policy and legislation.
 - 5.1.1 Pittwater Local Environmental Plan (LEP) 2014
 - 5.1.2 Pittwater 21 Development Control Plan (DCP) 2014
 - 5.1.3 State Environmental Planning Policy (Vegetation in Non-Rural Areas 2017).
 - 5.1.4 Northern Beaches Tree Management Controls
- 5.2 The site is orientated north east (front) to south west (rear). The site falls slightly approximately north south and appeared to have poor drainage at the time of the assessment. The site is a long block with the residential structures situated to the front of the site. The tree population on site consists of mainly small trees of native and exotic origin.
- 5.3 The proposed works consist of alterations and additions to the existing garage area and installation of drainage.
- 5.4 The site has not been identified as within a heritage conservation area or been identified as within an area containing high levels of biodiversity.⁴

⁴ <https://eservices.northernbeaches.nsw.gov.au/ePlanning/live/Public/XC.Track/SearchProperty.aspx>

Tile 1: Site Location ⁵



⁵ <https://www.google.com/maps/place/240+Powderworks+Rd,+Ingleside+NSW+2101>

6. OBSERVATIONS AND GENERAL INFORMATION IN RELATION TO PROTECTING TREES ON DEVELOPMENT SITES

- 6.1 **Tree information:** Details of each individual tree assessed, including the observations taken during the site inspection, can be found in the tree inspection schedule in appendix 2, where the indicative tree protection zone (TPZ) and Structural Root Zone (SRZ) has been calculated for each of the subject trees. The TPZ and SRZ should be measured in radius from the centre of the trunk. Each of the subject trees have been awarded a retention value based on the observations using the Tree AZ method. Tree AZ is used to identify higher value trees worthy of being a constraint to development and lower value trees that should generally not be a constraint to the development. The Tree AZ categories sheet (Barrell Tree Consultancy) has been included in appendix 3 to assist with understanding the retention values. The retention value that has been allocated to the subject trees in this report is not definitive and should only be used as a guideline.
- 6.2 **Site plan:** Appendix 1 contains a site plan showing the proposal, subject trees locations and tree protection advice where required. Information including canopy spread, TPZ and SRZ have been overlaid on both plans.
- 6.3 **Tree protection zone (TPZ):** The TPZ is the principle means of protecting trees on development sites and is an area required to maintain the viability of trees during development. It is commonly observed that tree roots will extend significantly further than the indicative TPZ, however the TPZ is an area identified in AS4970-2009 to be the area where root loss or disturbance will generally impact the viability of the tree. The TPZ is identified as a restricted area to prevent damage to trees either above or below ground during a development. Where trees are intended to be retained proposed developments must provide an adequate TPZ around trees. The TPZ is set aside for the tree's root zone, trunk and crown and it is essential for the stability and longevity of the tree. The TPZ also incorporates the SRZ (see below for more information about the SRZ). The TPZ is calculated by multiplying the DBH by twelve, with the exception of palms, other monocots, cycads, and tree ferns, the TPZ of which have been calculated at one metre outside the crown projection.

- 6.4 **Structural Root Zone (SRZ):** This is the area around the base of a tree required for the tree's stability in the ground. An area larger than the SRZ always needs to be maintained to preserve a viable tree. The SRZ is calculated using the following formula: $(DAB \times 50)^{0.42} \times 0.64$. There are several factors that can vary the SRZ which include height, crown area, soil type and soil moisture. It can also be influenced by other factors such as natural or built structures. Generally, work within the SRZ should be avoided. Soil level changes should also generally be avoided inside the SRZ of trees to be retained. Palms, other monocots, cycads, and tree ferns do not have an SRZ.
- 6.5 **Minor encroachment into TPZ:** Sometimes encroachment into the TPZ is unavoidable. Encroachment includes but is not limited to activities such as excavation, compacted fill, and machine trenching. Minor encroachment of up to 10% of the overall TPZ area is normally considered acceptable, providing there is space adjacent to the TPZ for the tree to compensate and the tree is displaying adequate vigour/health to tolerate changes to its growing environment.
- 6.6 **Major encroachment into TPZ:** Where encroachment of more than 10% of the overall TPZ area is proposed the project Arborist must investigate and demonstrate that the tree will remain in a viable condition. In some cases, tree sensitive construction methods such as pier and beam footings, suspended slabs, or cantilevered sections, can be utilised to allow additional encroachment into the TPZ by bridging over roots and minimising root disturbance. Major encroachment is only possible if it can be undertaken without severing significant size roots, or if it can be demonstrated that significant roots will not be impacted. Root investigations may be required to identify roots that will be impacted during major TPZ encroachment.

7. ASSESSEMENT OF CONSTRUCTION IMPACTS

7.1 **Table 2:** In the table below the impact of proposed development impact to all trees included in the report has been assessed.

Tree ID	Species	Retention value	TPZ radius (m)	SRZ radius (m)	TPZ encroachment	Discussion/ Conclusion	Recommendation
1	Willow Bottlebrush	A1	6.0	2.6	None	No encroachment proposed.	Retain and protect
2	Brush Cherry	A1	2.2	1.7	None	No encroachment proposed.	Retain and protect
3	Brush Cherry	A1	4.3	2.4	None	No encroachment proposed.	Retain and protect
4	Brush Cherry	A1	3.8	2.5	None	No encroachment proposed.	Retain and protect
5	Coastal Banksia	A1	4.2	2.2	None	No encroachment proposed.	Retain and protect
6	Old Man Banksia	A1	3.7	2.3	None	No encroachment proposed.	Retain and protect
7	Blueberry Ash	A1	2.8	2.2	None	No encroachment proposed.	Retain and protect
8	Old Man Banksia	A2	2.7	2.6	Major	The proposed driveway extension will encroach into the Tree Protection Zone and the Structural Root Zone by 7%. The encroachment is considered major under AS4970 Protection of Trees on Development Sites (2009) due to the encroachment into the SRZ area only. In the event tree roots are pruned to allow for the driveway footing the impact is unlikely to have a negative effect on the health of the tree. Tree 8 holds a height of 6 metres and is under suppressed growth between trees either side providing it protection adverse weather, the pruning of tree roots within the fringe of the SRZ area is not likely to cause the tree to become unstable.	Retain and protect



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Tree ID	Species	Retention value	TPZ radius (m)	SRZ radius (m)	TPZ encroachment	Discussion/ Conclusion	Recommendation
9	Lilly Pilly	A2	2.6	2.3	Major	The proposed driveway extension will encroach into the Tree Protection Zone and the Structural Root Zone by 13%. The encroachment is considered major under AS4970 Protection of Trees on Development Sites (2009). In the event tree roots are pruned to allow for the driveway footing the impact is unlikely to have a negative effect on the health of the tree. Tree 9 holds a height of 5 metres and has protection from surrounding vegetation that will be retained. The tree is not considered to be highly susceptible to destabilization as a result of the pruning of tree roots within the fringe of the SRZ area.	Retain and protect
10	Coastal Tea Tree	A2	2.0	2.1	None	No encroachment proposed.	Retain and protect
G1	Mixed Species	Z1	2.0	1.5	Major	Group 1 consists of several Citrus trees and one Murraya shrub. The trees are listed as exempt from protection in Northern Beaches and are also below the threshold for protection. The group is recommended to be removed as part of the development as individual trees within the group may be removed by the landowner as part of the development works.	Remove
11	Umbrella Tree	Z1	2.0	1.5	Minor	The proposed stormwater pipe will encroach into the TPZ area by less than 10% which is of low impact.	Retain and protect
12	Umbrella Tree	Z1	2.0	1.5	None	No encroachment proposed.	Retain and protect
13	Southern Magnolia	Z1	2.0	1.5	None	No encroachment proposed.	Retain and protect
14	Prunus Spp.	Z1	2.0	1.5	None	No encroachment proposed.	Retain and protect
15	Nyssa	Z1	2.0	1.5	Minor	The proposed stormwater pipe will encroach into the TPZ area by less than 10% which is of low impact.	Retain and protect



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Tree ID	Species	Retention value	TPZ radius (m)	SRZ radius (m)	TPZ encroachment	Discussion/ Conclusion	Recommendation
16	Tea tree	Z1	2.4	1.8	Major	The proposed stormwater pipe will transect through 40% of the Tree Protection Zone and the Structural Root Zone. The tree is likely to decline in health as a result.	Remove
17	Lilly Pilly	A2	2.0	1.7	None	No encroachment proposed.	Retain and protect
18	Lilly Pilly	A2	2.0	2.1	None	No encroachment proposed.	Retain and protect
19	Weeping Bottlebrush	A1	3.0	2.1	None	No encroachment proposed.	Retain and protect
G2	Bangalow Palm	Z3	4.0	NA	None	Group of six exempt Palm species. No encroachment proposed.	Retain and protect
20	Snow In Summer	Z1	5.0	1.6	None	No encroachment proposed.	Retain and protect

8. CONCLUSIONS

8.1 **Table 3:** Summary of the impact to trees during the development.

Impact	Reason	Category		
		AA1	A	Z
Trees to be removed	Building/landscape construction, new surfacing and/or proximity, or trees in poor condition.	None	None	G1,16 One Tree One Group
Retained trees subject to TPZ encroachment	Removal of existing surfacing/structures and/or installation of new surfacing/structures will not significantly impact the tree	None	8,9 Two Trees	11,15 Two trees
Retained trees subject to no TPZ encroachment	Located outside of the construction area	None	1,2,3,4,5,6,7, 10,17,18,19 Eleven Trees	12,13,14, G2,20 Four Trees One Group

9. PHOTOGRAPHS



Photo A: The proposed works will only impact low value trees such as Group 1 shown above. The higher value trees are located at the front of the site and outside of the proposed development area.

10. RECOMMENDATIONS

- 10.1 This report assesses the impact of a proposed development at the site on twenty individual trees located on and two groups of trees in accordance with AS4970 Protection of Trees on Development Sites (2009).
- 10.2 The proposed works will require one tree and one group of trees to be removed. Both T16 and Group 1 are assessed as category Z trees and are exempt from protection in Northern Beaches LGA.
- 10.3 A further four trees will be subject to tolerable levels of impact from the proposed works. Two trees are assessed as category A trees and two are category Z trees.
- 10.4 The remaining fifteen trees and Group 2 will be retained with no encroachment from the proposed works.
- 10.5 All retained trees are recommended to be protected in accordance with AS4970 Protection of Trees on Development Sites 2009 and appendix 1A of this report.
- 10.6 All underground services located inside the TPZ of any tree to be retained must be installed via tree sensitive techniques. This should include either directional drilling methods or manual excavations to minimise the impact to trees identified for retention.
- 10.7 This report does not provide approval for tree removal or pruning works. All recommendations in this report are subject to approval by the relevant authorities and/or tree owners. This report should be submitted as supporting evidence with any tree removal/pruning or development application.

11. ARBORICULTURAL WORK METHOD STATEMENT (AMS) AND TREE PROTECTION REQUIREMENTS

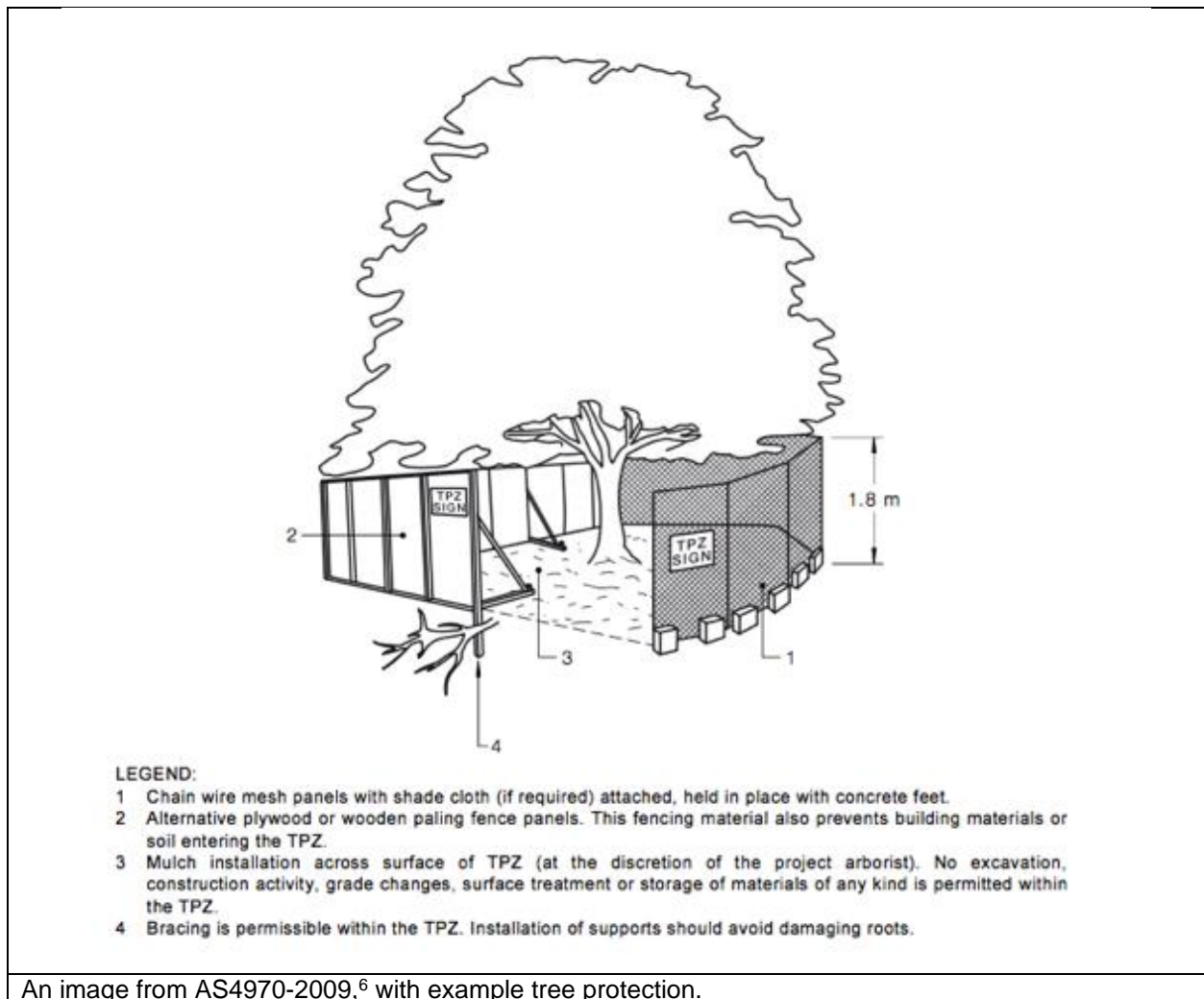
- 11.1 Use of this report:** All contractors must be made aware of the tree protection requirements prior to commencing works at the site and be provided with a copy of this report.
- 11.2 Project Arborist:** Prior to any works commencing at the site a project Arborist should be appointed. The project Arborist should be qualified to a minimum AQF level 5 and/or equivalent qualifications and experience and should assist with any development issues relating to trees that may arise. If at any time it is not feasible to carryout works in accordance with this, an alternative must be agreed in writing with the project Arborist.
- 11.3 Tree work:** All tree work must be carried out by a qualified and experienced Arborist with a minimum of AQF level 3 in arboriculture, in accordance with NSW Work Cover Code of Practice for the Amenity Tree Industry (1998) and AS4373 Pruning of amenity trees (2007).
- 11.4 Initial site meeting/on-going regular inspections:** The project Arborist is to hold a pre-construction site meeting with principal contractor to discuss methods and importance of tree protection measures and resolve any issues in relation to tree protection that may arise. In accordance with AS4970-2009, the project Arborist should carryout regular site inspections to ensure works are carried out in accordance with this document throughout the development process. I recommend regular site inspections on a frequency based on the longevity of the project; this is to be agreed in the initial meeting.

11.5 Table 4: Site Specific Tree Protection Recommendations

Tree Number	Protection specification
1 through 10 inclusive	- Ground protection.
Group 1	- Proposed removals.
11 and 12	- Existing garden boarder will provide protection.
13, 14, 15	- Star pickets and coloured tape to create visual barrier.
16	- Proposed removal.
17,18, 19	- Trees are located in a low trough on the boundary and are sufficiently isolated from and construction traffic.
Group 2	- No protection recommended.
20	- Star pickets and coloured tape to create visual barrier.

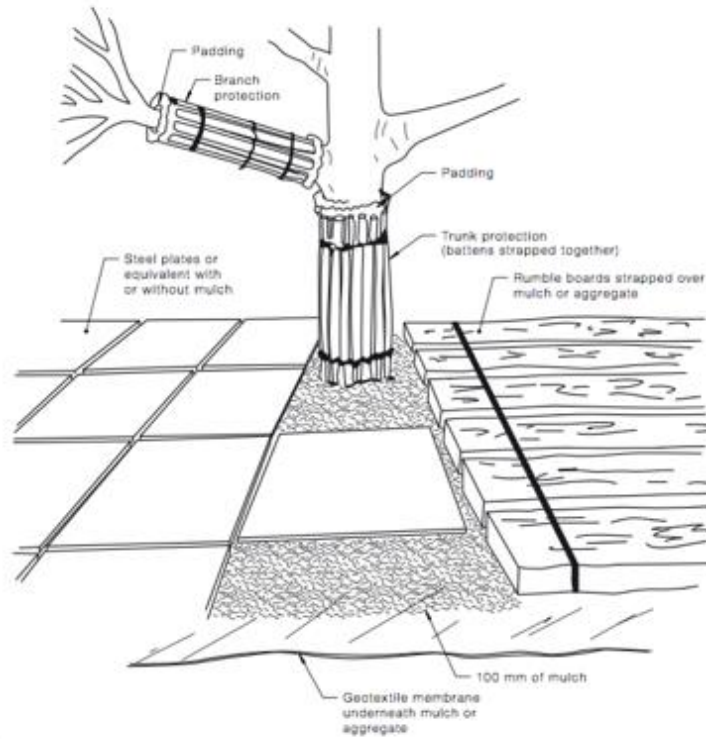
- 11.6 Tree protection Specifications:** It is the responsibility of the principal contractor to install tree protection prior to works commencing at the site (prior to demolition works) and to ensure that the tree protection remains in adequate condition for the duration of the development. The tree protection must not be moved without prior agreement of the project Arborist. The project Arborist must inspect that the tree protection has been installed in accordance with this document and AS4970-2009 prior to works commencing.
- 11.7 Protective fencing:** Where it is not feasible to install fencing at the specified location due to factors such as restricting access to areas of the site or for constructing new structures, an alternative location and protection specification must be agreed with the project Arborist. Where the installation of fencing is unfeasible due to restrictions on space, trunk and branch protection will be required (see below). The protective fencing must be constructed of 1.8 metre 'cyclone chainmesh fence'. The fencing must only be removed for the landscaping phase and must be authorised by the project Arborist. Any modifications to the fencing locations must be approved by the project Arborist.
- 11.8 TPZ signage:** Tree protection signage is to be attached to the protective fencing, displayed in a prominent position and the sign repeated at 10 metres intervals or closer where the fence changes direction. Each sign shall contain in a clearly legible form, the following information:
- Tree protection zone/No access.
 - This fence has been installed to prevent damage to the tree/s and their growing environment both above and below ground. Do not move fencing or enter TPZ without the agreement of the project Arborist.
 - The name, address, and telephone number of the developer/builder and project Arborist
- 11.9 Trunk and Branch Protection:** The trunk must be protected by wrapped hessian or similar material to limit damage. Timber planks (50mm x 100mm or similar) should then be placed around tree trunk. The timber planks should be spaced at 100mm intervals and must be fixed against the trunk with tie wire or strapping and connections finished or covered to protect pedestrians from injury. The hessian and timber planks must not be fixed to the tree in any instance. The trunk and branch protection shall be installed prior to any work commencing on site and shall be maintained in good condition for the entire development period.
- 11.10 Mulch:** Any areas of the TPZ located inside the subject site (only trees to be retained directly adjacent to site works must be mulched to a depth of 75mm with good quality composted wood chip/leaf mulch.

11.11 Ground Protection: Ground protection is required to protect the underlying soil structure and root system in areas where it is not practical to restrict access to whole TPZ, while allowing space for construction. Ground protection must consist of good quality composted wood chip/leaf mulch to a depth of between 150-300mm, laid on top of geo textile fabric. If vehicles are to be using the area, additional protection will be required such as rumble boards or track mats to spread the weight of the vehicle and avoid load points. Ground protection is to be specified by the project Arborist as required.



An image from AS4970-2009,⁶ with example tree protection.

⁶ Council of Standards Australia, *AS4970 Protection of trees on development sites* (2009), page 16.



NOTES:

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

An image from AS4970-2009,⁷ with example tree protection.

⁷ Council of Standards Australia, *AS4970 Protection of trees on development sites* (2009), page 17.

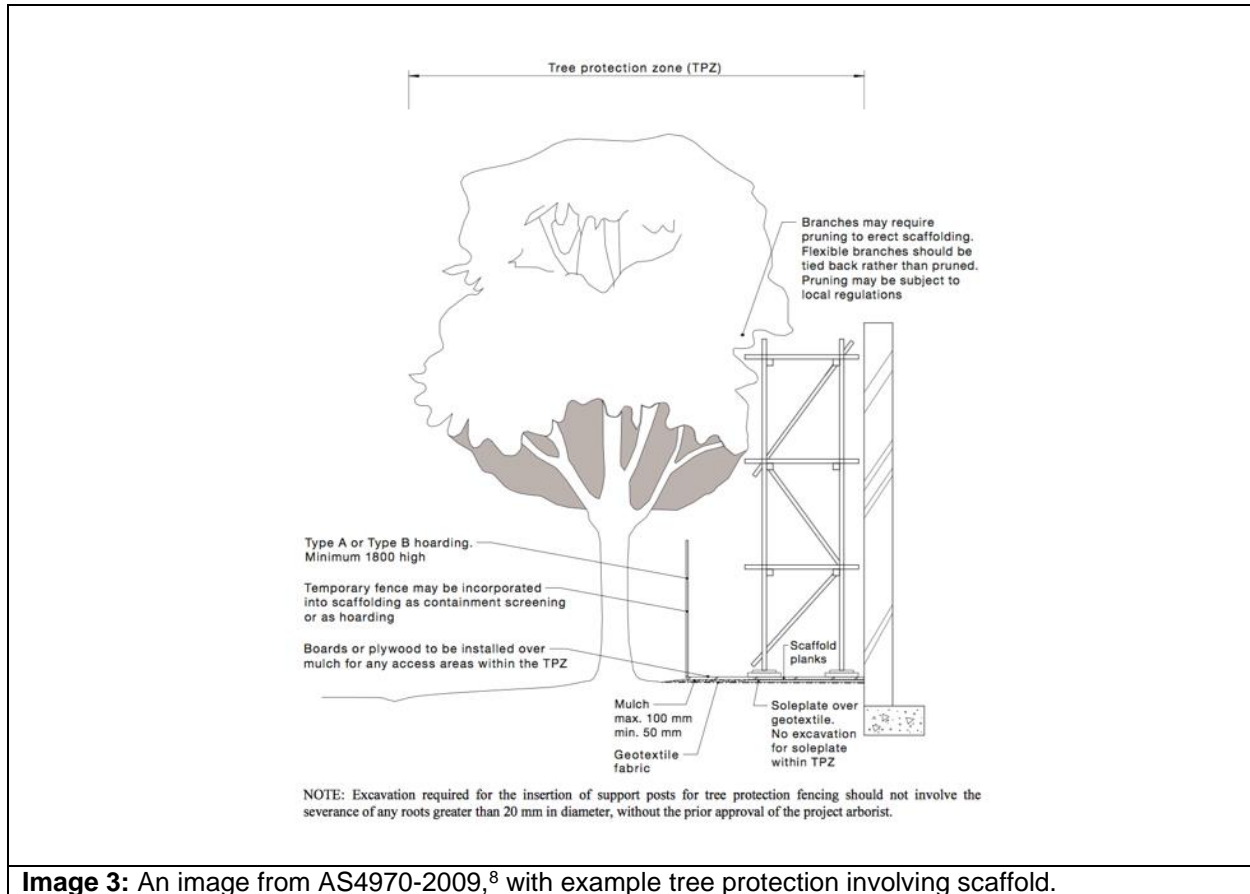


Image 3: An image from AS4970-2009,⁸ with example tree protection involving scaffold.

⁸ Council of Standards Australia, *AS4970 Protection of trees on development sites* (2009), page 19.

- 11.12 **Root investigations:** Where major TPZ encroachments require demonstrating the viability of trees the following method for root investigations is to be used. Non-destructive excavations are to be carried out along the outer edge of proposed or existing structures within the TPZ (excavation methods include the use of pneumatic and hydraulic tools, high-pressure air or a combination of high-pressure water and a vacuum device). Excavations generally consist of a trench to a depth dictated by the location of significant roots, bedrock, unfavourable conditions for root growth, or the required depth for footings up to 1 metre. The investigation is to be carried out by AQF5 consulting Arborist who is to record all roots greater than 30 millimetres in diameter and produce a report discussing the significance of the findings. No roots 30 millimetres in diameter are to be frayed or damaged during excavation and the trench is to be backfilled as soon as possible to reduce the risk of roots drying out. In the event roots must be left exposed, they are to be wrapped in hessian sack and regularly irrigated for the duration of exposure.
- 11.13 **Restricted activities inside TPZ:** The following activities must be avoided inside the TPZ of all trees to be retained unless approved by the project Arborist. If at any **time** these activities cannot be avoided an alternative must be agreed in writing with the project Arborist to minimise the impact to the tree.
- A) Machine excavation.
 - B) Ripping or cultivation of soil.
 - C) Storage of spoil, soil or any such materials
 - D) Preparation of chemicals, including preparation of cement products.
 - E) Refueling.
 - F) Dumping of waste.
 - G) Wash down and cleaning of equipment.
 - H) Placement of fill.
 - I) Lighting of fires.
 - J) Soil level changes.
 - K) Any physical damage to the crown, trunk, or root system.
 - L) Parking of vehicles.

- 11.14 **Excavations and root pruning:** The project Arborist must supervise and certify that all excavations and root pruning are in accordance with AS4373-2007 and AS4970-2009. For continuous strip footings, first manual excavation is required along the edge of the structures closest to the subject trees. Manual excavation should be a depth of 1 metre (or to unfavourable root growth conditions such as bed rock or heavy clay, if agreed by project Arborist). Next roots must be pruned back in accordance with AS4373-2007. After all root pruning is completed, machine excavation is permitted within the footprint of the structure. For tree sensitive footings, such as pier and beam, all excavations inside the TPZ must be manual. Manual excavation may include the use of pneumatic and hydraulic tools, high-pressure air or a combination of high-pressure water and a vacuum device. No pruning of roots greater 30mm in diameter is to be carried out without approval of the project arborist. All pruning of roots greater than 10mm in diameter must be carried out by a qualified Arborist/Horticulturalist with a minimum AQF level 3. Root pruning is to be a clean cut with a sharp tool in accordance with AS4373 Pruning of amenity trees (2007).⁹ The tree root is to be pruned back to a branch root if possible. Make a clean cut and leave as small a wound as possible.
- 11.15 **Landscaping:** All landscaping works within the TPZ of trees to be retained are to be undertaken in consultation with a consulting Arborist to minimize the impact to trees. General guidance is provided below to minimise the impact of new landscaping to trees to be retained.
- 11.16 **Level changes should be minimised.** The existing ground levels within the landscape areas should not be lowered by more than 50mm or increased by more 100mm without assessment by a consulting Arborist.
- 11.17 **New retaining walls** should be avoided. Where new retaining walls are proposed inside the TPZ of trees to be retained, they should be constructed from tree sensitive material, such as timber sleepers, that require minimal footings/excavations. If brick retaining walls are proposed inside the TPZ, consider pier and beam type footings to bridge significant roots that are critical to the trees condition. Retaining walls must be located outside the SRZ and sleepers/beams located above existing soil grades.
- 11.18 **New footpaths** and hard surfaces should be minimised, as they can limit the availability of water, nutrients, and air to the tree's root system. Where they are proposed, they should be constructed on or above existing soil grades to minimise root disturbance and consider using a permeable surface. Footpath should be located outside the SRZ.
- 11.19 **The location of new plantings** inside the TPZ of trees to be retained should be flexible to avoid unnecessary damage to tree roots greater than 30mm in diameter.

⁹ Council of Standards Australia, AS 4373 *Pruning of amenity trees* (2007) page 18

- 11.20 **Sediment and Contamination:** All contamination run off from the development such as but not limited to concrete, sediment and toxic wastes must be prevented from entering the TPZ at all times.
- 11.21 **Tree Wounding/Injury:** Any wounding or injury that occurs to a tree during the construction process will require the project Arborist to be contacted for an assessment of the injury and provide mitigation/remediation advice. It is generally accepted that trees may take many years to decline and eventually die from root damage. All repair work is to be carried out by the project Arborist, at the contractor's expense.
- 11.22 **Completion of Development Works:** After all construction works are complete the project Arborist should assess that the subject trees have been retained in the same condition and vigour. If changes to condition are identified the project Arborist should provide recommendations for remediation.

12. HOLD POINTS

12.1 Hold Points: Below is a sequence of hold points requiring project Arborist certification throughout the development process. The hold points must be checked and certified. All certifications must be provided in written format upon completion of the development. The final certification must include details of any instructions for remediation undertaken during the development.

Hold Point	Stage	Responsibility	Certification	Complete Y/N and date
Project Arborist to hold pre construction site meeting with principal contractor to discuss methods and importance of tree protection measures and resolve any issues in relation to feasibility of tree protection requirements that may arise.	Prior to work commencing.	Principle contractor	Project Arborist	
Project Arborist To supervise all pruning works to retained trees.	Prior to works commencing	Principal Contractor	Project Arborist	
Project Arborist to assess and certify that tree protection has been installed in accordance with section 11 and AS4970-2009 prior to works commencing at site.	Prior to development work commencing.	Principle contractor	Project Arborist	
In accordance with AS4970-2009 the project arborist should carryout regular site inspections to ensure works are carried out in accordance with the recommendations. I recommend site inspections on a bi-monthly frequency.	Ongoing throughout the development	Principle contractor	Project Arborist	
Project Arborist to oversee all excavations and demolition inside the TPZ of any tree to be retained.	Construction	Principle contractor	Project Arborist	
Project Arborist to certify that all pruning of roots greater than 30mm in diameter has been carried out in accordance with AS4373-2007. All root pruning must be carried out by a qualified Arborist/Horticulturalist with a minimum AQF level 3.	Construction	Principle contractor	Project Arborist	
Project Arborist to certify that all underground services including storm water inside TPZ of any tree to be retained have been installed in accordance with AS4970-2009.	Construction	Principle contractor	Project Arborist	
All landscaping works/boundary walls within the TPZ of trees to be retained are to be undertaken in consultation with the project Arborist to minimize the impact to trees.	Landscape	Principle contractor	Project Arborist	

After all construction works are complete the project Arborist should assess that the subject trees have been retained in the same condition and vigor and authorize the removal of protective fencing. If changes to condition are identified the project Arborist should provide recommendations for remediation.	Upon completion of construction	Principle contractor	Project Arborist	
Any wounding or injury that occurs to a tree during the demolition/construction process will require the project arborist to be contacted for an assessment of the injury and provide mitigation/remediation advice. All remediation work is to be carried out by the project arborist, at the contractor's expense.	Ongoing throughout the development	Principle contractor	Project Arborist	

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14. LIST OF APPENDICES

The following are included in the appendices:

Appendix 1 –Proposed Site Plan and Tree Protection Plan
Appendix 2 - Tree inspection schedule
Appendix 3 – Health
Appendix 4 – Amenity Value
Appendix 5 – Age Class
Appendix 6 – Structural Condition
Appendix 7 – SULE Categories
Appendix 8 – Retention Values
Appendix 9 – Trees AZ
Appendix 10 – TPZ Encroachment

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Appendix 2 - Tree Inspection Schedule

Tree ID	Common Name	Botanical Name	Age Class	Height (m)	Canopy Spread Radius (m)	Stem 1 (mm)	Stem 2 (mm)	DBH (mm)	DAB (mm)	Health	Structure	Amenity Value	SULE	Retention Value	TPZ Radius (m)	SRZ Radius (m)	Notes
1	Willow Bottlebrush	<i>Callistemon salignus</i>	Mature	8	4	500		500	550	Good	Good	Medium	1.Long	A1	6.0	2.6	None
2	Brush Cherry	<i>Syzegium australe</i>	Mature	5	3	180		180	200	Good	Good	Medium	1.Long	A1	2.2	1.7	None
3	Brush Cherry	<i>Syzegium australe</i>	Mature	5	3	300	200	361	450	Good	Good	Medium	1.Long	A1	4.3	2.4	None
4	Brush Cherry	<i>Syzegium australe</i>	Mature	5	3	200	100	316	500	Good	Good	Medium	1.Long	A1	3.8	2.5	None
5	Coastal Banksia	<i>Banksia integrifolia</i>	Mature	7	4	350		350	360	Good	Good	Medium	1.Long	A1	4.2	2.2	None
6	Old Man Banksia	<i>Banksia serrata</i>	Mature	9	4	230	200	305	420	Good	Good	Medium	1.Long	A1	3.7	2.3	None
7	Blueberry Ash	<i>Elaeocarpus reticulatus</i>	Mature	8	4	180	110	233	360	Good	Good	Medium	1.Long	A1	2.8	2.2	None
8	Old Man Banksia	<i>Banksia serrata</i>	Mature	6	4	200	110	228	550	Good	Fair	Medium	2.Medium	A2	2.7	2.6	Suppressed.
9	Lilly Pilly	<i>Acmena smithii</i>	Mature	5	4	120	110	220	400	Good	Fair	Medium	2.Medium	A2	2.6	2.3	None
10	Coastal Tea Tree	<i>Leptospermum laevigatum</i>	Mature	5	4	100	100	173	350	Fair	Fair	Medium	3.Short	A2	2.0	2.1	None
G1	Mixed Species	<i>Citrus Species</i>	Mature	3	2	100		100	150	Good	Good	Low	1.Long	Z1	2.0	1.5	Exempt vegetation fruit trees.
11	Umbrella Tree	<i>Schefflera elegantissima</i>	Semi-mature	3	2	40	40	80	110	Good	Good	Low	1.Long	Z1	2.0	1.5	None
12	Umbrella Tree	<i>Schefflera elegantissima</i>	Semi-mature	3	2	40	40	80	110	Good	Good	Low	1.Long	Z1	2.0	1.5	None
13	Southern Magnolia	<i>Magnolia grandiflora</i>	Semi-mature	4	2	90	100	135	150	Good	Good	Low	1.Long	Z1	2.0	1.5	None
14	Prunus Spp.	<i>Prunus Spp.</i>	Semi-mature	3	2	20	20	40	100	Fair	Fair	Low	3.Short	Z1	2.0	1.5	None
15	Nyssa	<i>Nyssa sylvatica</i>	Young	4	3	100	50	112	150	Good	Good	Low	1.Long	Z1	2.0	1.5	None
16	Tea tree	<i>Leptospermom Spp.</i>	Young	4	3	90	90	201	250	Good	Good	Low	1.Long	Z1	2.4	1.8	None
17	Lilly Pilly	<i>Acmena smithii</i>	Semi-mature	6	3	160		160	200	Fair	Good	Low	3.Short	A2	2.0	1.7	None
18	Lilly Pilly	<i>Acmena smithii</i>	Semi-mature	6	4	150	150	235	320	Fair	Good	Low	3.Short	A2	2.0	2.1	None
19	Weeping Bottlebrush	<i>Callistemon viminalis</i>	Mature	5	4	110	110	185	350	Good	Good	Low	1.Long	A1	3.0	2.1	None
G2	Bangalow Palm	<i>Archontophoenix cunninghamiana</i>	Mature	7	2	160		160	NA	Good	Good	Low	1.Long	Z3	4.0	NA	Group of 6
20	Snow In Summer	<i>Melaleuca linarifolia</i>	Young	3	2	170		170	180	Good	Good	Low	1.Long	Z1	5.0	1.6	None

Explanatory Notes

Tree Species - Botanical name followed by common name in brackets. Where species is unknown it is indicated with an 'spp'.

Age Class - Over mature (OM), Mature (M), Early mature (EM), Semi mature (SM), Young (Y), Dead (D).

Diameter at Breast Height (DBH) - Measured with a DBH tape or estimated at approximately 1.4m above ground level. Where DBH has been estimated it is indicated with an 'est'.

Diameter Above root Buttresses (DAB): Measured with a DBH tape or estimated above root buttresses (DAB) for calculating the SRZ.

Height - Height from ground level to top of crown. All heights are estimated unless otherwise indicated.

Spread - Radius of crown at widest section. All tree spreads are estimated unless otherwise indicated.

Tree Protection Zone (TPZ) - DBH x 12. Measured in radius from the centre of the trunk. Rounded to nearest 0.1m. For monocots, the TPZ is set at 1 metre outside the crown projection.

Structural Root Zone (SRZ) - (DAB x 50)^{0.42} x 0.64. Measured in radius from the centre of the trunk. Rounded up to nearest 0.1m.

Health - Good/Fair/Poor/Dead

Structure - Good/Fair/Poor

Safe Useful Life Expectancy (SULE) - 1. Long (40+years), 2. Medium (15 - 40 years), 3. Short (5 - 15 years), 4. Remove (under 5 years), 5. Small/young.

Amenity Value - Very High/High/Medium/Low/Very Low.

(x) Indicates the measurement taken for the diameter at tree base above the buttress roots.

(E) Indicates estimated measurements.

Appendix 3 - Health/Physiological condition

<u>Category</u>	<u>Example condition</u>	<u>Summary</u>
Good	<ul style="list-style-type: none">• Crown has good foliage density for species.• Tree shows no or minimal signs of pathogens that are unlikely to have an effect on the health of the tree.• Tree is displaying good vigour and reactive growth development.	<ul style="list-style-type: none">• The tree is in above average health and condition and no remedial works are required.
Fair	<ul style="list-style-type: none">• The tree may be starting to dieback or have over 25% deadwood.• Tree may have slightly reduced crown density or thinning.• There may be some discolouration of foliage.• Average reactive growth development.• There may be early signs of pathogens which may further deteriorate the health of the tree.• There may be epicormic growth indicating increased levels of stress within the tree.	<ul style="list-style-type: none">• The tree is in below average health and condition and may require remedial works to improve the trees health.
Poor	<ul style="list-style-type: none">• The may be in decline, have extensive dieback or have over 30% deadwood.• The canopy may be sparse or the leaves may be unusually small for species.• Pathogens or pests are having a significant detrimental effect on the tree health.	<ul style="list-style-type: none">• The tree is displaying low levels of health and removal or remedial works may be required.
Dead	<ul style="list-style-type: none">• The tree is dead or almost dead.	<ul style="list-style-type: none">• The tree should generally be removed.

Appendix 4 - Amenity value

To determine the amenity value of a tree we assess a number of different factors which include but are not limited to the information below.

- The visibility of the tree to adjacent sites.
- The relationship between the tree and the site.
- Whether the tree is protected by any statutory conditions.
- The habitat value of the tree.
- Whether the tree is considered a noxious weed species.

Appendix 5 - Age class

If can be difficult to determine the age of a tree without carrying out invasive tests that may damage the tree, so we have categorised there likely age class which is defined below.

<u>Category</u>	<u>Description</u>
Young/Newly planted	<ul style="list-style-type: none">• Young or recently planted tree.
Semi Mature	<ul style="list-style-type: none">• Up to 20% of the usual life expectancy for the species.
Early mature/Mature	<ul style="list-style-type: none">• Between 20% - 80% of the usual life expectancy for the species.
Over mature	<ul style="list-style-type: none">• Over 80% of the usual life expectancy for the species.
Dead	<ul style="list-style-type: none">• Tree is dead or almost dead.

Appendix 6 - Structural condition

<u>Category</u>	<u>Example condition</u>	<u>Summary</u>
Good	<ul style="list-style-type: none">• Branch unions appear to be strong with no sign of defects.• There are no significant cavities.• The tree is unlikely to fail in usual conditions.• The tree has a balanced crown shape and form.	<ul style="list-style-type: none">• The tree is considered structurally good with well developed form.
Fair	<ul style="list-style-type: none">• The tree may have minor structural defects within the structure of the crown that could potentially develop into more significant defects.• The tree may have a cavity that is currently unlikely to fail but may deteriorate in the future.• The tree is an unbalanced shape or leans significantly.• The tree may have minor damage to its roots.• The root plate may have moved in the past but the tree has now compensated for this.• Branches may be rubbing or crossing.	<ul style="list-style-type: none">• The identified defects are unlikely to cause major failure.• Some branch failure may occur in usual conditions.• Remedial works can be undertaken to alleviate potential defects.
Poor	<ul style="list-style-type: none">• The tree has significant structural defects.• Branch unions may be poor or weak.• The tree may have a cavity or cavities with excessive levels of decay that could cause catastrophic failure.• The tree may have root damage or is displaying signs of recent movement.• The tree crown may have poor weight distribution which could cause failure.	<ul style="list-style-type: none">• The identified defects are likely to cause either partial or whole failure of the tree.

Appendix 7 - Safe Useful Life Expectancy (SULE), (Barrel, 2001)

A tree's safe useful life expectancy is determined by assessing a number of different factors including the health and vitality, estimated age in relation to expected life expectancy for the species, structural defects, and remedial works that could allow retention in the existing situation.

Category	Description
1. Long	Useful life expectancy over 40 years
2. Medium	Useful life expectancy 15 to 40 years
3. Short	Useful life expectancy 5 to 15 years
4. Remove	Useful life expectancy under 5 years
5. Small/Young	Trees that could be transplanted or replaced with similar specimen.
6. Unstable	Tree has become hazardous or structurally unstable.

Appendix 8 - Retention value

The retention value that has been allocated to each tree in this report is not definitive and should only be used as a guideline by the client. We have assigned the retention value after assessing the combined SULE, structural condition, health, and amenity value of the tree. Any heritage listing that may apply to the tree has not been considered in this value, although if it has been identified it is included in the notes for the tree. Each tree has been assessed individually and consideration has not been given to value of the tree within a group.

<u>Category</u>	<u>Example recommendation</u>
Very high	Every effort should be made to preserve and retain trees in this category.
High	The trees in this category should be retained if it is reasonably possible.
Medium	The trees in this category should be retained if they do not constrain the development on the site.
Low	The trees in this category should not cause a constraint on the development proposals. They should be retained only if they do not or will not cause a risk to people or property.
Very low	The tree should generally be removed unless they do not or will not cause a risk to people or property.

TreeAZ Categories (Version 10.04-ANZ)

CAUTION: TreeAZ assessments must be carried out by a competent person qualified and experienced in arboriculture. The following category descriptions are designed to be a brief field reference and are not intended to be self-explanatory. They must be read in conjunction with the most current explanations published at www.TreeAZ.com.

Category Z: Unimportant trees not worthy of being a material constraint

Local policy exemptions: Trees that are unsuitable for legal protection for local policy reasons including size, proximity and species

Z1	Young or insignificant small trees, i.e. below the local size threshold for legal protection, etc
Z2	Too close to a building, i.e. exempt from legal protection because of proximity, etc
Z3	Species that cannot be protected for other reasons, i.e. scheduled noxious weeds, out of character in a setting of acknowledged importance, etc

High risk of death or failure: Trees that are likely to be removed within 10 years because of acute health issues or severe structural failure

Z4	Dead, dying, diseased or declining
Z5	Severe damage and/or structural defects where a high risk of failure <u>cannot</u> be satisfactorily reduced by reasonable remedial care, i.e. cavities, decay, included bark, wounds, excessive imbalance, overgrown and vulnerable to adverse weather conditions, etc
Z6	Instability, i.e. poor anchorage, increased exposure, etc

Excessive nuisance: Trees that are likely to be removed within 10 years because of unacceptable impact on people

Z7	Excessive, severe and intolerable inconvenience to the extent that a locally recognized court or tribunal would be likely to authorize removal, i.e. dominance, debris, interference, etc
Z8	Excessive, severe and intolerable damage to property to the extent that a locally recognized court or tribunal would be likely to authorize removal, i.e. severe structural damage to surfacing and buildings, etc

Good management: Trees that are likely to be removed within 10 years through responsible management of the tree population

Z9	Severe damage and/or structural defects where a high risk of failure can be <u>temporarily</u> reduced by reasonable remedial care, i.e. cavities, decay, included bark, wounds, excessive imbalance, vulnerable to adverse weather conditions, etc
Z10	Poor condition or location with a low potential for recovery or improvement, i.e. dominated by adjacent trees or buildings, poor architectural framework, etc
Z11	Removal would benefit better adjacent trees, i.e. relieve physical interference, suppression, etc
Z12	Unacceptably expensive to retain, i.e. severe defects requiring excessive levels of maintenance, etc

NOTE: Z trees with a high risk of death/failure (Z4, Z5 & Z6) or causing severe inconvenience (Z7 & Z8) at the time of assessment and need an urgent risk assessment can be designated as ZZ. ZZ trees are likely to be unsuitable for retention and at the bottom of the categorization hierarchy. In contrast, although Z trees are not worthy of influencing new designs, urgent removal is not essential and they could be retained in the short term, if appropriate.

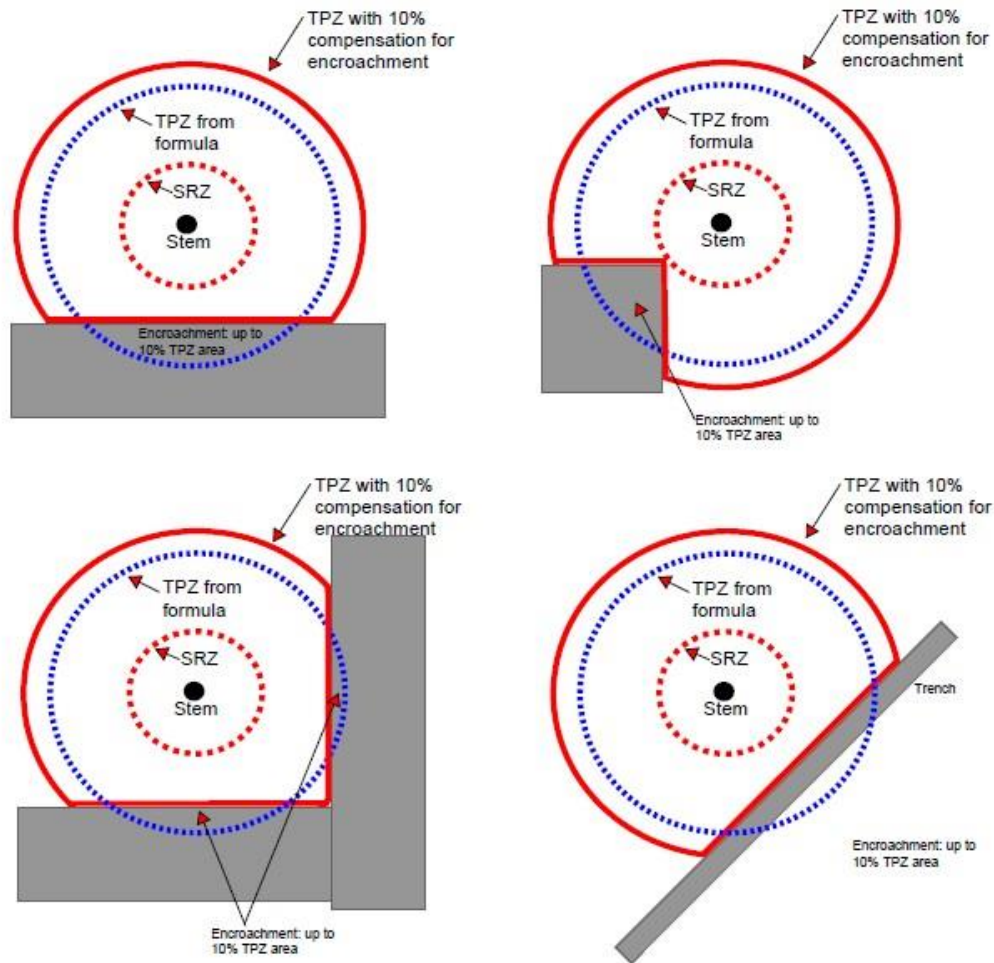
Category A: Important trees suitable for retention for more than 10 years and worthy of being a material constraint

A1	No significant defects and could be retained with minimal remedial care
A2	Minor defects that could be addressed by remedial care and/or work to adjacent trees
A3	Special significance for historical, cultural, commemorative or rarity reasons that would warrant extraordinary efforts to retain for more than 10 years
A4	Trees that may be worthy of legal protection for ecological reasons (Advisory requiring specialist assessment)

NOTE: Category A1 trees that are already large and exceptional, or have the potential to become so with minimal maintenance, can be designated as AA at the discretion of the assessor. Although all A and AA trees are sufficiently important to be material constraints, AA trees are at the top of the categorization hierarchy and should be given the most weight in any selection process.

Appendix 10 – Examples of TPZ Encroachment

Encroachment into the Tree Protection Zone is sometimes unavoidable. The following diagram shows examples of acceptable levels of encroachment and how they may be compensated for by providing additional space contiguous to the TPZ area.



Note: Less than 10% TPZ area and outside SRZ. Any loss of TPZ compensated for elsewhere.