



Arboricultural Impact Assessment

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Revision: A

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1. INTRODUCTION

- 1.1 Revision A has been prepared to assess design amendments that have been implemented to reduce the impact on trees. I have been advised that T12 located on the adjoining site has been removed by the owner of the tree and no longer forms part of this assessment.
- 1.2 This report has been commissioned by the clients Luke & Julie Preston to assess trees located within the site and adjoining sites that may be impacted by a proposed development.
- 1.3 The following table contains all documents and information reviewed for the assessment.

Table 1: Documents provided for the assessment

Title	Author	Date	Reference on document
Site Survey	CMS Surveyors Pty Ltd	17 February 2023	8392Cdetail
Architectural Plan Set	Hot House Architects	1 st November 2023	Revision A See schedule below

DA SHEET LIST

DA_001	COVER SHEET
DA_002	SITE ANALYSIS
DA_090	DEMOLITION PLAN - LOWER LEVEL
DA_091	DEMOLITION PLAN - UPPER LEVEL
DA_100	LOWER LEVEL / STREET LEVEL
DA_101	UPPER LEVEL
DA_103	ROOF PLAN
DA_200	ELEVATIONS
DA_201	ELEVATIONS
DA_300	SECTIONS
DA_350	DRIVEWAY DETAILS
DA_600	SITE MANAGEMENT PLAN
DA_701	LANDSCAPE PLANS & COMPLIANCE
DA_800	SHADOW DIAGRAMS - WINTER 21 JUNE

- 1.4 The site and tree inspections were carried out on 27 September 2023. Access was available to the subject site and adjoining public areas only. All tree data contained in this report has been duplicated from the Preliminary Arboricultural Assessment Report.

2. SCOPE OF THE REPORT

2.1 This report has been undertaken to meet the following objectives;

- 2.1.1 Conduct a ground level visual assessment of all significant trees located within 5 metres of development works. For the purpose of this report, a significant tree is a tree with a height equal to or greater than 5 metres.
- 2.1.2 Determine the trees estimated contribution years and remaining useful life expectancy and award the trees a retention value.
- 2.1.3 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).
- 2.1.4 Recommend methods to mitigate development impacts where possible.
- 2.1.5 Recommend tree protection measures for any tree to be retained in accordance with AS4970 Protection of trees on development sites (2009).

3. LIMITATIONS

- 3.1 Access was not available to neighbouring sites, therefore the tree measurements for trees located within neighbouring sites have been estimated from within the subject site.
- 3.2 The observations and recommendations are based on one site inspection. The findings of this report are based on the observations and site conditions at the time of the inspection.
- 3.3 All observations were carried out from ground level. No additional detailed testing was carried out on trees or soil on site and none of the surrounding surfaces were lifted for investigated.
- 3.4 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.
- 3.5 The report reflects the subject tree(s) as found on the day of the inspection. Any changes to the growing environment of the subject trees, 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.
- 3.6 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.

- 3.7 All diagrams, plans and photographs included in this report are visual aids only, and are not to scale unless otherwise indicated.
- 3.8 Hugh The Arborist neither guarantees, nor is responsible for, the accuracy of information provided by others that is contained within this report.
- 3.9 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 the trees at the site.
- 3.10 Where trees are stated as retainable under the current proposal, this will only be possible if all recommendations and specifications are followed with consultation with the Project Arborist.
- 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) - millimetres.
 - 4.1.5 DAB (Trunk diameter directly above the root buttress) – millimetres.
 - 4.1.6 Estimated height - metres
 - 4.1.7 Estimated crown spread (radius of crown) - metres
 - 4.1.8 Health
 - 4.1.9 Structural condition
 - 4.1.10 Amenity value
 - 4.1.11 Estimated remaining contribution years (SULE)¹
 - 4.1.12 Retention value (Tree AZ)²
 - 4.1.13 Notes/comments

¹ Barrell, J. (2001), 'SULE: Its use and status in the new millennium' in *Management of Mature Trees proceedings of the 4th NAAA Workshop*, Sydney, 2001. Barrell.

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

Report on trees at: 1 Harewood Place, Warriewood, NSW

Prepared for: Luke & Julie Preston

Prepared by: Hugh Millington, hugh@hughtheArborist.com.au

Date prepared: 29th November 2023

Revision A

- 4.2 An assessment of the trees condition was made using the visual tree assessment (VTA) model (Mattheck & Breloer, 1994).³
- 4.3 Trunk diameter was measured using a DBH tape or in some cases estimated. The trunk diameter of all trees in adjoining sites has been estimated. Tree height and tree canopy spread was measured with a clinometer or in some cases estimated. All other measurements were estimations unless otherwise stated. The other tool used during the assessment was a digital camera.
- 4.4 All information was imported into (GIS) PT-mapper pro software. This software was used to measure/calculate all encroachment estimates included in this report.
- 4.5 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) in a Microsoft Excel spreadsheet.⁴
- 4.6 Details of how the observations in this report have been assessed are listed in the appendices.

5. SITE LOCATION AND BRIEF DESCRIPTION OF PROPOSAL

- 5.1 The site is located in the Northern Beaches Local Government Area (LGA), this assessment has been carried out in accordance with the following legislation and policy.
 - 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 (Biodiversity and Conservation 2021)

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

⁴ Council Of Standards Australia, *AS4970 Protection of trees on development sites* (2009).



Site location plan provided by Sixmaps ⁵

- 5.1 The site is not located within a heritage conservation area and has not been identified as a heritage item in the Pittwater LEP heritage maps⁶.
- 5.2 The site has not been identified as containing biodiversity the Pittwater LEP biodiversity maps⁷.
- 5.3 The vegetation within the site and adjoining sites consists of native and exotic species.

⁵ <https://maps.six.nsw.gov.au/>

⁶ Pittwater LEP Heritage map - Sheet HER_018,
https://eplanningdlprod.blob.core.windows.net/pdfmaps/6370_COM_HER_019_010_20150325.pdf, accessed 28 September 2023.

⁷ Pittwater LEP Biodiversity map - Sheet BIO_019,
https://eplanningdlprod.blob.core.windows.net/pdfmaps/6370_COM_BIO_019_010_20140217.pdf, accessed 28 September 2023.

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

- 6.1 **Tree information:** Details of each individual tree I have assessed, including the observations taken during the site inspection can be found in the tree inspection schedule in appendix 2, where I have calculated the indicative tree protection zone (TPZ) for the subject trees. The TPZ and SRZ should be measured in radius from the centre of the trunk. I awarded the subject trees a retention value based on my observations. The system I have used to award the retention value is Tree AZ. 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. I have included the Tree AZ categories sheet (Barrell Tree Consultancy) 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:** In appendix 1 two site plans have been prepared, where the tree information including canopy spread, TPZ and SRZ have been overlaid onto the received site plans. The following site plans are included;
- Appendix 1A: Existing Site Plan
 - Appendix 1B: Proposed Site Plan
- 6.3 **Tree protection zone (TPZ):** The TPZ is 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 AS4970-2009 to be the extent 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 tree protection also incorporates the SRZ (see below for more information about the SRZ). I have calculated the TPZ of palms, other monocots, cycads and tree ferns 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 trees stability in the ground. An area larger than the SRZ always needs to be maintained to preserve a viable tree. 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.

7. ASSESSMENT OF CONSTRUCTION IMPACTS

7.1 **Table 2:** In the table below, the impact of the proposed development has been assessed for all trees included in the report. The assessed TPZ encroachments include proposed structures and hard landscaping only. All soft landscaping should be completed in accordance with section 10.16 – 10.20 of this report.

Tree ID	Botanical Name	Retention value	TPZ radius (m)	TPZ area (m ²)	SRZ radius (m)	TPZ encroachment	Discussion/ Conclusion	Recommendation
1	<i>Acmena smithii</i>	Z10	3.0	28.3	2.5	Major	The tree is located within the adjoining property. The proposed stone retaining wall and excavations for the turf area (cut of up to 1m below existing grades) will encroach into the TPZ by 16% (4.5m ²) and into the SRZ. This is considered to be a major TPZ encroachment, indicating the proposed works could potentially impact the condition and stability of the tree. However, the tree consists of epicormic regrowth from a previously lopped and partially ground stump. The Northern portion of the trunk (adjacent to the subject site) has a visible cut line, indicating no significant root growth is located within the subject site (see Photo 1). Therefore, the proposed works will not significantly impact the tree.	Retain and protect
2	<i>Cupaniopsis anacardioides</i>	Z3	2.0	12.6	1.8	None	The tree has not been identified on the survey and is located within the adjoining property. There is an existing boundary masonry retaining wall located between the trunk of the tree and the area of the proposed TPZ encroachment (see Photo 2). The existing boundary retaining wall is likely to be restricting significant root growth from entering the site. Therefore, the proposed works will not significantly impact the tree.	Retain and protect
3	<i>Cupaniopsis anacardioides</i>	Z3	2.0	12.6	1.8	None	The tree has not been identified on the survey and is located within the adjoining property. There is an existing boundary masonry retaining wall located between the trunk of the tree and the area of the proposed TPZ encroachment (see Photo 2). The existing boundary retaining wall is likely to be restricting significant root growth from entering the site. Therefore, the proposed works will not significantly impact the tree.	Retain and protect

Tree ID	Botanical Name	Retention value	TPZ radius (m)	TPZ area (m ²)	SRZ radius (m)	TPZ encroachment	Discussion/ Conclusion	Recommendation
4	<i>Strelitzia nicolai</i>	Z1	2.4	18.1	2.0	Footprint	The trunk of the tree is located within the footprint of the proposed retaining wall. The tree is of low value and can easily be replaced.	Remove
5	<i>Strelitzia nicolai</i>	Z1	2.4	18.1	2.0	Footprint	The trunk of the tree is located within the footprint of the proposed retaining wall. The tree is of low value and can easily be replaced.	Remove
6	<i>Phoenix canariensis</i>	Z3	3.0	28.3	NA	Major	The tree has not been identified on the survey and is located within the adjoining property. Based on the estimated location of the tree, the proposed stone retaining wall and pool hard surfacing will encroach into the TPZ by less than 10% and is considered to be a minor encroachment that will not significantly impact the tree. In addition, there is an existing boundary masonry retaining wall located between the trunk of the tree and the area of the proposed TPZ encroachment (see Photo 2). The existing boundary retaining wall is likely to be restricting significant root growth from entering the site. Therefore, the proposed works will not significantly impact the tree.	Retain and protect
7	<i>Melaleuca quinquenervia</i>	A1	3.6	40.7	2.2	Major	The tree is located within the adjoining property. The proposed stone retaining wall and pool construction will encroach into the TPZ by a combined 14% (5.8m ²) but not into the SRZ which is a major encroachment under AS4970 Protection of Trees on Development Sites (2009). There is an existing sandstone block wall along the lower portion of the boundary fence that could potentially be limiting significant root growth within the subject site (see Photo 3). While the distribution of the tree roots is not known, the presence of the structure is likely to have had some reducing effect on the presence of roots and the associated impacts can be offset with mitigation strategies to improve tree health during the development. Refer to the recommendations section for further details.	Retain and protect

Tree ID	Botanical Name	Retention value	TPZ radius (m)	TPZ area (m ²)	SRZ radius (m)	TPZ encroachment	Discussion/ Conclusion	Recommendation
8	<i>Ficus rubiginosa</i>	A2	10.5	346.4	3.9	Major	The tree is located within the adjoining property. The proposed works include the construction of the swimming pool, the installation of a retaining wall along the rear boundary and the demolition and replacement of a retaining wall to the rear of the existing dwelling. The combined encroachment from the proposed works will be up to 10% (33m ²) with no encroachment into the SRZ. This is considered to be a minor encroachment and providing none of the large surface roots close to the northern boundary are damaged the tree will not significantly affect the condition of the tree.	Retain and protect
9	<i>Callistemon viminalis</i>	A1	3.2	32.2	2.2	Minor	The tree is located within the adjoining property. The proposed stone retaining wall and dwelling wall will encroach into the TPZ by 2% (0.6m ²) but not into the SRZ. This is considered to be a minor and acceptable TPZ encroachment. The proposed works will not significantly impact the tree.	Retain and protect
10	<i>Callistemon viminalis</i>	A1	3.9	47.8	2.4	None	The tree has not been identified on the survey and is located within the adjoining property. Based on the estimated location of the tree, there is no proposed TPZ encroachment.	Retain and protect
11	<i>Acmena smithii</i>	Z2	2.0	12.6	1.7	Footprint	The trunk of the tree is located within the footprint of the proposed hard surfacing.	Remove
G1	<i>Mixed species</i>	Z1	2.0	12.6	1.5	Footprint	Group of trees not identified on the survey. Based on the estimated location of the trees, the majority of the trees will be located within the footprint of the proposed hard surfacing and dwelling construction. The trees do not feature on the proposed plans and are assumed to be removed as part of the works.	Remove

8. CONCLUSIONS

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

Impact	Reason	Category A	Category Z	Total
		A	Z	
Trees recommended to be removed	Building construction, new surfacing and/or proximity, or trees in poor condition.	11	4,5,G1	3 trees & 1 group of trees
Trees recommended to be retained	Removal of existing surfacing/structures and/or installation of new surfacing/structures will not impact the viability of the trees	6,7,8,9,10,	1,2,3,	8 trees

8.2 Photographs



Photo 1: Looking over the boundary fence towards the base of tree 1. Showing epicormic regrowth from stump and the cut line within the trunk parallel to the fence, indicating no significant root growth remains within the subject site.



Photo 2: Looking East from within the site towards tree 2, 3 and 6 (located within the adjoining property). The existing boundary masonry fence appears to be restricting root growth into the subject site.





Photo 4: Looking East from within the site towards tree 8 (located within the adjoining property). Showing the surface roots emanating from tree 8 (within the yellow rectangle) that must remain undamaged.

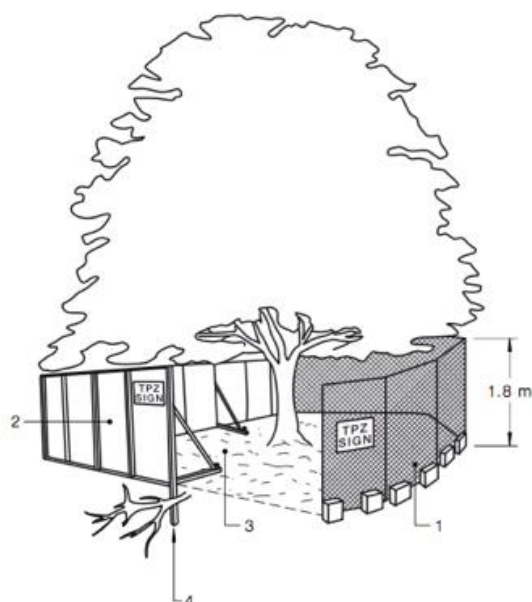
9. RECOMMENDATIONS

- 9.1 This report assesses the impact of a proposed development at the subject site to all significant trees located within 5 metres of development works.
- 9.2 I have been informed by the client that neighbouring tree 12 has been removed from the site by the tree owner, therefore a total of eleven trees and one group of trees are assessed.
- 9.3 Three (3) trees and one (1) group of trees have been recommended for removal to accommodate the development works, including tree 4, 5, 11 and G1. All trees recommended for removal are lower value category Z retention value trees.
- 9.4 The remaining eight trees consisting of five category A trees and three category Z trees are proposed to be retained and protected as part of the development under acceptable or no encroachment.
- 9.5 Tree 7 will be subject to major encroachment and it is recommended that the associated impact be offset with remediation consisting of leaf mulch and irrigation between the proposed wall and the rear boundary for the duration of the works until the landscape phase as directed by the project Arborist.
- 9.6 All trees to be retained must be protected in accordance with AS4970-2009, details of which are included in section 10. Generic tree protection guidance has been provided in section 10 only. It is recommended that a detailed tree management plan (TMP) is prepared for the development in accordance with AS4970-2009 and developed in combination with the overall construction management plan for the site. The TMP should be prepared by a consulting Arborist with a minimum AQF level 5 qualification following the final design layout.
- 9.7 Retained trees are to be provided with remedial care prior to the commencement of works, during and post construction phases to assist with mitigating the development impacts.
- 9.8 One month prior to the commencement of works, all trees are to be provided with soil conditioner (Seasol or GoGo) and a balanced NPK fertiliser (Nitrosol). This is to be carried out by the project Arborist and repeated midway through the development phase. Additional remedial measures are to be implemented by the project Arborist during the development depending on site and climatic conditions.
- 9.9 No landscape plan has been assessed as part of this report. See section 10.16 – 10.20 for general guidance when landscaping within the TPZ of trees to be retained.
- 9.10 No services plan has been assessed as part of this report. 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, see section 10.21 for more information.
- 9.11 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.

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

- 10.1 **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.
- 10.2 **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.
- 10.3 **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).
- 10.4 **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.
- 10.5 **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.
- 10.6 **Protective fencing:** Where it is not feasible to install fencing at the specified location due to factors such 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.

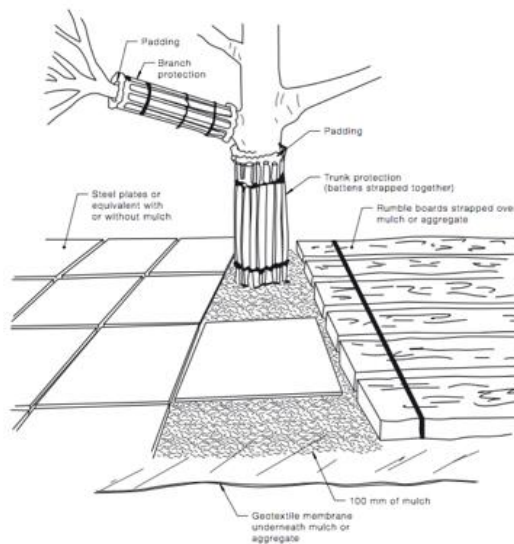
- 10.7 **TPZ signage:** Tree protection signage is to be attached to the protective fencing, displayed in a prominent position and the sign repeated at 10 metres intervals or closer where the fence changes direction. Each sign shall contain in a clearly legible form, the following information:
- Tree 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
- 10.8 **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.
- 10.9 **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.
- 10.10 **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.



LEGEND:

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

An image from AS4970-2009,⁸ with example tree protection.



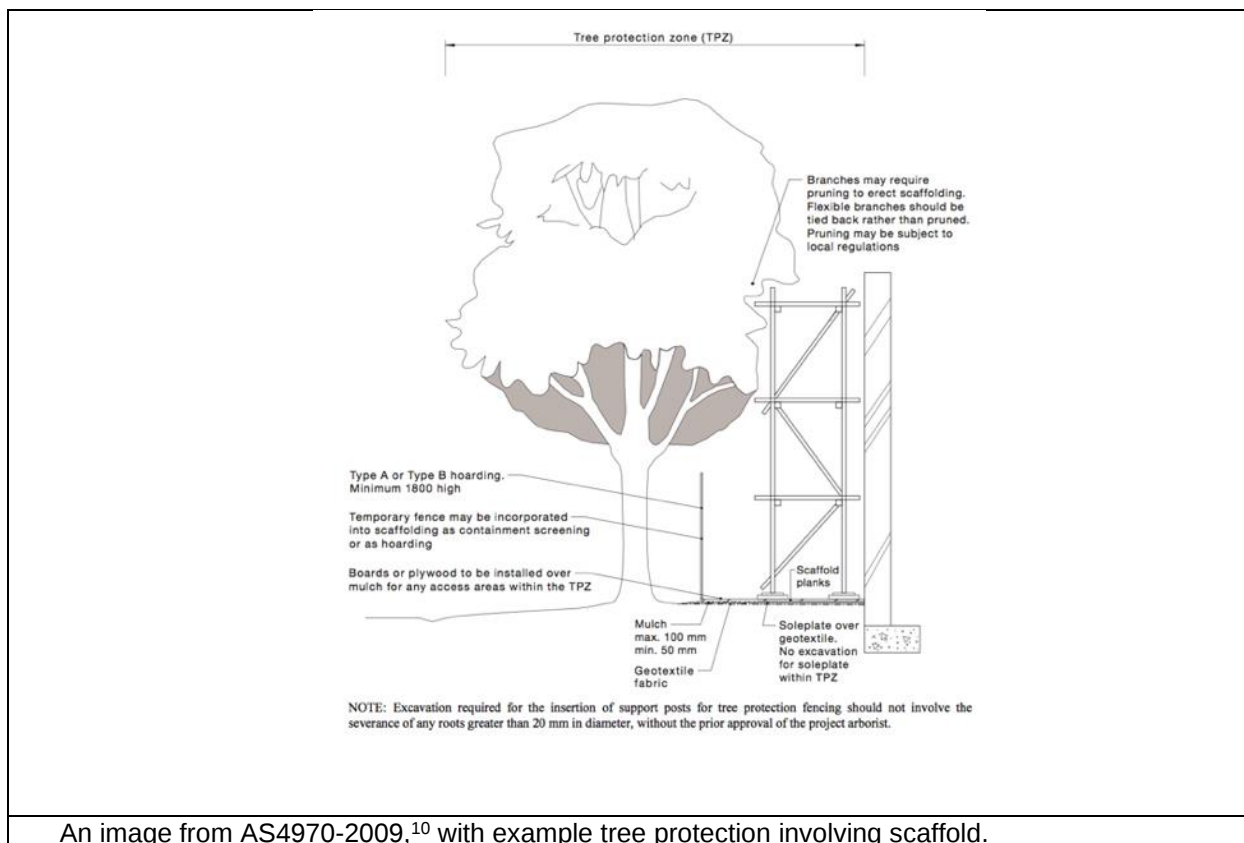
NOTES:

- 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 AS4970-2009,⁹ with example tree protection.

⁸ Council of Standards Australia, *AS4970 Protection of trees on development sites* (2009), page 16.

⁹ Council of Standards Australia, *AS4970 Protection of trees on development sites* (2009), page 17.



- 10.11 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.
- 10.12 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.

¹⁰ Council of Standards Australia, *AS4970 Protection of trees on development sites* (2009), page 19.
Report on trees at: 1 Harewood Place, Warriewood, NSW
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- 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.

10.13 **Demolition:** The demolition of all existing structures inside or directly adjacent to the TPZ of trees to be retained must be undertaken in consultation with the project Arborist. Any machinery is to work from inside the footprint of the existing structures or outside the TPZ, reaching in to minimise soil disturbance and compaction. If it is not feasible to locate demolition machinery outside the TPZ of trees to be retained, ground protection will be required. The demolition should be undertaken inwards into the footprint of the existing structures, sometimes referred to as the 'top down, pull back' method.

10.14 **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).¹¹ 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.

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

- 10.16 **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 than 100mm without assessment by a consulting Arborist.
- 10.17 **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, considerer 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.
- 10.18 **New footpaths** and hard surfaces should be minimised, as they can limit the availability of water, nutrients and air to the trees 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.
- 10.19 **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.
- 10.20 **Underground Services:** Where possible underground services should be located outside the TPZ of trees to be retained. 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. No roots greater than 30mm in diameter should be severed during the installation of service pipes unless approved in writing by the project Arborist
- 10.21 **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.
- 10.22 **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.
- 10.23 **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.

11. HOLD POINTS

11.1 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 certification 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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13. LIST OF APPENDICES

The following are included in the appendices:

- Appendix 1A – Existing Site Plan
- Appendix 1B – Proposed Site 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

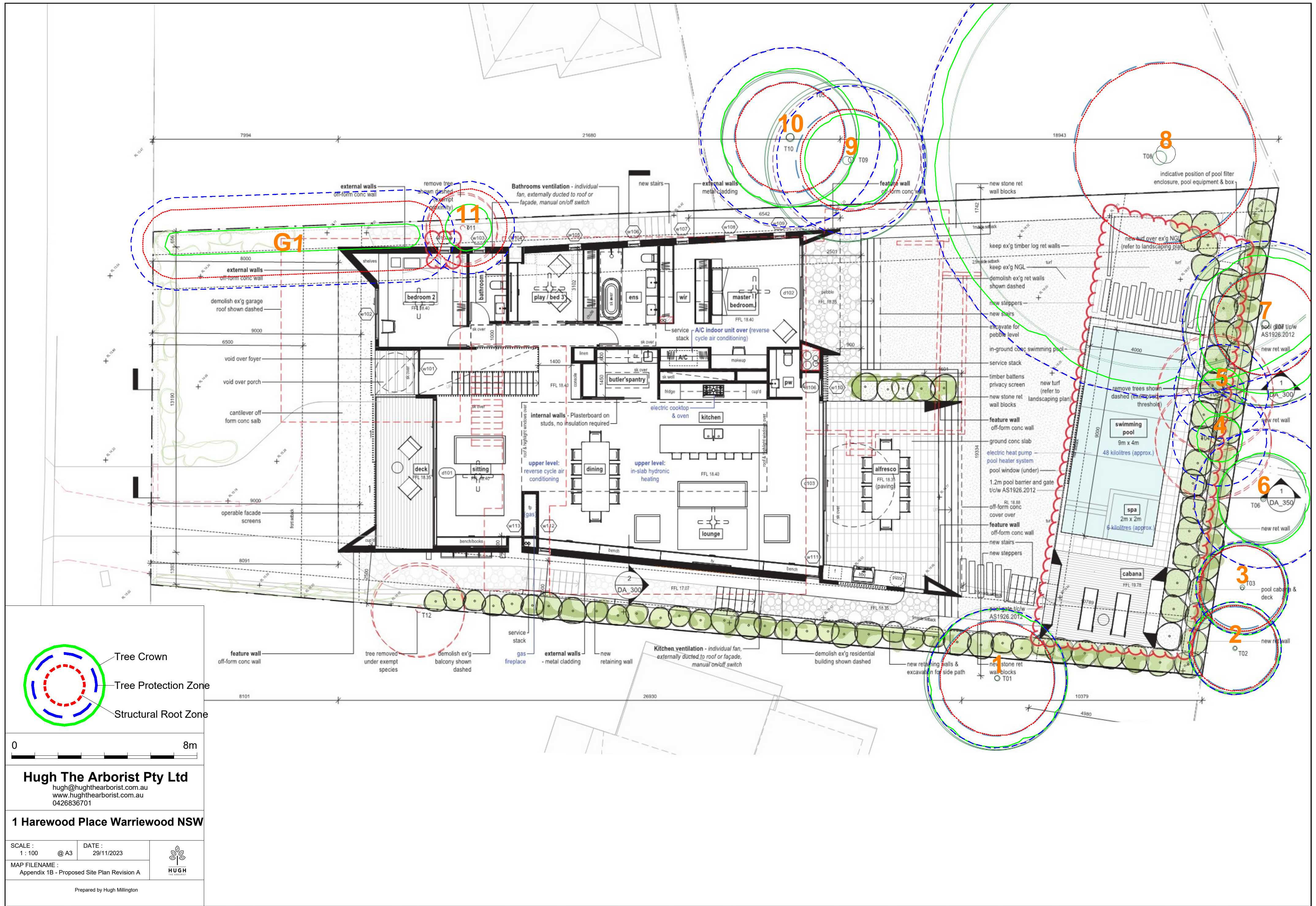
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Appendix 2 - Tree Inspection Schedule

Tree ID	Common Name	Botanical Name	Age Class	Height (m)	Canopy Spread Radius (m)	Stem 1	Stem 2	Stem 3	Stem 4	Stem 5	DBH (mm)	DAB (mm)	Health	Structure	Amenity Value	SULE	Retention Value	TPZ Radius (m)	SRZ Radius (m)	Notes
1	Lilly Pilly	<i>Acmena smithii</i>	Semi-mature	6	3	120	120	120	100	100	251	500	Good	Poor	Low	3. Short	Z10	3.0	2.5	The tree is located within the adjoining property. Regrowth from stump with visible cut line adjacent to boundary fence.
2	Tuckeroo	<i>Cupaniopsis anacardioides</i>	Mature	6	2	120	90				150	250	Good	Good	Medium	1. Long	Z3	2.0	1.8	The tree has not been identified on the survey and is located within the adjoining property. The tree is located behind a masonry wall. Exempt species.
3	Tuckeroo	<i>Cupaniopsis anacardioides</i>	Mature	6	2	120	90				150	250	Good	Good	Medium	1. Long	Z3	2.0	1.8	The tree has not been identified on the survey and is located within the adjoining property. The tree is located behind a masonry wall. Exempt species.
4	Giant Strelitzia	<i>Strelitzia nicolai</i>	Mature	7	1	200					200	300	Good	Good	Very Low	1. Long	Z1	2.4	2.0	None.
5	Giant Strelitzia	<i>Strelitzia nicolai</i>	Mature	7	1	200					200	300	Good	Good	Very Low	1. Long	Z1	2.4	2.0	None.
6	Canary Palm	<i>Phoenix canariensis</i>	Semi-mature	9	2	500					500	NA	Good	Good	Low	1. Long	Z3	3.0	NA	The tree has not been identified on the survey and is located within the adjoining property. The tree is located behind a masonry wall. Exempt species.
7	Broad Leaved Paperbark	<i>Melaleuca quinquenervia</i>	Semi-mature	10	3	300					300	380	Good	Good	Medium	1. Long	A1	3.6	2.2	The tree is located within the adjoining property. DBH estimate. Small sandstone step up separate sites.
8	Port Jackson Fig	<i>Ficus rubiginosa</i>	Mature	12	10	408	300	300	420	500	879	1500	Good	Fair	Medium	2. Medium	A2	10.5	3.9	The tree is located within the adjoining property. Decay in stems and surface roots within site.
9	Weeping Bottlebrush	<i>Callistemon viminalis</i>	Mature	8	2	200	180				269	380	Good	Good	Medium	1. Long	A1	3.2	2.2	The tree is located within the adjoining property.
10	Weeping Bottlebrush	<i>Callistemon viminalis</i>	Mature	8	3	150	180	200	100		324	450	Good	Good	Medium	1. Long	A1	3.9	2.4	The tree has not been identified on the survey and is located within the adjoining property.
11	Lilly Pilly	<i>Acmena smithii</i>	Semi-mature	5	1	70	90				114	200	Good	Good	Low	1. Long	Z2	2.0	1.7	Exempt due to proximity
G1	Mixed Species	<i>Mixed species</i>	Semi-mature	5	0.5	50	80				94	100	Good	Good	Low	1. Long	Z1	2.0	1.5	Group of trees not identified on the survey. Four lilly pilly and four lemon myrtle

Explanatory Notes

Tree Species - Common name followed by botanical name. 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).

Diameter at Breast Height (DBH) - Measured with a DBH tape or estimated at approximately 1.4m above ground level.

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.

Retention Value: Tree AZ, see appendix 3 for categories.

Appendix 3 – Assessment of Health

<u>Category</u>	<u>Example condition</u>	<u>Summary</u>
Good	• 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.	• The tree is in above average health and condition and no remedial works are required.
Fair	• 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.	• The tree is in below average health and condition and may require remedial works to improve the trees health.
Poor	• 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.	• The tree is displaying low levels of health and removal or remedial works may be required.
Dead	• The tree is dead or almost dead.	• The tree should generally be removed.

Appendix 4 Landscape Value

RATING	HERITAGE VALUE	ECOLOGICAL VALUE	AMENITY VALUE
1. SIGNIFICANT	The subject tree is listed as a Heritage Item under the Local Environment Plan (LEP) with a local, state or national level of significance or is listed on Council's Significant Tree Register	The subject tree is scheduled as a Threatened Species as defined under the Threatened Species Conservation Act 1995 (NSW) or the Environmental Protection and Biodiversity Conservation Act 1999	The subject tree has a very large live crown size exceeding 300m ² with normal to dense foliage cover, is located in a visually prominent position in the landscape, exhibits very good form and habit typical of the species
	The subject tree forms part of the curtilage of a Heritage Item (building /structure /artefact as defined under the LEP) and has a known or documented association with that item	The tree is a locally indigenous species, representative of the original vegetation of the area and is known as an important food, shelter or nesting tree for endangered or threatened fauna species	The subject tree makes a significant contribution to the amenity and visual character of the area by creating a sense of place or creating a sense of identity
	The subject tree is a Commemorative Planting having been planted by an important historical person (s) or to Commemorate an important historical event	The subject tree is a Remnant Tree, being a tree in existence prior to development of the area	The tree is visually prominent in view from surrounding areas, being a landmark or visible from a considerable distance
2. VERY HIGH	The tree has a strong historical association with a heritage item (building/structure/artefact/garden etc) within or adjacent the property and/or exemplifies a particular era or style of landscape design associated with the original development of the site.	The tree is a locally-indigenous species, representative of the original vegetation of the area and is a dominant or associated canopy species of an Endangered Ecological Community (EEC) formerly occurring in the area occupied by the site.	The subject tree has a very large live crown size exceeding 200m ² ; a crown density exceeding 70% (normal-dense), is a very good representative of the species in terms of its form and branching habit or is aesthetically distinctive and makes a positive contribution to the visual character and the amenity of the area
3. HIGH	The tree has a suspected historical association with a heritage item or landscape supported by anecdotal or visual evidence	The tree is a locally-indigenous species and representative of the original vegetation of the area and the tree is located within a defined Vegetation Link / Wildlife Corridor or has known wildlife habitat value	The subject tree has a large live crown size exceeding 100m ² ; The tree is a good representative of the species in terms of its form and branching habit with minor deviations from normal (e.g. crown distortion/suppression) with a crown density of at least 70% normal); The subject tree is visible from the street and surrounding properties and makes a positive contribution to the visual character and the amenity of the area
4. MODERATE	The tree has no known or suspected historical association, but does not detract or diminish the value of the item and is sympathetic to the original era of planting.	The subject tree is a non-local native or exotic species that is protected under the provisions of this DCP.	The subject tree has a medium live crown size exceeding 40m ² ; The tree is a fair representative of the species, exhibiting moderate deviations from typical form (distortion/suppression etc) with a crowndensity of more than 50% (thinning to normal); and The tree is visible from surrounding properties, but is not visually prominent – view may be partially obscured by other vegetation or built forms. The tree makes a fair contribution to the visual character and amenity of the area.
5. LOW	The subject tree detracts from heritage values or diminishes the value of a heritage item	The subject tree is scheduled as exempt (not protected) under the provisions of this DCP due to its species, nuisance or position relative to buildings or other structures.	The subject tree has a small live crown size of less than 40m ² and can be replaced within the short term (5-10 years) with new tree planting
6. VERY LOW	The subject tree is causing significant damage to a heritage Item.	The subject tree is listed as an Environment Weed Species in the Local Government Area, being invasive, or is a known nuisance species.	The subject tree is not visible from surrounding properties (visibility obscured) and makes a negligible contribution or has a negative impact on the amenity and visual character of the area. The tree is a poor representative of the species, showing significant deviations from the typical form and branching habit with a crown density of less than 50% (sparse).
7. INSIGNIFICANT	The tree is completely dead and has no visible habitat value	The tree is a declared Noxious Weed under the Noxious Weeds Act (NSW) 1993 within the relevant Local Government Area.	The tree is completely dead and represents a potential hazard.

Appendix 5 - Age class

Determining the exact age of a tree is difficult without carrying out potentially invasive testing. The age class of the subject tree has been estimated using the definitions below.

<u>Category</u>	<u>Description</u>
Young/Newly planted	• Young or recently planted tree.
Semi Mature	• Up to 20% of the usual life expectancy for the species.
Early mature/Mature	• Between 20% - 80% of the usual life expectancy for the species.
Over mature	• Over 80% of the usual life expectancy for the species.
Dead	• Tree is dead or almost dead.

Appendix 4 - Structural condition

<u>Category</u>	<u>Example condition</u>	<u>Summary</u>
Good	• 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.	• The tree is considered structurally good with well developed form.
Fair	• 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.	• The identified defects are unlikely cause major failure. • Some branch failure may occur in usual conditions. • Remedial works can be undertaken to alleviate potential defects.
Poor	• 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.	• 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.

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.

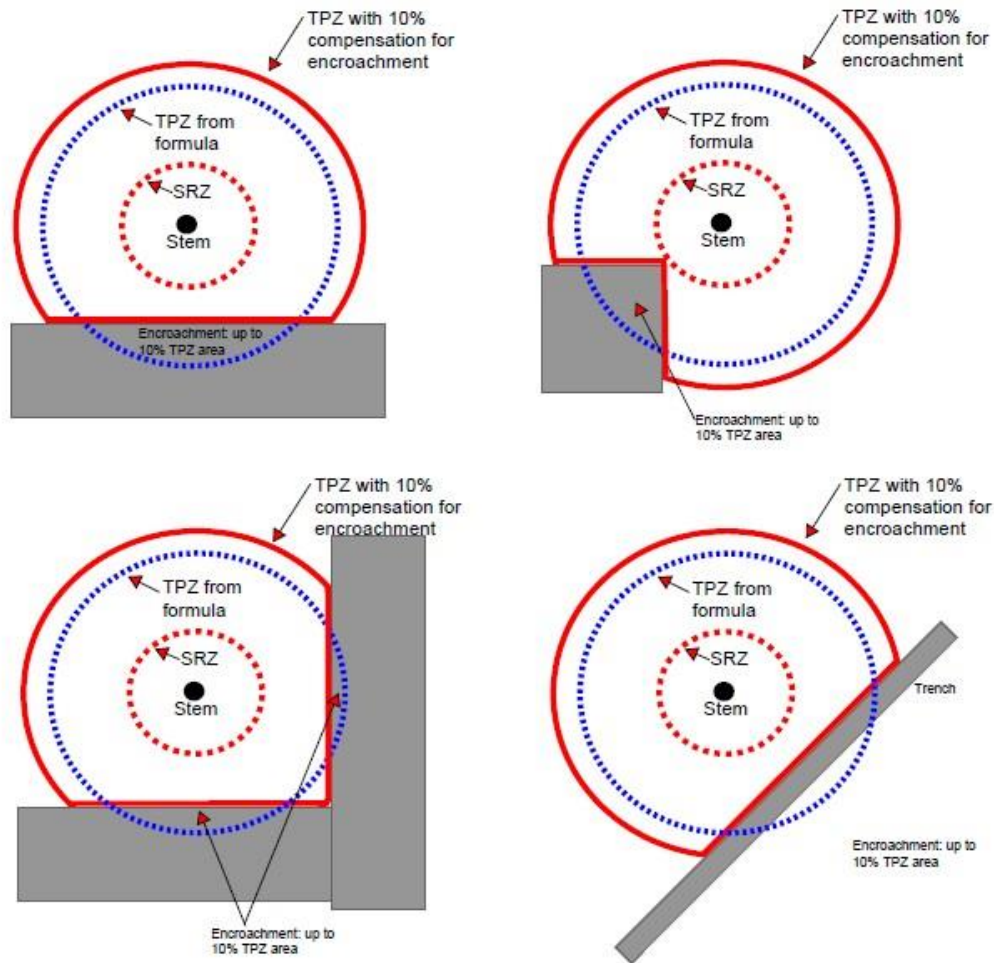
Category A: Important trees suitable for retention for more than 10 years and worthy of being a material constraint

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.