URBAN ARBOR
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HASH-00-SD-TM-RP-0001

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Arboricultural Impact Assessment Report

Site location:

Hurlstone Agricultural High School
Hawkesbury Campus
Londonderry Road
Richmond NSW

Prepared for: Conrad Gargett Ancher Mortlock Woolley

Prepared by: Bryce Claassens
Urban Arbor Pty Ltd
Date Prepared: 10 October 2017
Ref: 17/10/10/WSU

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1. EXECUTIVE SUMMARY

1.1 This report assesses the impact of a proposed development at the subject site to thirty-five (35) trees located either inside or adjoining the site, in accordance with AS4970 Protection of trees on development sites (2009).

1.2 A site plan has been included in Appendix 1, where the indicative TPZ/SRZ of the trees assessed have been overlaid onto the proposed landscape master plan provided by the client to assist with understanding tree constraints at the site and how the impact to trees has been assessed. Appendix 1 also includes site-specific tree protection.

1.3 Twenty-three (23) trees will have to be removed to accommodate the development. Sixteen of these are higher value category A retention value trees including 1, 2, 18, 21, 22, 24, 25, 26, 27, 28, 29, 30, 31, 32, 32 and 35. Seven trees are lower value category Z retention value trees including tree 3, 7, 16, 17, 19, 20 and 23, these trees are not worthy of being a constraint to the development, due to poor existing condition, undesirable species or small/young trees that could be replaced with higher value trees within a ten-year time period.

1.4 Three (3) trees will be subject to TPZ encroachments greater than 10%, including tree 4, 15 and 34. Tree 4^{AA} and 34 are higher value category A retention value trees (Tree 4 has been awarded an increased 'AA' retention value rating due to its high amenity and long SULE), and tree 15 is a lower value category Z retention value tree. All three trees will remain viable for retention providing the proposed hard surfacing is completed in accordance with section 9.3.1.

1.5 The remaining trees will be subject to minor and acceptable TPZ encroachments of 10% or less and can be retained in a viable condition, including trees 5, 6, 8, 9, 10, 11, 12, 13 and 14.

1.6 All trees to be retained must be protected for the duration of development, (including demolition and landscaping, in accordance with AS4970-2009). See section 12 for more information.

1.7 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.

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2. INTRODUCTION

2.1 Urban Arbor have been instructed by Conrad Gargett Ancher Mortlock Woolley to provide an Arboricultural Impact Assessment Report in relation to trees located on the site and adjoining neighbouring sites in relation to a proposed development.

2.2 Below is a list of all documents and information provided to Urban Arbor by the client to assist in preparing this report.

A) Landscape Architectural Package, Conrad Gargett Ancher Mortlock Woolley, School ID: HASH, Project No: 16052, including the following documents:

Landscape Drawing List	
Sheet Number	Sheet Name
101	Cover Sheet
102	Landscape Master Plan
103	Landscape Finishes Schedule
104	Planting Schedule
105	Irrigation Extent Plan - Sheet 1
106	Irrigation Extent Plan - Sheet 2
107	Trees to be Retained and Removed
201	Assembly Court - Enlargement Plan
202	Assembly Court - 3D Views
203	Assembly Court - Sections
204	Assembly Court - Seating Details
205	Assembly Court - Planting Palette
301	Agricultural Narrative and Food Forest - Enlargement Plan Sheet 1
302	Agricultural Narrative and Food Forest - Enlargement Plan Sheet 2
303	Food Forest - 3D Views
304	Food Forest - Section and Details
401	Outdoor Learning Area - Enlargement Plan
402	Outdoor Learning - 3D Views
501	Library and Outdoor Dining - Enlargement Plan
502	Library and Outdoor Dining - 3D Views

2.3 Urban Arbor carried out one tree inspection on 7 September 2017. Access was available to the subject site and adjoining public areas only. All tree data contained in this report was collected during this site inspection.

3. SCOPE OF THE REPORT

3.1 This report has been undertaken to meet the following objectives.

2.1.1 Conduct a visual assessment from ground level of all significant trees located inside or adjoining the site, of any tree within 5 metres of proposed development works. For the purpose of this report a tree with a height greater than 4m is a significant tree.

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).

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4. LIMITATIONS

4.1 The observations and recommendations are based on the site inspections identified in the introduction (section 1) and the access available at the time of inspection. Findings of this report are based on the observations and site conditions at the time inspection.

4.2 All of the observations were carried out from ground level and none of the surrounding surfaces were lifted or removed during the inspection. No tests were carried out to the subject trees or surrounding area during the inspection.

4.1 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.

4.2 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.

4.3 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 an *spp*.

4.4 All diagrams, plans and photographs included in this report are visual aids only, and are not to scale unless otherwise indicated.

4.5 Urban Arbor neither guarantees, nor is it responsible for, the accuracy of information provided by others that is contained within this report.

4.6 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.

4.7 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.

4.8 Alteration of this report invalidates the entire report.

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5. METHODOLOGY

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

5.1.1 Tree common name

5.1.2 Tree botanical name

5.1.3 Tree age class

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

5.1.5 Estimated height - metres

5.1.6 Estimated crown spread (diameter of crown) - metres

5.1.7 Health

5.1.8 Structural condition

5.1.9 Amenity value

5.1.10 Estimated remaining contribution years (SULE)[1]

5.1.11 Retention value (Tree AZ)[2]

5.1.12 Notes/comments

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

5.3 Tree diameter was measured using a DBH tape or in some cases 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.

5.4 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) [4] and in some cases estimated. See appendices for information.

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

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[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 10.04-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).

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

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6. SITE LOCATION AND BRIEF DESCRIPTION

6.1 The site is located in the suburb of Richmond, New South Wales, which is located within the Hawkesbury Local Government Area (LGA) and all trees at the site are subject to protection under the Hawkesbury Local Environmental Plan (LEP) 2012[5] and Development Control Plan (DCP) 2002.[6] The site is not located inside a Heritage Conservation Area or forms part of a heritage item or listed as environmental heritage in the LEP heritage maps.[7] The Southern strip of trees within the site/neighbouring site has been identified as 'Significant Vegetation' in the LEP biodiversity maps.[8]

6.2 Proposed works include the construction of the new Hurlstone Agricultural High School (Hawkesbury Campus), including proposed buildings/classrooms, hard surfacing, and landscaping.

[5] *Hawkesbury Local Environmental Plan 2012*, http://www.legislation.nsw.gov.au/, accessed 22 September 2017.

[6] *Hawkesbury Development Control Plan 2002,* https://www.hawkesbury.nsw.gov.au/development/development-information/development-control-plan, accessed 22 September 2017.

[7] *Hawkesbury LEP Heritage map - Sheet HER_008BA*, http://www.legislation.nsw.gov.au/maps/d8d365b2-50f4-42c9-99d3-822f243434e2/6700_COM_HER_004_010_20140528.pdf, accessed 22 September 2017.

[8] *Hawkesbury LEP Biodiversity map - Sheet BIO_008BA,* https://www.legislation.nsw.gov.au/maps/67824f0d-f040-65b6-fe6c-cb07a22b2ee0/3800_COM_BIO_008BA_020_20120314.pdf, accessed 22 September 2017.

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7. GENERAL INFORMATION IN RELATION TO PROTECTING TREES ON DEVELOPMENT SITES

7.1 **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 significant further than the indicative TPZ, however the TPZ is an area identified AS4970-2009 to be extent where root loss or disturbance will generally not 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). The TPZ of palms, other monocots, cycads and tree ferns has been calculated at one metre outside the crown projection. In the appendices, additional information has been included about the TPZ including information about calculating the TPZ and examples of TPZ encroachment.

7.2 **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. See appendices for more information about the SRZ.

7.3 **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.

7.4 **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.

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8. OBSERVATIONS

8.1 **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) for the subject trees has been calculated. The TPZ and SRZ should be measured in radius from the centre of the trunk. The subject trees have been awarded a retention value based on the observations during the site inspection. The system 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. The Tree AZ categories sheet (Barrell Tree Consultancy) has been included in the appendices 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. This information has been summarised below.

8.2 **Site plan:** A site plan has been included in Appendix 1, where the indicative TPZ/SRZ of the trees assessed have been overlaid onto the proposed landscape master plan provided by the client to assist with understanding tree constraints at the site and how the impact to trees has been assessed. Appendix 1 also includes site-specific tree protection.

9. ASSESSEMENT OF CONSTRUCTION IMPACTS

9.1 Table 1: In the table below I have summarised the impact of proposed development impact to all trees included in the report. As some trees have not been recorded on the received site survey, unmarked trees have been included and new tree numbers have been allocated to all trees and the TPZ encroachment percentage has been estimated based on the available information.

Tree ID	Botanical Name	Retention Value	TPZ radius (m)	TPZ area (m^2)	SRZ radius (m)	TPZ encroachment	Discussion/ Conclusion	Recommendation
1	*Pyrus calleryana*	A1	3.9	47.8	2.7	Major	Tree identified for removal on received tree retention plan. Trunk is located directly adjacent to the proposed new access road.	Remove
2	*Pyrus calleryana*	A1	2.0	12.6	1.7	Major	Tree identified for removal on received tree retention plan. Trunk is located directly adjacent to the proposed new access road.	Remove
3	*Populus nigra var betulifolia*	Z3	5.4	91.6	3.2	Footprint	Tree identified for removal on received tree retention plan. Trunk is located within the footprint of the proposed development. Tree is an exempt species and should not be a constraint to the development.	Remove.
4	*Angophora floribunda*	AA1	15.0	706.9	4.9	Major	Proposed hard surfacing will encroach into the TPZ by 25% (177.5m^2), but not into the SRZ. This is considered to be a major encroachment and could potentially impact the condition of the tree. However, providing the hard surfacing is installed on or above grade and in accordance with section 9.3.1, the impact to the tree will be minor and acceptable. Remaining works in the TPZ include landscaping to create a new turfed area, which will have minimal impact to the tree providing existing soil grades are not significantly altered. All landscaping inside the TPZ must be undertaken in accordance with section 9.3.	Retain and Protect.
5	*Cinnamomum camphora*	Z3	6.9	149.6	3.3	Minor (LS Only)	Works inside the TPZ include landscaping to create a new amenity planting bed, which will have minimal impact to the tree providing existing soil grades are not significantly altered. All landscaping inside the TPZ must be undertaken in accordance with section 9.3.	Retain and Protect.

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6	*Angophora floribunda*	A1	8.2	211.2	3.2	Minor (LS Only)	Not marked on received survey. Works inside the TPZ include landscaping to create a new amenity planting bed, which will have minimal impact to the tree providing existing soil grades are not significantly altered. All landscaping inside the TPZ must be undertaken in accordance with section 9.3.	Retain and Protect.
7	*Angophora floribunda*	Z4	10.8	366.4	3.6	Minor (LS Only)	Landscaping only inside TPZ. However, tree is dead and should not be a constraint to the development. To avoid damage to the root systems of adjacent trees, stump grinding is not recommended when removing the tree.	Remove.
8	*Angophora floribunda*	A2	4.2	55.4	2.3	Minor (LS Only)	Not marked on received survey. Live sucker of adjacent dead tree. Works inside the TPZ include landscaping to create a new amenity planting bed, which will have minimal impact to the tree providing existing soil grades are not significantly altered. All landscaping inside the TPZ must be undertaken in accordance with section 9.3.	Retain and Protect.
9	*Angophora floribunda*	A1	7.6	181.5	3.2	Minor (LS Only)	Not marked on received survey. Works inside the TPZ include landscaping to create a new amenity planting bed, which will have minimal impact to the tree providing existing soil grades are not significantly altered. All landscaping inside the TPZ must be undertaken in accordance with section 9.3.	Retain and Protect.
10	*Angophora floribunda*	A1	10.8	366.4	3.6	None	Not marked on received survey. No proposed TPZ encroachment.	Retain and Protect.
11	*Eucalyptus melliodora*	Z5	10.8	366.4	3.6	None	No proposed TPZ encroachment.	Retain and Protect.
12	*Eucalyptus melliodora*	A1	11.5	415.5	3.7	None	No proposed TPZ encroachment.	Retain and Protect.
13	*Eucalyptus melliodora*	A1	3.7	43.0	2.4	None	No proposed TPZ encroachment.	Retain and Protect.
14	*Eucalyptus melliodora*	A1	3.8	45.4	3.0	None	Not marked on received survey. No proposed TPZ encroachment.	Retain and Protect.
15	*Pinus radiata*	Z3	6.7	141.0	3.2	Major	Proposed hard surfacing will encroach into the TPZ by 13% (18.1m^2), but not into the SRZ. This is considered to be a major encroachment and could potentially impact the condition of the tree. However, providing the hard surfacing is installed on or above grade and in accordance with section 9.3.1, the impact to the tree will be minor and acceptable. Remaining works in the TPZ include landscaping to create a new turfed area, which will have minimal impact to the tree providing existing soil grades are not significantly altered. All landscaping inside the TPZ must be undertaken in accordance with section 9.3.	Retain and Protect.

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16	*Populus nigra var betulifolia*	Z3	8.4	221.7	3.1	Major	Tree identified for removal on received tree retention plan. Trunk is located directly adjacent to the proposed development. Tree is an exempt species and should not be a constraint to the development.	Remove.
17	*Populus nigra var betulifolia*	Z3	4.8	72.4	2.7	Footprint	Tree identified for removal on received tree retention plan. Trunk is located within the footprint of the proposed development. Tree is an exempt species and should not be a constraint to the development.	Remove.
18	*Pyrus calleryana*	A1	4.2	55.4	2.3	Major	Tree identified for removal on received tree retention plan. Trunk is located directly adjacent to the proposed development.	Remove.
19	*Cinnamomum camphora*	Z3	4.2	55.4	2.8	Footprint	Tree identified for removal on received tree retention plan. Trunk is located within the footprint of the proposed development. Tree is an exempt species and should not be a constraint to the development.	Remove.
20	*Cinnamomum camphora*	Z3	6.0	113.1	2.7	Footprint	Not marked on received survey. Trunk is located within the footprint of the proposed wetlands. Tree is an exempt species and should not be a constraint to the development.	Remove.
21	*Casuarina glauca*	A1	7.0	153.9	3.2	Footprint	Tree identified for removal on received tree retention plan. Trunk is located within the footprint of proposed development works. Native tree located within land zoned SP1. Removal subject to approval by Hawkesbury council.	Remove.
22	*Casuarina glauca*	A1	5.3	88.3	2.6	Footprint	Tree identified for removal on received tree retention plan. Trunk is located within the footprint of proposed development works. Native tree located within land zoned SP1. Removal subject to approval by Hawkesbury council.	Remove.
23	*Cinnamomum camphora*	Z3	4.8	72.4	2.7	Footprint	Tree identified for removal on received tree retention plan. Trunk is located within the footprint of proposed development works. Tree is an exempt species and should not be a constraint to the development.	Remove.
24	*Casuarina glauca*	A1	5.3	88.3	2.6	Footprint	Tree identified for removal on received tree retention plan. Trunk is located within the footprint of proposed development works. Native tree located within land zoned SP1. Removal subject to approval by Hawkesbury council.	Remove.
25	*Casuarina glauca*	A1	4.9	75.4	2.5	Footprint	Tree identified for removal on received tree retention plan. Trunk is located within the footprint of proposed development works. Native tree located within land zoned SP1. Removal subject to approval by Hawkesbury council.	Remove.
26	*Casuarina glauca*	A1	4.7	69.4	2.5	Footprint	Tree identified for removal on received tree retention plan. Trunk is located within the footprint of proposed development works. Native tree located within land zoned SP1. Removal subject to approval by Hawkesbury council.	Remove.
27	*Casuarina glauca*	A1	4.9	75.4	2.5	Footprint	Tree identified for removal on received tree retention plan. Trunk is located within the footprint of proposed development works. Native tree located within land zoned SP1. Removal subject to approval by Hawkesbury council.	Remove.
28	*Casuarina glauca*	A1	4.3	58.1	2.4	Footprint	Tree identified for removal on received tree retention plan. Trunk is located within the footprint of proposed development works. Native tree located within land zoned SP1. Removal subject to approval by Hawkesbury council.	Remove.

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29	*Casuarina glauca*	Z9	4.6	66.5	2.5	Footprint	Tree identified for removal on received tree retention plan. Trunk is located within the footprint of proposed development works. Native tree located within land zoned SP1. Removal subject to approval by Hawkesbury council.	Remove.
30	*Casuarina glauca*	A1	3.8	45.4	2.3	Footprint	Tree identified for removal on received tree retention plan. Trunk is located within the footprint of proposed development works. Native tree located within land zoned SP1. Removal subject to approval by Hawkesbury council.	Remove.
31	*Casuarina glauca*	A1	3.4	36.3	2.2	Footprint	Tree identified for removal on received tree retention plan. Trunk is located within the footprint of proposed development works. Native tree located within land zoned SP1. Removal subject to approval by Hawkesbury council.	Remove.
32	*Casuarina glauca*	A1	6.0	113.1	2.6	Footprint	Tree identified for removal on received tree retention plan. Trunk is located within the footprint of proposed development works. Native tree located within land zoned SP1. Removal subject to approval by Hawkesbury council.	Remove.
33	*Casuarina glauca*	A1	4.7	69.4	2.5	Footprint	Tree identified for removal on received tree retention plan. Trunk is located within the footprint of proposed development works. Native tree located within land zoned SP1. Removal subject to approval by Hawkesbury council.	Remove.
34	*Pyrus calleryana*	A1	9.6	289.5	3.3	Major	Proposed hard surfacing will encroach into the TPZ by 30% (88.0m^2), but not into the SRZ. This is considered to be a major encroachment and could potentially impact the condition of the tree. However, providing the hard surfacing is installed on or above grade and in accordance with section 9.3.1, the impact to the tree will be minor and acceptable. Remaining works in the TPZ include landscaping to create a new turfed area, which will have minimal impact to the tree providing existing soil grades are not significantly altered. All landscaping inside the TPZ must be undertaken in accordance with section 9.3.	Retain and Protect.
35	*Pyrus calleryana*	A1	5.5	95.0	2.8	Major	Tree identified for removal on received tree retention plan. Trunk is located directly adjacent to the proposed development.	Remove.

Notes

TPZ Encroachment Percentage: TPZ encroachment percentages are based on new structures (i.e. buildings, retaining walls) and hard surfaces only. New soft landscaping, such as turf or amenity planting areas have not been included in the calculation for TPZ encroachment.
Minor (LS only): Only soft landscaping works proposed in TPZ.

9.2 General Landscaping Requirements

New landscaping is proposed inside the TPZ of the majority of the trees at the site. If the trees are to be retained in a viable condition, the landscaping must be undertaken in a tree sensitive method to ensure trees are adversely impacted by the landscape construction.

9.2.1 Structural Root Zone: This is the area of structural woody roots around the base of trunk required for tree stability. No roots greater than 30mm inside the SRZ should be severed or damaged, unless the impact of the root pruning has been assessed and approved by the project Arborist.

9.2.2 Soil Grades: Existing soil grades inside the TPZ of trees to should not be significantly altered, to minimise impact to the trees root system. The existing soil grades inside the TPZ must be lowered by more than 50mm, as this could result in removing significant fibrous root mass, impacting the trees health and vigour. Where soil grades must be lowered by more than 50mm, consultation is required from the project Arborist to assess the impact to the individual tree(s). Soil level increases should also be minimised, as this can restrict the availability of water, nutrients and air to root system below. Soil level must not be increased by more than 100mmm inside the TPZ, unless assessed and approved by the project Arborist.

9.2.3 Soil compaction: As described in AS4970-2009, apart from the actual removal of roots during excavation or trenching, soil compaction is one of the major causes of root damage on development sites. Compaction is defined as the loss of large pore spaces (macropores) within the soil with a net loss of total pore space. Macropores are essential for the exchange of gases between the soil air and the atmosphere (aeration) and the removal of excess water from the soil (drainage). Soil compaction must be minimised during the development works.

9.2.4 Demolition/Removal of existing hard surfaces/structures: 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/hard surface 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 lowest layers of sub base of are to be carefully removed in maximum 50mm to minimise potential damage to the underlying root system. Existing turf must be removed manually inside the TPZ.

9.2.5 Soil preparation: Any cultivation of soil inside the TPZ of trees to be retained in preparation for laying turf/grass must be undertaken manually. The soil should be carefully forked through, and approximately 20% organic matter introduced to improve soil condition. Roots greater than 30mm in diameter should be retained. After any existing hard surfaces are and sub based are removed, good quality top soil free of contaminants should be used to fill in the excavated area and bring flush with surrounding levels within new landscape areas. Soil must be imported and spread manually, when the underlying soil conditions are dry to avoid compaction of the soil profile.

9.2.6 Sub base Materials: Where sub base is used inside the TPZ of trees to be retained, sub base material should be a coarse aggregate/granular material that does not

restrict the flow of water and air to the root system below. A layer of permeable geotextile fabric should be placed over the soil surface, between the soil and lowest level of sub base. Where hard surfaces are being replaced with new hard surfacing, the lowest layers of sub base should be retained and re used to avoid unnecessary root disturbance.

9.3 Site Specific Landscaping Specifications

9.3.1 New Paving/Decorative Gravel/Hard Surfaces: To ensure that tree root systems are not significantly impacted, all new hard surfaces should be constructed on or above existing soil grades. If the new hard surface is replacing and existing hard surface, the existing sub base should be retained where possible to minimise root disturbance. Compaction of lowest sub base materials must be minimised, as this can cause soil compaction and impact the health of trees. Sub base must be in accordance with section 9.2.6.

9.3.2 Turf Cells/Amenity Grass: Soil preparation must be in accordance with section 9.2.5. Roots greater than 30mm in diameter should be retained. Water saving crystals must not be used in the TPZ of trees to be retained, as these can draw moisture from tree roots and damage the trees health.

9.3.3 Amenity Planting Areas: 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. Any replacement trees must be selected in accordance with AS2303-2015 Tree stock for landscape use. Soil preparation in accordance with section 9.2.5.

9.3.4 Drainage pipes/Underground services: Where possible underground services and drainage pipes should be located outside the TPZ of trees to be retained. Where this is not possible, they 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. Section 4.5.5 of AS4970-2009 says that 'The directional drilling bore should be at least 600 mm deep. The project Arborist should assess the likely impacts of boring and bore pits on retained trees. For manual excavation of trenches the project Arborist should advise on roots to be retained and should monitor the works'.[9] Roots greater than 30mm should be retained and the pipe threaded above/below the roots to allow for their retention.

[9] Council Of Standards Australia, *AS 4970 Protection of trees on development sites* (2009) page 18.

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10. CONCLUSIONS

10.1 **Table 2:** Summary of the impact to trees during the development;

Impact	Reason	Category A		Category Z
		AA	A	Z
Trees to be removed	Building construction, new surfacing and/or proximity, or trees in poor condition.	None	1, 2, 18, 21, 22, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 45 (Sixteen trees)	3, 7, 16, 17, 19, 20, 23 (Seven trees)
Retained trees subject to TPZ encroachment greater than 10%	Removal of existing surfacing/structures and/or installation of new surfacing/structures	4 (One tree)	34 (One tree)	15 (One tree)
Retained trees subject to TPZ encroachment of 10% or less	Removal of existing surfacing/structures and/or installation of new surfacing/structures	None	6, 8, 9, 10, 12, 13, 14 (Seven trees)	5, 11 (Two trees)

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11. RECOMMENDATIONS

11.1 This report assesses the impact of a proposed development at the subject site to thirty-five (35) trees located either inside or adjoining the site, in accordance with AS4970 Protection of trees on development sites (2009).

11.2 A site plan has been included in Appendix 1, where the indicative TPZ/SRZ of the trees assessed have been overlaid onto the proposed landscape master plan provided by the client to assist with understanding tree constraints at the site and how the impact to trees has been assessed. Appendix 1 also includes site-specific tree protection.

11.3 Twenty-three (23) trees will have to be removed to accommodate the development. Sixteen of these are higher value category A retention value trees including 1, 2, 18, 21, 22, 24, 25, 26, 27, 28, 29, 30, 31, 32, 32 and 35. Seven trees are lower value category Z retention value trees including tree 3, 7, 16, 17, 19, 20 and 23, these trees are not worthy of being a constraint to the development, due to poor existing condition, undesirable species or small/young trees that could be replaced with higher value trees within a ten-year time period.

11.4 Three (3) trees will be subject to TPZ encroachments greater than 10%, including tree 4, 15 and 34. Tree 4^{AA} and 34 are higher value category A retention value trees (Tree 4 has been awarded an increased 'AA' retention value rating due to its high amenity and long SULE), and tree 15 is a lower value category Z retention value tree. All three trees will remain viable for retention providing the proposed hard surfacing is completed in accordance with section 9.3.1.

11.5 The remaining trees will be subject to minor and acceptable TPZ encroachments of 10% or less and can be retained in a viable condition, including trees 5, 6, 8, 9, 10, 11, 12, 13 and 14.

11.6 All trees to be retained must be protected for the duration of development, (including demolition and landscaping, in accordance with AS4970-2009). See section 12 for more information.

11.7 No services plan has been assessed in this report. Where possible underground services must 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. Section 4.5.5 of AS4970-2009 says that 'The directional drilling bore should be at least 600 mm deep. The project Arborist should assess the likely impacts of boring and bore pits on retained trees. For manual excavation of trenches the project Arborist should advise on roots to be retained and should monitor the works'.[10]

11.8 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] Council Of Standards Australia, *AS 4970 Protection of trees on development sites* (2009) page 18.

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12. TREE PROTECTION REQUIREMENTS

12.1 **Use of this report:** All contractors must be made aware of the tree protection requirements prior to commencing works at the site. This report and a copy of the proposed site plan drawing (Appendix 1) must also be made available to any contractor prior to works commencing and during any on site operations.

12.2 **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.

12.3 **Tree work:** All tree work must be carried out by a qualified and experienced Arborist with a minimum of AQF level 2 in arboriculture, in accordance with NSW Work Cover Code of Practice for the Amenity Tree Industry (1998) and AS4373 Pruning of amenity trees (2007).

12.4 **Initial site meeting/on-going regular inspections:** The project Arborist is to hold a pre-construction site meeting with principle 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 site inspections on a two-month frequency.

12.5 **Site Specific Tree Protection Recommendations:** The table below provides recommendations for each tree, including site specific tree protection requirements. All trees to be retained must be protected in accordance with general requirements of AS4970-2009 for the duration of the development, details of which are discussed in further details in this section of the report.

Tree ID	Botanical Name	TPZ Radius (m)	SRZ Radius (m)	Recommendations
1	*Pyrus calleryana*	3.9	2.7	Remove and replace.
2	*Pyrus calleryana*	2.0	1.7	Remove and replace.
3	*Populus nigra var betulifolia*	5.4	3.2	Remove and replace.
4	*Angophora floribunda*	15.0	4.9	Retain and Protect. Tree protection fencing required. Fencing to encompass TPZ perimeter (15m radius from centre of trunk) within site only. Fencing only to be moved for installation of hard surfacing and landscaping under the supervision and approval of the project Arborist.

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5	*Cinnamomum camphora*	6.9	3.3	Retain and Protect. Tree protection fencing required. Fencing to encompass tree 5, 6, 8 and 9. Fencing to run along the TPZ perimeter of tree 5 and 6, within site only. Fencing only to be moved for demolition and landscaping under the supervision and approval of the project Arborist.
6	*Angophora floribunda*	8.2	3.2	Retain and Protect. Tree protection fencing required. Fencing to encompass tree 5, 6, 8 and 9. Fencing to run along the TPZ perimeter of tree 5 and 6, within site only. Fencing only to be moved for demolition and landscaping under the supervision and approval of the project Arborist.
7	*Angophora floribunda*	10.8	3.6	Remove.
8	*Angophora floribunda*	4.2	2.3	Retain and Protect. Tree protection fencing required. Fencing to encompass tree 5, 6, 8 and 9. Fencing to run along the TPZ perimeter of tree 5 and 6, within site only. Fencing only to be moved for demolition and landscaping under the supervision and approval of the project Arborist.
9	*Angophora floribunda*	7.6	3.2	Retain and Protect. Tree protection fencing required. Fencing to encompass tree 5, 6, 8 and 9. Fencing to run along the TPZ perimeter of tree 5 and 6, within site only. Fencing only to be moved for demolition and landscaping under the supervision and approval of the project Arborist.
10	*Angophora floribunda*	10.8	3.6	Retain. Set back significantly from proposed works. No protection required.
11	*Eucalyptus melliodora*	10.8	3.6	Retain. Set back significantly from proposed works. No protection required.
12	*Eucalyptus melliodora*	11.5	3.7	Retain. Set back significantly from proposed works. No protection required.
13	*Eucalyptus melliodora*	3.7	2.4	Retain. Set back significantly from proposed works. No protection required.
14	*Eucalyptus melliodora*	3.8	3.0	Retain. Set back significantly from proposed works. No protection required.
15	*Pinus radiata*	6.7	3.2	Retain and Protect. Tree protection fencing required. Fencing to encompass TPZ perimeter (6.7m radius from centre of trunk). Fencing only to be moved for installation of hard surfacing and landscaping under the supervision and approval of the project Arborist.
16	*Populus nigra var betulifolia*	8.4	3.1	Remove and replace.
17	*Populus nigra var betulifolia*	4.8	2.7	Remove and replace.
18	*Pyrus calleryana*	4.2	2.3	Remove and replace.
19	*Cinnamomum camphora*	4.2	2.8	Remove and replace.
20	*Cinnamomum camphora*	6.0	2.7	Remove and replace.

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21	*Casuarina glauca*	7.0	3.2	Remove and replace.
22	*Casuarina glauca*	5.3	2.6	Remove and replace.
23	*Cinnamomum camphora*	4.8	2.7	Remove and replace.
24	*Casuarina glauca*	5.3	2.6	Remove and replace.
25	*Casuarina glauca*	4.9	2.5	Remove and replace.
26	*Casuarina glauca*	4.7	2.5	Remove and replace.
27	*Casuarina glauca*	4.9	2.5	Remove and replace.
28	*Casuarina glauca*	4.3	2.4	Remove and replace.
29	*Casuarina glauca*	4.6	2.5	Remove and replace.
30	*Casuarina glauca*	3.8	2.3	Remove and replace.
31	*Casuarina glauca*	3.4	2.2	Remove and replace.
32	*Casuarina glauca*	6.0	2.6	Remove and replace.
33	*Casuarina glauca*	4.7	2.5	Remove and replace.
34	*Pyrus calleryana*	9.6	3.3	Retain and Protect. Tree protection fencing required. Fencing to encompass TPZ perimeter (9.6m radius from centre of trunk) within site only. Fencing only to be moved for installation of hard surfacing and landscaping under the supervision and approval of the project Arborist.
35	*Pyrus calleryana*	5.5	2.8	Remove and replace.

12.6 **Tree protection Specifications:** It is the responsibility of the principle 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.

12.6.1 Protective fencing: Site specific tree protection requirements are discussed in table section 12.5. 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 in 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.

12.6.2 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

12.6.3 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.

12.6.4 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.

12.6.5 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.

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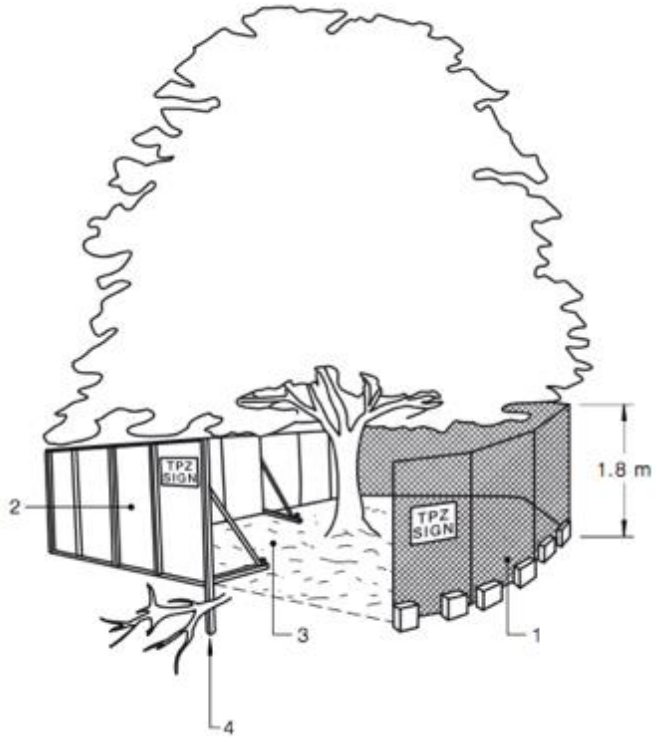

LEGEND:
1 Chain wire mesh panels with shade cloth (if required) attached, held in place with concrete feet.
2 Alternative plywood or wooden paling fence panels. This fencing material also prevents building materials or soil entering the TPZ.
3 Mulch installation across surface of TPZ (at the discretion 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,[11] with example tree protection.

[11] Council Of Standards Australia, *AS4970 Protection of trees on development sites* (2009), page 16.

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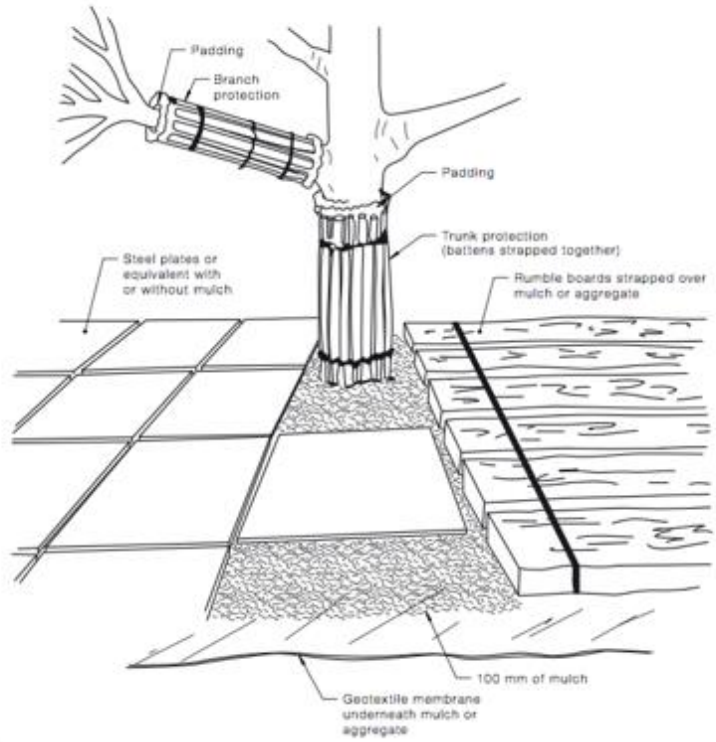

NOTES:

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,[12] with example tree protection.

12.7 **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.

[12] Council Of Standards Australia, *AS4970 Protection of trees on development sites* (2009), page 17.

12.8 **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.

12.9 **Excavations:** 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).[13] 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.

12.10 **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.

- 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.
- 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.
- 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

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

root disturbance and consider using a permeable surface. Footpath should be located outside the SRZ.

- Where fill/sub base is used inside the TPZ, fill material should be a coarse granular material that does not restrict the flow of water and air to the root system below. This type of material will also reduce the impact of soil compaction during construction.
- 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.

12.11 **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.

12.12 **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.

12.13 **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.

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13. CONSTRUCTION HOLD POINTS FOR TREE PROTECTION

13.1 **Hold Points:** Below is a sequence of hold points requiring project Arborist certification throughout the development process**.** It provides a list of hold points that 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. The principle contractor should be responsible for implemented all tree protection requirements.

Hold Point	Stage	Date Completed and Signature of Project Arborist Responsible
Project Arborist to hold pre construction site meeting with principle 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. Project Arborist to mark all trees approved for removal under DA consent.	Prior to development work commencing	
Project Arborist to assess and certify that tree protection has been installed in accordance with AS4970-2009 prior to works commencing at site.	Prior to development work commencing.	
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 two-month frequency.	On-going throughout the development	
The removal of existing structures inside the TPZ of any tree to be retained, such as the existing buildings and hard surfaces must be supervised by the project Arborist.	Demolition	
Project Arborist to supervise all manual excavations and root pruning inside the TPZ of any tree to be retained. Project Arborist to approve all pruning of roots greater than 30mm inside TPZ. All root pruning of roots greater than 10mm in diameter must be carried out by a qualified Arborist/Horticulturalist with a minimum AQF level 3.	Construction	
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	
All landscaping works within the TPZ of trees to be retained are to be undertaken in consultation with the project Arborist to minimise the impact to trees.	Construction/ Landscape	
After all demolition, construction and landscaping 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.	Upon completion of development	

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14. BIBLIOGRAPHY/REFERENCES

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15. LIST OF APPENDICES

The following are included in the appendices:
Appendix 1 - Proposed Landscape Plan & Tree Protection
Appendix 2 - Tree Inspection Schedule
Appendix 3 - Further information of methodology

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Cert III Landscape Construction
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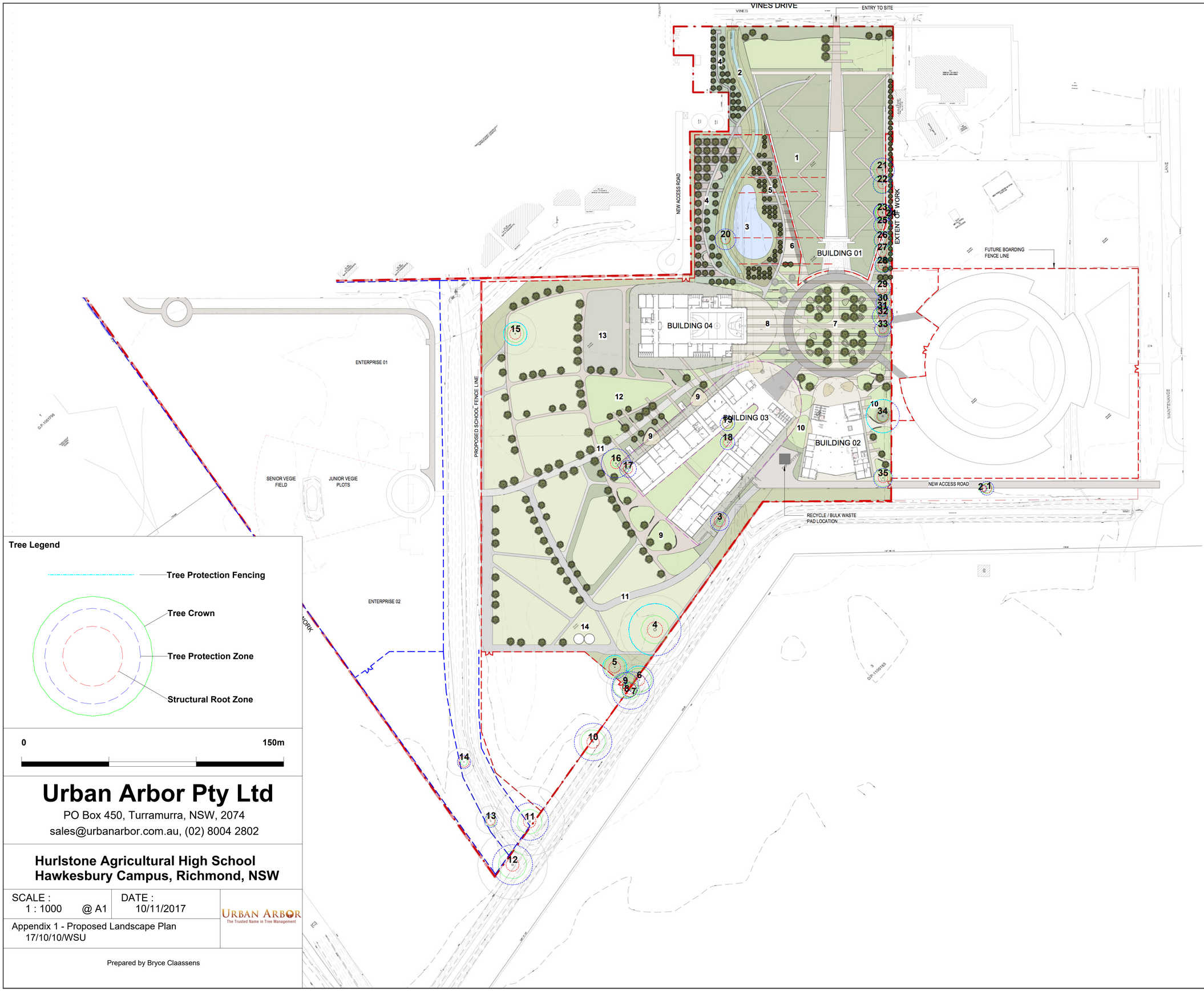

Tree Legend

- Tree Protection Fencing
- Tree Crown
- Tree Protection Zone
- Structural Root Zone

0 — 150m

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Hurlstone Agricultural High School
Hawkesbury Campus, Richmond, NSW

SCALE :	DATE :
1 : 1000 @ A1	10/11/2017

Appendix 1 - Proposed Landscape Plan
17/10/10/WSU

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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	DBH (mm)	DAB (mm)	Health	Structure	Amenity Value	SULE	Retention Value	TPZ radius (m)	SRZ radius (m)	Notes
1	Callery Pear	*Pyrus calleryana*	Mature	6	3	180	170	150	150	326	600	Good	Good	Medium	1. Long	A1	3.9	2.7	None.
2	Callery Pear	*Pyrus calleryana*	Semi-mature	5	2.5	110	110	0	0	155	200	Good	Fair	Medium	2. Medium	A1	2.0	1.7	Co-dominant stems with relatively good form to union. Not marked on survey
3	Black Poplar	*Populus nigra var betulifolia*	Mature	12	1.5	200	400	0	0	447	900	Good	Good	Low	1. Long	Z3	5.4	3.2	Exempt species.
4	Rough Barked Apple	*Angophora floribunda*	Over Mature	16	8	1600	0	0	0	1600	2500	Good	Fair	Very High	1. Long	AA1	15.0	4.9	Possible remnant tree. Large cavity at 2m with good response growth. Minor deadwood through crown.
5	Camphor Laurel	*Cinnamomum camphora*	Mature	9	6	420	260	290	0	572	1000	Good	Fair	Medium	1. Long	Z3	6.9	3.3	Exempt species. Co-dominant stems with included bark.
6	Rough Barked Apple	*Angophora floribunda*	Mature	14	7	680	0	0	0	680	900	Good	Good	High	1. Long	A1	8.2	3.2	Minor apical die back.
7	Rough Barked Apple	*Angophora floribunda*	Dead	14	5	900	0	0	0	900	1200	Dead	Poor	Low	4. Remove	Z4	10.8	3.6	Dead tree.
8	Rough Barked Apple	*Angophora floribunda*	Mature	9	4	350	0	0	0	350	420	Good	Fair	Medium	2. Medium	A2	4.2	2.3	Sucker of adjacent dead tree. Do not stump grind dead tree.
9	Rough Barked Apple	*Angophora floribunda*	Mature	14	7	630	0	0	0	630	900	Good	Good	High	1. Long	A1	7.6	3.2	Growing adjacent to dead tree. Do not stump grind dead tree.
10	Rough Barked Apple	*Angophora floribunda*	Mature	14	7	900	0	0	0	900	1200	Good	Good	High	1. Long	A1	10.8	3.6	Not marked on survey.
11	Yellow Box	*Eucalyptus melliodora*	Mature	12	7	900	0	0	0	900	1200	Good	Poor	High	3. Short	Z5	10.8	3.6	Extensive cambium damage. Evidence of termite activity. Hollow sounding trunk.
12	Yellow Box	*Eucalyptus melliodora*	Mature	15	8	960	0	0	0	960	1300	Good	Good	High	1. Long	A1	11.5	3.7	None.
13	Yellow Box	*Eucalyptus melliodora*	Semi-mature	6	3	150	270	0	0	308	460	Good	Good	Medium	2. Medium	A1	3.7	2.4	Pest and disease attack on foliage.
14	Yellow Box	*Eucalyptus melliodora*	Semi-mature	6	2	130	140	170	190	318	800	Good	Good	Medium	1. Long	A1	3.8	3.0	Multi stemmed tree.
15	Monterey Pine	*Pinus radiata*	Mature	9	5	560	0	0	0	560	900	Good	Good	Medium	1. Long	Z3	6.7	3.2	Exempt species.
16	Black Poplar	*Populus nigra var betulifolia*	Mature	12	2	700	0	0	0	700	850	Good	Good	Low	1. Long	Z3	8.4	3.1	Exempt species. Red Belly Black Snake living in base of trunk.
17	Black Poplar	*Populus nigra var betulifolia*	Mature	13	1.5	400	0	0	0	400	600	Good	Good	Low	1. Long	Z3	4.8	2.7	Exempt species.
18	Callery Pear	*Pyrus calleryana*	Mature	6	3	350	0	0	0	350	400	Good	Good	Medium	1. Long	A1	4.2	2.3	Multi stem tree.
19	Camphor Laurel	*Cinnamomum camphora*	Semi-mature	6	3	250	250	0	0	353	700	Good	Good	Low	1. Long	Z3	4.2	2.8	Exempt species.
20	Camphor Laurel	*Cinnamomum camphora*	Semi-mature	7	3	500	0	0	0	500	600	Good	Good	Low	1. Long	Z3	6.0	2.7	Exempt species. Not marked on survey.
21	Swamp Oak	*Casuarina glauca*	Mature	12	5	580	0	0	0	580	900	Good	Good	High	1. Long	A1	7.0	3.2	Surrounded by smaller casuarinas.
22	Swamp Oak	*Casuarina glauca*	Mature	10	5	440	0	0	0	440	560	Good	Good	High	1. Long	A1	5.3	2.6	Surrounded by smaller casuarinas.
23	Camphor Laurel	*Cinnamomum camphora*	Semi-mature	7	4	240	180	270	0	403	600	Good	Good	Low	1. Long	Z3	4.8	2.7	Exempt species.
24	Swamp Oak	*Casuarina glauca*	Mature	10	4	440	0	0	0	440	580	Good	Good	High	1. Long	A1	5.3	2.6	Not marked on survey.
25	Swamp Oak	*Casuarina glauca*	Mature	11	4	410	0	0	0	410	530	Good	Good	High	1. Long	A1	4.9	2.5	None.
26	Swamp Oak	*Casuarina glauca*	Mature	12	5	390	0	0	0	390	510	Good	Fair	Medium	2. Medium	A1	4.7	2.5	Cambium die back. Snap out of stem at 8m.
27	Swamp Oak	*Casuarina glauca*	Mature	12	5	410	0	0	0	410	530	Good	Good	High	1. Long	A1	4.9	2.5	None.
28	Swamp Oak	*Casuarina glauca*	Mature	10	4	360	0	0	0	360	470	Good	Good	High	1. Long	A1	4.3	2.4	None.
29	Swamp Oak	*Casuarina glauca*	Mature	10	4	380	0	0	0	380	520	Fair	Good	Medium	2. Medium	Z9	4.6	2.5	Die back through crown. Low foliage density for species.
30	Swamp Oak	*Casuarina glauca*	Mature	9	3	320	0	0	0	320	400	Good	Good	High	1. Long	A1	3.8	2.3	None.
31	Swamp Oak	*Casuarina glauca*	Mature	10	3	280	0	0	0	280	370	Good	Good	High	1. Long	A1	3.4	2.2	None.
32	Swamp Oak	*Casuarina glauca*	Mature	11	5	400	300	0	0	500	560	Good	Good	High	1. Long	A1	6.0	2.6	None.
33	Swamp Oak	*Casuarina glauca*	Mature	10	3	390	0	0	0	390	500	Good	Good	High	1. Long	A1	4.7	2.5	None.
34	Callery Pear	*Pyrus calleryana*	Mature	5	3	800	0	0	0	800	1000	Good	Good	Medium	1. Long	A1	9.6	3.3	Crossing branches.
35	Callery Pear	*Pyrus calleryana*	Mature	7	5	230	230	230	230	460	650	Good	Good	Medium	1. Long	A1	5.5	2.8	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'. The (1) indicates the stem number and the (t) indicates the total DBH when calculated in accordance with AS4970-2009 definition.
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 from centre of trunk 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) - $(DAB \times 50)^{0.42} \times 0.64$. 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.

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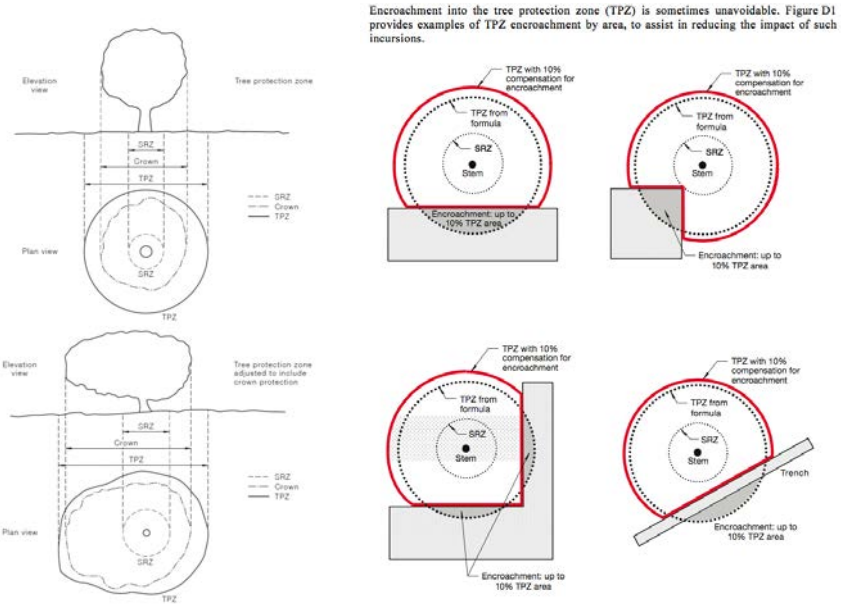
Date of survey: 7 September 2017.

Appendix 3 - Further Information of Methodology

1. **Tree Protection Zone:** The tree protection zone (TPZ) is the principle means of protecting trees on development sites. The TPZ is a combination of the root area and crown area requiring protection. It is an area isolated from construction disturbance, so that the tree remains viable. The radius of the TPZ is calculated for each tree by multiplying its DBH x 12. The derived value is measured in radius from the centre of the stem/trunk at ground level. A TPZ should not be less than 2.0 metres nor greater than 15 metres (except where crown protection is required).
   It is commonly observed that tree roots will extend significant further than the indicative TPZ, however the TPZ is an area identified AS4970-2009 to be extent where root loss or disturbance will generally not 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. See appendices for additional information about the TPZ including information about calculating the TPZ and examples of TPZ encroachment.
   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.
   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.



2. **Structural Root Zone:** 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 need to be maintained to preserve a viable tree as it will only have a minor effect on the trees vigour and health. There are several factors that determine 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.
   An indicative SRZ radius can be determined from the diameter of the trunk measured immediately above the root buttresses. Root investigation could provide more information about the extent of the SRZ. The following formula should be used to calculate the SRZ.
   SRZ radius = $(D \times 50)^{0.42} \times 0.64$ (D = Diameter above root buttress).

3. **Tree 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;
   - 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.

4. **Health/Physiological Condition:** Below are examples conditions used when assigning a category for tree health.

Category	Example condition	Summary
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.

5. **Structural Condition:** Below are examples conditions used when assigning a category for structural condition.

Category	Example condition	Summary
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 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.

6. **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 statuary conditions.
   - The habitat value of the tree.
   - Whether the tree is considered a noxious weed species.

   The amenity value is rated using one of the following values.
   - Very High
   - High
   - Moderate
   - Low
   - Very Low

7. **Safe Useful Life Expectancy (SULE), (Barrel, 2001):** A trees 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 - Over 40 years	(a) Structurally sound trees located in positions that can accommodate future growth. (b) Trees that could be made suitable for retention in the long term by remedial tree care. (c) Trees of special significance for historical, commemorative or rarity reasons that would warrant extraordinary efforts to secure their long term retention.
2. Medium - 15 to 40 years	(a) Trees that may only live between 15 and 40 more years. (b) Trees that could live for more than 40 years but may be removed for safety or nuisance reasons. (c) Trees that could live for more than 40 years but may be removed to prevent interference with more suitable individuals or to provide space for new planting. (d) Trees that could be made suitable for retention in the medium term by remedial tree care.
3. Short - 5 to 15 years	(a) Trees that may only live between 5 and 15 more years. (b) Trees that could live for more than 15 years but may be removed for safety or nuisance reasons. (c) Trees that could live for more than 15 years but may be removed to prevent interference with more suitable individuals or to provide space for new planting. (d) Trees that require substantial remedial tree care and are only suitable for retention in the short term.
4. Remove - Under 5 years	(a) Dead, dying, suppressed or declining trees because of disease or inhospitable conditions. (b) Dangerous trees because of instability or recent loss of adjacent trees. (c) Dangerous trees because of structural defects including cavities, decay, included bark, wounds or poor form. (d) Damaged trees that are clearly not safe to retain. (e) Trees that could live for more than 5 years but may be removed to prevent interference with more suitable individuals or to provide space for new planting. (f) Trees that are damaging or may cause damage to existing structures within 5 years. (g) Trees that will become dangerous after removal of other trees for the reasons given in (a) to (f). (h) Trees in categories (a) to (g) that have a high wildlife habitat value and, with appropriate treatment, could be retained subject to regular review.
5. Small/Young	(a) Small trees less than 5m in height. (b) Young trees less than 15 years old but over 5m in height. (c) Formal hedges and trees intended for regular pruning to artificially control growth.

8. **Root investigations:** The root investigations should identify roots greater than 30mm in diameter that are located along the edge of the structures footprint or in the location of footings. Root investigations must be carried out using non-invasive methods (manual excavations). Any excavations for the root investigations must carried out manually to avoid damaging the roots during excavations. Manual excavation may include the use of a high-pressure air/air knife, or a combination of high-pressure water and a vacuum device. When hand excavating carefully work around roots retaining as many as possible. Take care to not fray, wound, or cause damage to any roots during excavations as this may cause decay or infection from pathogens. It is essential that exposed roots are kept moist and the excavation back filled as soon as possible. The root investigations should be carried out by a qualified Arborist minimum AQF3. Once roots are exposed, a visual assessment can be carried out by a consulting Arborist to evaluate the potential impact of the proposed root loss on the health and stability of the tree. A root map/report should be prepared identifying the findings of investigations, including photographs as supporting evidence in the report.

9. **Retention Value:** 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. The table below provides a brief description of each category.

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 cannot 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 temporarily 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.

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Glossary of Terms

Abiotic - Pertaining to non-living agents; e.g. environmental factors

Adventitious shoots - Shoots that develop other than from apical, axillary or dormant buds; see also 'epicormic'

Anchorage - The system whereby a tree is fixed within the soil, involving cohesion between roots and soil and the development of a branched system of roots which withstands wind and gravitational forces transmitted from the aerial parts of the tree

Bark - A term usually applied to all the tissues of a woody plant lying outside the vascular cambium, thus including the phloem, cortex and periderm; occasionally applied only to the periderm or the phellem

Branch:
• **Primary**. A first order branch arising from a stem
• **Lateral**. A second order branch, subordinate to a primary branch or stem and bearing sub-lateral branches
• **Sub-lateral**. A third order branch, subordinate to a lateral or primary branch, or stem and usually bearing only twigs

Branch collar - A visible swelling formed at the base of a branch whose diameter growth has been disproportionately slow compared to that of the parent stem; a term sometimes applied also to the pattern of growth of the cells of the parent stem around the branch base

Brown-rot - A type of wood decay in which cellulose is degraded, while lignin is only modified

Buckling - An irreversible deformation of a structure subjected to a bending load

Buttress zone - The region at the base of a tree where the major lateral roots join the stem, with buttress-like formations on the upper side of the junctions

Cambium - Layer of dividing cells producing xylem (woody) tissue internally and phloem (bark) tissue externally

Canker - A persistent lesion formed by the death of bark and cambium due to colonisation by fungi or bacteria

Compartmentalisation - The confinement of disease, decay or other dysfunction within an anatomically discrete region of plant tissue, due to passive and/or active defences operating at the boundaries of the affected region

Compressive loading - Mechanical loading which exerts a positive pressure; the opposite to tensile loading

Condition - An indication of the physiological condition of the tree. Where the term ‘condition’ is used in a report, it should not be taken as an indication of the stability of the tree

Crown/Canopy - The main foliage bearing section of the tree

Crown lifting - The removal of limbs and small branches to a specified height above ground level

Crown thinning - The removal of a proportion of secondary branch growth throughout the crown to produce an even density of foliage around a well-balanced branch structure

Crown reduction/shaping - A specified reduction in crown size whilst preserving, as far as possible, the natural tree shape

DAB (Diameter Above Buttress) - Trunk diameter measured above the root buttress

Defect - In relation to tree hazards, any feature of a tree which detracts from the uniform distribution of mechanical stress, or which makes the tree mechanically unsuited to its environment

Dieback - The death of parts of a woody plant, starting at shoot-tips or root-tips

Disease - A malfunction in or destruction of tissues within a living organism, usually excluding mechanical damage; in trees, usually caused by pathogenic micro-organisms

Dominance - In trees, the tendency for a leading shoot to grow faster or more vigorously than the lateral shoots; also the tendency of a tree to maintain a taller crown than its neighbours

Dormant bud - An axial bud which does not develop into a shoot until after the formation of two or more annual wood increments; many such buds persist through the life of a tree and develop only if stimulated to do so

Dysfunction - In woody tissues, the loss of physiological function, especially water conduction, in sapwood

DBH (Diameter at Breast Height) - Stem diameter measured at a height of 1.4 metres or the nearest measurable point. Where measurement at a height of 1.4 metres is not possible, another height may be specified

Deadwood - Branch or stem wood bearing no live tissues. Retention of deadwood provides valuable habitat for a wide range of species and seldom represents a threat to the health of the tree. Removal of deadwood can result in the ingress of decay to otherwise sound tissues and climbing operations to access deadwood can cause significant damage to a tree. Removal of deadwood is generally recommended only where it represents an unacceptable level of hazard

Epicormic shoot - A shoot having developed from a dormant or adventitious bud and not having developed from a first year shoot

Flush-cut - A pruning cut which removes part of the branch bark ridge and or branch-collar

Girdling root - A root which circles and constricts the stem or roots possibly causing death of phloem and/or cambial tissue

Habit - The overall growth characteristics, shape of the tree and branch structure

Hazard beam - An upwardly curved part of a tree in which strong internal stresses may occur without being reduced by adaptive growth; prone to longitudinal splitting

Incorporating extracts from Lonsdale, D. 1999. Principles of Tree Hazard Assessment. Her Majesty's Stationary Office, London

Heartwood/false-heartwood - The dead central wood that has become dysfunctional as part of the aging processes and being distinct from the sapwood

Heave - A term mainly applicable to a shrinkable clay soil which expands due to re-wetting after the felling of a tree which was previously extracting moisture from the deeper layers; also the lifting of pavements and other structures by root diameter expansion; also the lifting of one side of a wind-rocked root-plate

Included bark (ingrown bark) - Bark of adjacent parts of a tree (usually forks, acutely joined branches or basal flutes) which is in face-to-face contact

Lever arm - A mechanical term denoting the length of the lever represented by a structure that is free to move at one end, such as a tree or an individual branch

Lignin - The hard, cement-like constituent of wood cells; deposition of lignin within the matrix of cellulose microfibrils in the cell wall is termed Lignification

Lions tailing - A term applied to a branch of a tree that has few if any side-branches except at its end, and is thus liable to snap due to end- loading

Loading - A mechanical term describing the force acting on a structure from a particular source; e.g. the weight of the structure itself or wind pressure

Mycelium - The body of a fungus, consisting of branched filaments (hyphae)

Occlusion - The process whereby a wound is progressively closed by the formation of new wood and bark around it

Pathogen - A micro-organism which causes disease in another organism

Photosynthesis - The process whereby plants use light energy to split hydrogen from water molecules, and combine it with carbon dioxide to form the molecular building blocks for synthesizing carbohydrates and other biochemical products

Probability - A statistical measure of the likelihood that a particular event might occur

Pruning - The removal or cutting back of twigs or branches, sometimes applied to twigs or small branches only, but often used to describe most activities involving the cutting of trees or shrubs

Radial - In the plane or direction of the radius of a circular object such as a tree stem

Reactive Growth/Reaction Wood - Production of woody tissue in response to altered mechanical loading; often in response to internal defect or decay and associated strength loss (cf. adaptive growth)

Ring-barking - The removal of a ring of bark and phloem around the circumference of a stem or branch, normally resulting in an inability to transport photosynthetic assimilates below the area of damage. Almost inevitably results in the eventual death of the affected stem or branch above the damage

Root-collar - The transitional area between the stem/s and roots

Sapwood - Living xylem tissues

Soft-rot - A kind of wood decay in which a fungus degrades cellulose within the cell walls, without any general degradation of the wall as a whole

Stem/s - Principle above-ground structural component(s) of a tree that supports its branches

Stress - In plant physiology, a condition under which one or more physiological functions are not operating within their optimum range, for example due to lack of water, inadequate nutrition or extremes of temperature

SRZ (Structural Root Zone) - The area around the base of the tree required for the trees stability in the ground

Subsidence - In relation to soil or structures resting in or on soil, a sinking due to shrinkage when certain types of clay soil dry out, sometimes due to extraction of moisture by tree roots

Taper - In stems and branches, the degree of change in girth along a given length

Targets - In tree risk assessment (with slight misuse of normal meaning) persons or property or other things of value which might be harmed by mechanical failure of the tree or by objects falling from it

Topping - In arboriculture, the removal of the crown of a tree, or of a major proportion of it

Transpiration - The evaporation of moisture from the surface of a plant, especially via the stomata of leaves; it exerts a suction which draws water up from the roots and through the intervening xylem cells

TPZ (Tree Protection Zone) - A specified area above and below ground and at a given distance from the trunk set aside for the protection of a tree's roots and crown to provide for the viability and stability of a tree to be retained where it is potentially subject to damage by development

Understory - This layer consists of younger individuals of the dominant trees, together with smaller trees and shrubs which are adapted to grow under lower light conditions

Veteran tree - Tree that, by recognised criteria, shows features of biological, cultural or aesthetic value that are characteristic of, but not exclusive to, individuals surviving beyond the typical age range for the species concerned. These characteristics might typically include a large girth, signs of crown retrenchment and hollowing of the stem

Vigour - The expression of carbohydrate expenditure to growth (in trees)

White-rot - A range of kinds of wood decay in which lignin, usually together with cellulose and other wood constituents, is degraded

Wind exposure - The degree to which a tree or other object is exposed to wind, both in terms of duration and velocity

Wind pressure - The force exerted by a wind on a particular object

Windthrow - The blowing over of a tree at its roots

Incorporating extracts from Lonsdale, D. 1999. Principles of Tree Hazard Assessment. Her Majesty's Stationary Office, London