Tree Impact Assessment Report – Rail Corridor

SMCSWSSJ-JHL-WSS-EM-REP-000001

Document and Revision History

Document Details	
Title	Tree Impact Assessment Report – Rail Corridor
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Revisions

Revision	Date	Description	Prepared by	Reviewed by
00	30 April 2018	Issued for Review	DK	CN
01	21 May 2019	Update for SM and ER comments	DK	CN
02	1 June 2018	Update for ER comments	DK	CN
03	16 August 2018	Updated to include two additional trees within the Sydenham Equipment Centre	DK	CN
04	25 September 2018	Updated to reference one additional tree on the city side of Sydenham Station	DK	CN
05	8 October 2018	Update for ER comments	DK	CN
06	8 February 2019	Update to include additional trees within the Way Street access area	KN	CN
07	13 April 2020	Updated for changes to group 4 trees	DK	PF
08	27 April 2020	Updated for text error	DK	PF
09	18 June 2021	Updated for additional trees between Carrington Road Pump Station and Meeks Road	RD	DK
10	21 June 2021	Updated to address SM and ER comments	RD	DK

Management reviews

Review date	Details	Reviewed by

Controlled: NO Copy no.: Uncontrolled: YES

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1. Introduction

1.1 Background

This report has been produced to detail the species and number of trees within the rail corridor that will be removed as part of the Sydenham Station and Junction (SSJ) works. A separate report will detail trees to be removed as part of the works that are located outside the rail corridor. It is noted that for the purpose of this report the rail corridor includes all land owned by RailCorp where trains operate.

The ecological potential of the project site has been assessed under the *Sydney Metro City & Southwest Chatswood to Sydenham Environmental Impact Statement* and the subsequent *Sydenham Station and Sydney Metro Trains Facility South Modification Report*. The assessment found "All vegetation identified within the study area is mapped as Urban – Exotic / Native in Native Vegetation of the Sydney Metropolitan Catchment Management Authority Area (Department of Environment, Climate Change and Water, 2009a) and field assessment has confirmed that most vegetation is planted or exotic regrowth... No native vegetation communities were observed during site inspections, and none of the vegetation in the study area meets the criteria for any threatened ecological community listed under the EPBC Act or the TSC Act... No threatened flora species were recorded." (Page 804 C2S – EIS). Also, "The existing biodiversity environment in the vicinity of Sydenham was described as part of the assessment of the approved project." (Page 243 C2S EIS Modification report).

In accordance with the *Sydney Metro City & Southwest Chatswood to Sydenham Conditions of Approval* a tree is defined as "Long lived woody perennial plant greater than (or usually greater than) 3 m in height with one or relatively few main stems or trunks". Condition of Approval E6 requires a Tree Report to be prepared prior to the removal of any trees from the project area. A copy of the tree report is to be submitted to the Secretary before the removal, damage and/or pruning of any trees.

In accordance with the *Sydney Metro City & Southwest Chatswood to Sydenham Conditions of Approval* E6 this report is a standalone Tree Report for the area within rail corridor associated with the SSJ works.

1.2 Project Location

Sydenham Station lies approximately 6km south of the Sydney CBD and 2.5km from Sydney (Kingsford Smith) Airport. The project site is located within the rail corridor at Sydenham Station, approximately 1km to the north and 750m to the south of the station, 11 Sydenham Road, Marrickville, NSW, the Sydenham Pit and Drainage Pump Station and future precinct areas on Railway Parade and Burrows Avenue, Sydenham, NSW. The project site covers an area of approximately 35 hectares.

2. Site Inspections

Bryce Claassens, Consulting Arborist of Urban Arbor, attended the project site to undertake a tree inspection and assessment on the 7th of March 2018. An additional inspection was conducted on 17th of January 2019 to assess additional trees at Way st and Bolton st. No additional assessment or changes to these assessed tree groups were undertaken as part of this revision. An additional inspection was conducted on 10th of June 2021 to include an area of trees in the Sydney Water Building area, to be included in this revision A copy of Bryce's curriculum vitae is included within Appendix A.

Trees have been assessed for visual amenity in regards to;

- The health of the tree
- Screening provided by the tree
- Whether the tree has any cultural or heritage significance
- Whether the tree forms part of a habitat linkage

The visual amenity is referenced in the aboricultural report in appendix D as 'landscape value.'

All trees to be removed in this report are within the rail corridor and within the project boundary.

3. Inspection Results

Trees to be removed within the corridor have been mapped, counted and assessed. A copy of the mapping is included within Appendix B. For this revision, an arboricultural report has been included as appendix D to specific tree locations and conditions in group 19 as opposed to broad mapping. It is not the intention of this report to apply this approach to earlier assessed groups of trees in the corridor.

Details of the trees present within the rail corridor are included within Table 1.

Table 1 Trees Recorded Within Rail Corridor

Area	Species	Condition	Amenity/Visual Character	Number
1	Acacia spp	Healthy	Will provide some minor screening of local residents from rail corridor. These trees must be removed to allow the construction of the shunt track. The trees will remain in place for as long as possible and will only be removed prior to the shunt track works.	5
2	Acacia spp	Healthy	Single tree away from residential properties - negligible amenity/visual significance	1
3	Acacia spp	Healthy	Single tree away from residential properties - negligible amenity/visual significance	1
4	Grevillea robusta	Healthy	Negligible amenity/visual significance – no residential properties in vicinity – clearance would be consistent with character of remaining corridor	3
5	Grevillea robusta	Healthy	Negligible amenity/visual significance – no residential properties in vicinity – clearance would be consistent with character of remaining corridor	8
6	Jacaranda mimosifolia	Healthy	Negligible amenity/visual significance – no residential properties in vicinity – clearance would be consistent with character of remaining corridor	1
7	Lephostemon confertus	Healthy	Negligible amenity/visual significance – no residential properties in vicinity – clearance would be consistent with character of remaining corridor	1
8	Populus spp	Healthy	Negligible amenity/visual significance – no residential properties in vicinity – clearance would be consistent with character of remaining corridor	1
9	Grevillea spp & Acacia spp	Healthy	Negligible amenity/visual significance – no residential properties in vicinity – clearance would be consistent with character of remaining corridor	10

10	Grevillea spp Eucalyptus spp and Acacia spp.	Healthy	Negligible amenity/visual significance – no residential properties in vicinity – clearance would be consistent with character of remaining corridor	30
11	Acacia spp	Healthy	Negligible amenity/visual significance – no residential properties in vicinity – clearance would be consistent with character of remaining corridor	12
12	Grevillea spp Eucalyptus spp and Acacia spp.	Healthy	Negligible amenity/visual significance – no residential properties in vicinity – clearance would be consistent with character of remaining corridor	30
13	Casuarina glauca	Healthy	Trimming only – negligible amenity/visual significance	30
14	Syagrus romanzoffiana	Healthy	Single tree away from residential properties - negligible amenity/visual significance	1
15	Grevillea spp	Healthy	Single tree away from residential properties - negligible amenity/visual significance	1
16	Callistemon spp	Healthy	Single tree away from residential properties - negligible amenity/visual significance	1
17	Casuarina glauca	Healthy	Single tree away from residential properties - negligible amenity/visual significance	1
18 (group 8.1 in Appendix D)	Casuarina glauca and Eucalyptus spp,	Healthy	The trees range from low to medium amenity value, with the exception of one tree consisting of high amenity value. Trees along the southeast boundary of the area, located closest to the residential properties, will be retained	6 & 1 group of trees (approx. 20 small trees)
19 (group 8.3 in Appendix D)	Casuarina glauca, casuarina spp., angophora costata, acacia parramattensis, acacia spp., celtis senensis, phoenix senensis, eucalyptus paniculate, Cinnamomum camphora, Allocasuarina littoralis	58 Healthy, 3 Dead	Group of trees between Bankstown line and the Meeks road triangle ARTC line. The trees range from very low to very high amenity value.	61

Up to 174 trees and one group of trees (of approximately 20 small trees) within the rail corridor will be removed as part of the works. An additional 10 trees in area 18 will be retained and protected for the duration of the development and an additional 30 trees will be trimmed in area 13. It is noted that as all trees are planted or native regrowth and as they are within the rail corridor, none of the trees have cultural or heritage significance.

4. Alternatives to Design

Trees in areas 1, 2 & 3 must be removed for the construction of the shunt track. These stands of vegetation would be within clearance limits of overhead power lines and must be removed to ensure the safe operation of the railway.

Trees in area 4 must be removed due to clashes with the combined service route. The combined service route cannot avoid these trees due to existing services and the maintenance of the existing haul road.

Trees in areas 5, 6 & 7 must be removed to facilitate embankment works. The embankment must be upgraded as part of the works to ensure this part of the track remains stable.

Trees in areas 8, 9, 10, 11, 12 must be removed to facilitate service works. These areas are critical for clearance as the Combined Service Route must follow a certain alignment to ensure services such as power, communications and signals are connected to new rail components.

Trees in area 13 must be trimmed to ensure clearance is maintained between the trees and overhead wire structures and power lines.

The tree in area 14 must be removed to facilitate the installation of Combined Service Route. The CSR must be installed in this alignment to connect Sydenham Station to ULX16.

The trees in area 15 and 16 must be removed to allow installation of the Combined Service Route with sufficient clearance to existing services.

Tree 17 must be removed to enable the construction of GST along the Illawarra Main line.

The trees in area 18 must be removed to provide additional space for stockpiling and storage of materials at the Way Street access due to the small footprint of the project area. This area is categorised as being within the rail corridor.

The trees in area 19 must be removed to facilitate the installation of new security fencing and embankment works area. This fencing alignment cannot avoid these trees due to the poor geotechnical condition of the top embankment and existing services within the area. Works will be conducted from the rail side to avoid impact to Sydney Water heritage curtilage (Carrington rd pump station SHR# 01342) and to maintain as many trees as possible. No trees within the heritage curtilage area are to be impacted. It is unlikely that all trees in this area will need to be removed, however since this work must occur during a rail shutdown possession and due to the uncertain nature of the embankment all trees have been included within this report for removal. JHLOR will endeavour to maintain as many trees as possible.

5. Mitigation Measures

JHLOR will implement a number of measures to ensure the correct trees are removed and to mitigate the risk of damage to trees that will remain. These mitigation measures include;

- An ecologist would be present during the removal of any hallow bearing trees in accordance with REMM B1
- The project will be designed to minimise impacts to trees where possible. This will include a review of design impacts and construction impacts on trees
- Relevant Councils and the DPE will be consulted in regards to replacement tree planting locations. Relevant Councils will be consulted in regards to appropriate sizes for replacement trees.
- A Vegetation Trimming and Removal Procedure will be implemented
- All existing trees to be retained within the site area must be protected in accordance with Australian Standard AS 4970 ‘Tree protection in development sites’ to avoid and minimise impacts
- All trees to be removed or trimmed will be appropriately demarcated
- Qualified and experienced tree loppers will be engaged to removed and trim trees

- Where works will occur in the vicinity of trees that are to remain intact, demarcation or barriers will be put in place around the tree at the extent of the structural root zone
- Ground protection will be in place for all remaining areas of the tree protection zone (TPZ) where material storage is proposed
- Access tracks will be clearly delineated and defined within the Environmental Control Maps
- Staff and workers to be educated on vegetation trimming and removal requirements
- A copy of the Tree Report must be submitted to the Secretary before the removal, damage and/or pruning of any trees, including those affected by the site establishment works.
- All recommendations of the Tree Report must be implemented by the Proponent, unless otherwise agreed by the Secretary.

It is also noted that the Critical State Significant Infrastructure (CSSI) must be designed to retain as many trees as possible and provide replacement trees such that there a net increase in the number of trees. In the event that tree removal cannot be avoided, then replacement trees are to be planted within, or in close proximity to the CSSI or other location in consultation with the Relevant Councils and agreed by the Secretary. The size of the replacement trees will be determined in consultation with the relevant Council.

Appendix A – Bryce Claassens CV

Curriculum Vitae - Bryce Claassens - Consulting Arborist
Urban Arbor Pty Ltd

Address: Urban Arbor Pty Ltd, Unit 12/36 Leighton Place, Hornsby, NSW
Contact: 0450 554 715, 02 8004 2802, bryce@urbanarbor.com.au

Arboricultural and Horticultural Qualifications

- Diploma of Arboriculture (AQF5)
- Cert III Horticulture - Landscape (AQF3)
- Registered Quantified Tree Risk Assessment assessor (QTRA)

Professional Memberships

- General Membership of Arboriculture Australia (AA)

Experience

Bryce brings ten (10) years of experience in Arboriculture and Horticulture. His career has varied experience in both landscape construction/horticulture and arboricultural consulting.

Bryce is a Consulting Arborist for Urban Arbor Pty Ltd. Urban Arbor is a consultancy company that specifically deals with tree management with no practical tree work being offered. Bryce has managed sites and provided expert reports on various projects, from single trees through to large sites with over 600 trees.
Bryce has experience delivering arboricultural management and recommendations throughout the Sydney region.

Bryce's current role includes the following;
- Report writing including preliminary reports, development impact assessments, risk assessment and tree protection during development.
- Developing and implementing tree management programs
- Risk assessments using the QTRA method
- Project Arborist work
- Diagnostic procedures for determination of various tree related issues
- Consultancy work both verbal and written format

Arboricultural and Horticultural Employment History

- 2017 to Present: Consulting Arborist at Urban Arbor Pty Ltd, Sydney, NSW
- 2015 to 2017: Landscape Construction Tradesman/Stonemason at Collaroy Stoneworks, Sydney, NSW
- 2008 to 2015: Landscape Construction Apprentice-Tradesman at All Landscape Services, Sydney, NSW

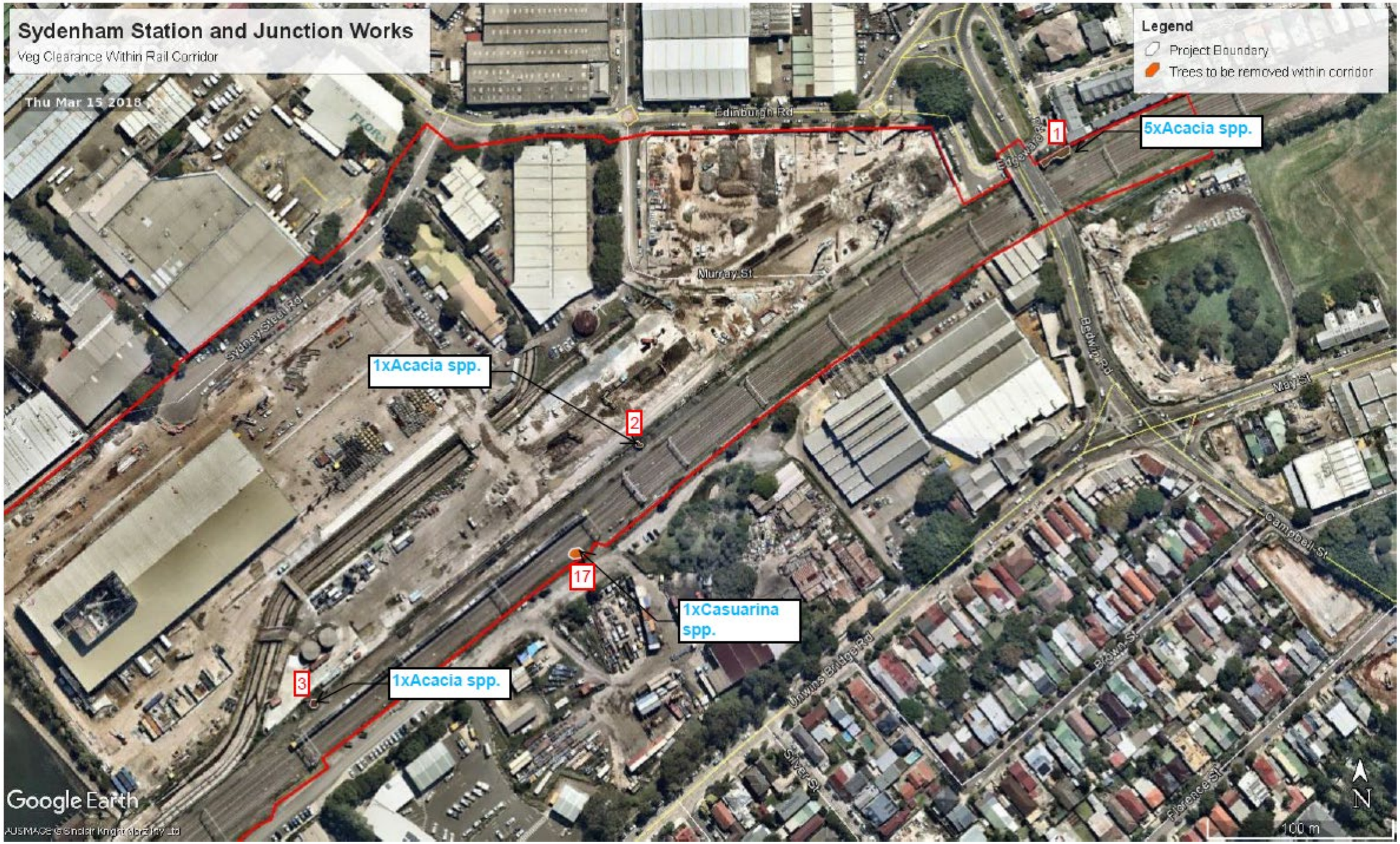
Recent Project Works Undertaken

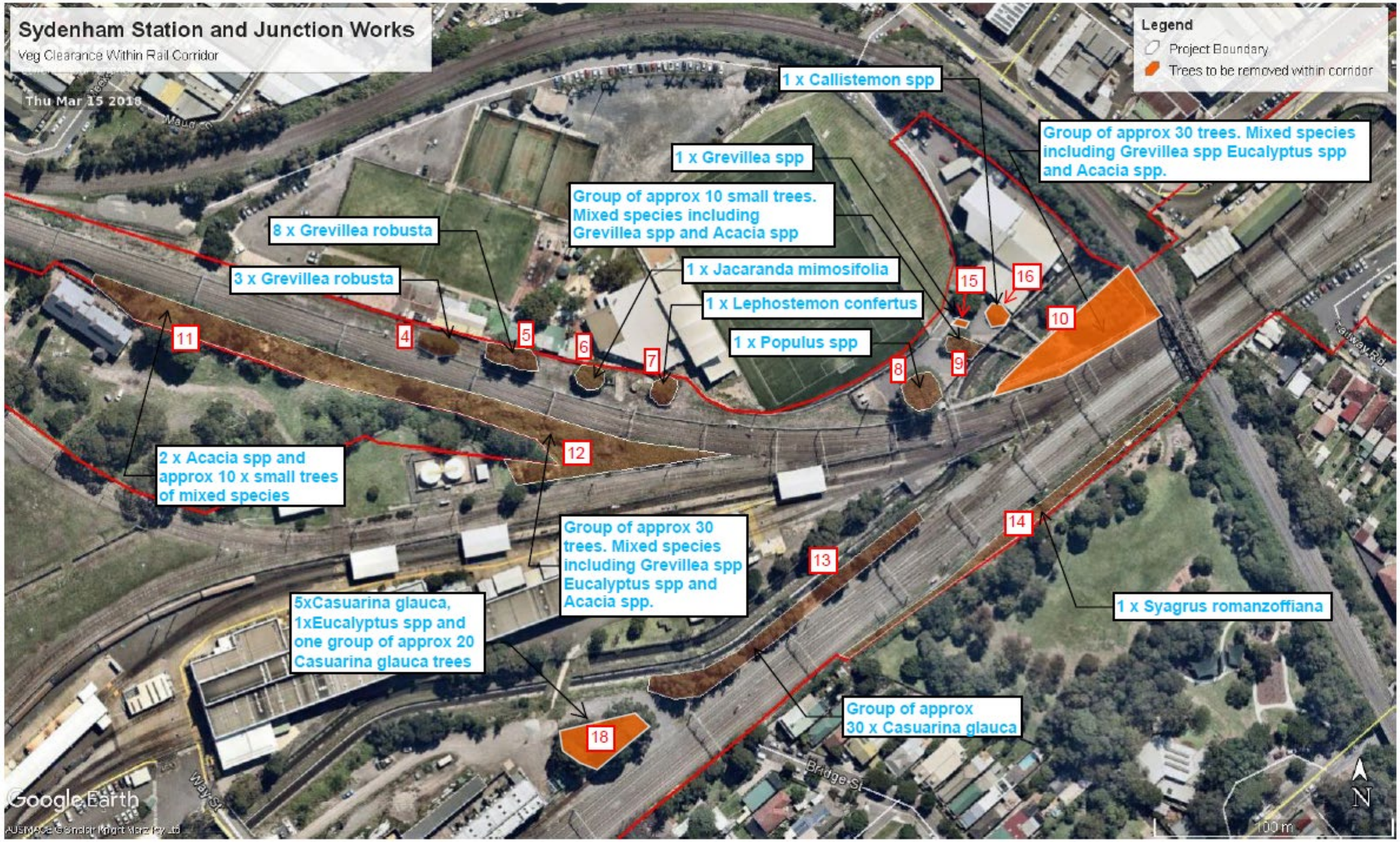
Preparing Arboricultural Impact Assessment reports for large projects, such as the new private hospital in Terrey Hills and various public schools for the Department of Education and Training school beautification project, including providing significant tree sensitive solutions of developments within public schools across Sydney.

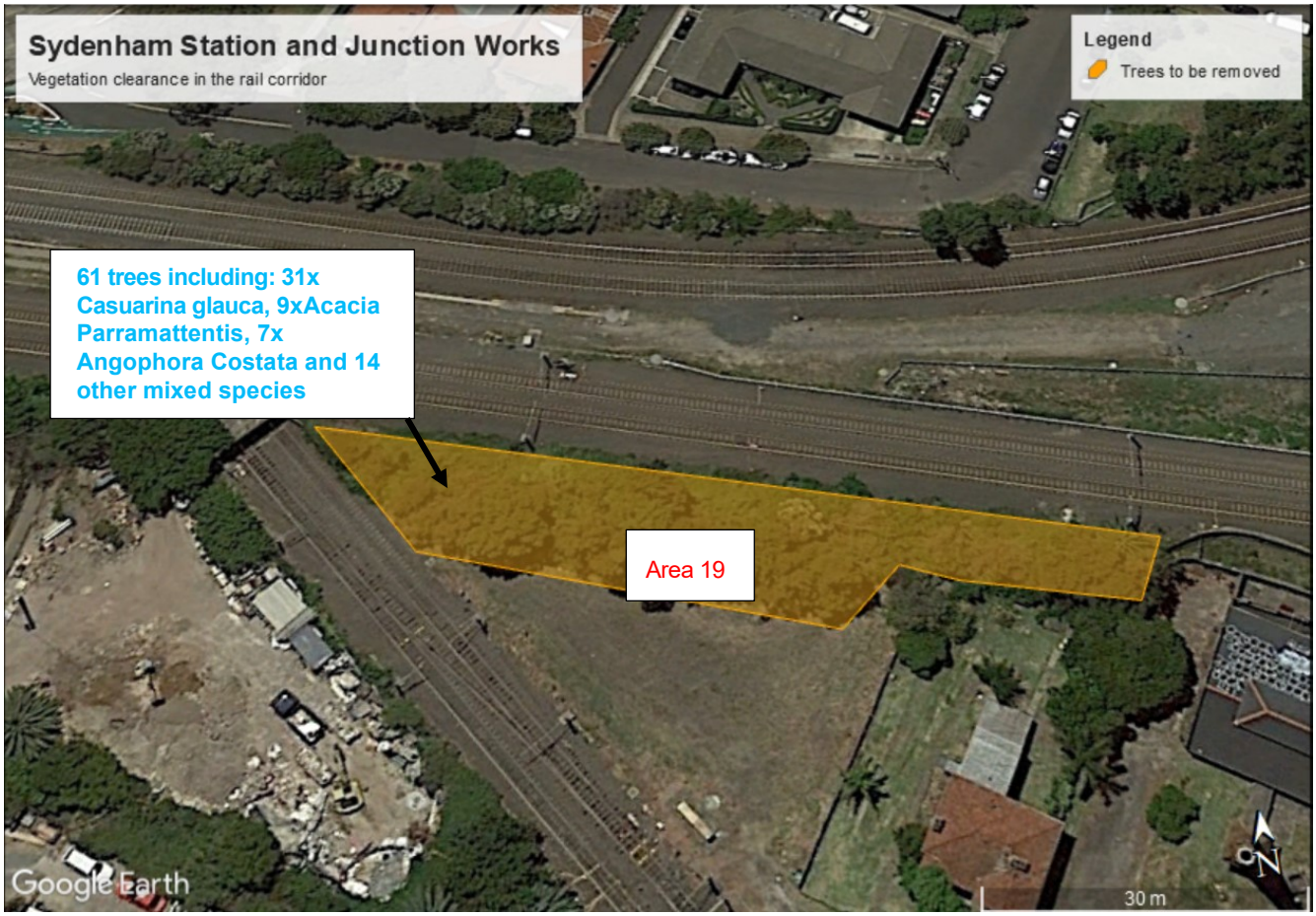
Project Arborist on large developments including Royal Far West in Manly and Macquarie University. Bryce has worked as a project Arborist for many first tier construction companies, such as Richard Crookes, Liang O'Rourke, PDS Group and FDC Construction.

Delivering Arboricultural Impact Assessments and Project Arborist works for private developers within Councils including Ku Ring Gai Council, Hornsby Council, The Hills Shire, Holroyd Council, Inner West Council, Manly Council, Warringah Council, Pittwater Council, North Sydney Council, Mosman Council, Hunters Hill Council, Lane Cove Council, Parramatta Council, Ryde Council, Blacktown Council, Woollahra Council, Waverley Council, Sutherland Council, and Hawkesbury Council.

Appendix B – Rail Corridor Tree Mapping


Sydenham Station and Junction Works
Veg Clearance Within Rail Corridor
Thu Mar 15 2018
Legend
Project Boundary
Trees to be removed within corridor
5xAcacia spp.
1xAcacia spp.
1xCasuarina spp.
1xAcacia spp.
1
2
3
17
Edinburgh Rd
Murray St
Sydney Steel Rd
Edgeware Rd
Baldwin Rd
May St
Campbell St
Brown St
Uralba St
Florence St
Google Earth
100 m
N


Sydenham Station and Junction Works
Veg Clearance Within Rail Corridor
Thu Mar 15 2018
Legend
Project Boundary
Trees to be removed within corridor
1 x Callistemon spp
Group of approx 30 trees. Mixed species including Grevillea spp Eucalyptus spp and Acacia spp.
1 x Grevillea spp
Group of approx 10 small trees. Mixed species including Grevillea spp and Acacia spp
8 x Grevillea robusta
3 x Grevillea robusta
1 x Jacaranda mimosifolia
1 x Lephostemon confertus
1 x Populus spp
11
4
5
6
7
8
9
15
16
10
12
2 x Acacia spp and approx 10 x small trees of mixed species
Group of approx 30 trees. Mixed species including Grevillea spp Eucalyptus spp and Acacia spp.
14
13
1 x Syagrus romanzoffiana
5xCasuarina glauca, 1xEucalyptus spp and one group of approx 20 Casuarina glauca trees
Group of approx 30 x Casuarina glauca
18
Railway Rd
Bridge St
Way St
Google Earth
100 m
N


Sydenham Station and Junction Works
Vegetation clearance in the rail corridor
Legend
Trees to be removed
61 trees including: 31x Casuarina glauca, 9xAcacia Parramattentis, 7x Angophora Costata and 14 other mixed species
Area 19
Google Earth
30 m
N

Appendix C – Compliance Matrix

Table 2 lists the Section of this report that demonstrate compliance with CoA – E6.

Details	Compliance
The CSSI must be designed to retain as many trees as possible and provide replacement trees such that there a net increase in the number of trees	Section 5. New rail components have been designed to minimise the removal of trees where possible.
The Proponent must commission an independent, experienced and suitably qualified arborist to prepare a comprehensive Tree Report before removing any trees as detailed in the EIS, as amended by the documents listed in A1.	Section 2 and Appendix A. Bryce Claassens, consulting arborist from Urban Arbor was engaged to assess trees within the rail corridor.
The Tree Report must include:	
(a) a description of the conditions of the tree(s) and its amenity and visual value;	Section 3 - Table 1
(b) consideration of all options to avoid tree removal, including relocation of services, redesign or relocation of ancillary components (such as substations, fencing etc.) and reduction of standard offsets to underground services; and	Section 4
(c) measures to avoid tree removal, minimise damage to, and ensure the health and stability of those trees to be retained and protected. This includes details of any proposed canopy or root pruning, root protection zone, excavation, site controls on waste disposal, vehicular access, materials storage and protection of public utilities.	Section 5
In the event that tree removal cannot be avoided, then replacement trees are to be planted within, or in close proximity to the CSSI or other location in consultation with the Relevant Councils and agreed by the Secretary. The size of the replacement trees will be determined in consultation with the relevant Council.	Section 5. 174 trees including one group of trees (approx. 20 small trees) to be removed from within the rail corridor and will be replaced. Relevant Councils and the DPE will be consulted in regards to replacement tree planting locations. Relevant Councils will be consulted in regards to appropriate sizes for replacement trees.
A copy of the Tree Report must be submitted to the Secretary before the removal, damage and/or pruning of any trees, including those affected by the site establishment works.	Section 5. This report will be submitted to the Secretary prior to the removal, damage and/or pruning of any trees
All recommendations of the Tree Report must be implemented by the Proponent, unless otherwise agreed by the Secretary.	Section 5.
The Tree Report may be prepared for the entire CSSI or separate reports may be prepared for individual areas where tree removal and/or pruning is proposed	Section 1. This report is for trees within the rail corridor only. A separate report will be prepared for trees outside of the rail corridor.

Appendix D – Arboricultural Report Related to Area 19

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Arboricultural Report

Site Location: Sydenham Station and Junction Project (SSJ)

Prepared for:
John Holland Laing O'Rourke

Prepared by: Bryce Claassens
Urban Arbor Pty Ltd
Date prepared: 16 June 2021
Reference: 210616-SSJ-AR
Rev: 1

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1. INTRODUCTION

1.1 Urban Arbor have been instructed by John Holland Laing O'Rourke to provide an Arboricultural Report for trees located at the site and adjoining sites in relation to the Sydenham Station and Junction Project (SSJ). The locations of the three areas that have been assessed in this report were identified during two separate site meetings, on 17 January 2019 and 10 June 2021.

1.2 No documents or information have been provided to assist in preparing this report.

1.3 The site and tree inspections were carried out on 17 January 2019 and 10 June 2021. Access was available to the subject site and adjoining public areas only.

2. SCOPE OF THE REPORT

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

2.1.1 Conduct a visual assessment of all significant trees located within the areas identified for assessment by John Holland Laing O'Rourke. For the purpose of this report, a significant tree is a 'Long lived woody perennial plant greater than (or usually greater than) 3 m in height with one or relatively few main stems or trunks'.

2.1.2 Determine the trees estimated contribution years and remaining, useful life expectancy and award the trees a retention value.

2.1.3 Determine trees that are to be removed or retained within each area.

2.1.4 Specify tree protection measures for trees to be retained in accordance with AS4970-2009.

3. LIMITATIONS

3.1 The observations and recommendations are based on the site inspections identified in section 1 only. The findings of this report are based on the observations and site conditions at the time of inspection.

3.2 All of the observations were carried out from ground level. The accuracy of the assessment of the subject trees structural condition and health is limited to the visibility of the tree at the time of inspection.

3.3 The tree inspection was visual from ground level only. No soil or tissue testing was carried out as part of the tree inspection. None of the surrounding surfaces adjacent to trees were lifted or removed during the tree inspections.

3.4 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 inspection. Any changes to the growing environment of the subject tree, or tree management works beyond those recommended in this report may alter the findings of the report. There is no warranty, expressed or implied, that problems or deficiencies relating to the subject tree, or subject site may not arise in the future.

3.6 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 an *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 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 (diameter 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

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

4.3 Tree diameter was measured using a DBH tape or in some cases estimated. 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 tools used during the assessment were a nylon mallet, compass, camera and a steel probe.

[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/.

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

4.4 All information was imported into our computerised geographical information system (GIS) PT-mapper pro. 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).[4]

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

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

5.1 **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 significantly further than the indicative TPZ, however the TPZ is an area identified in AS4970-2009 to be the area where root loss or disturbance will generally impact the viability of the tree. The TPZ is identified as a restricted area to prevent damage to trees either above or below ground during a development. Where trees are intended to be retained proposed developments must provide an adequate TPZ around trees. The TPZ is set aside for the tree's root zone, trunk and crown and it is essential for the stability and longevity of the tree. The TPZ also incorporates the SRZ (see below for more information about the SRZ). The TPZ is calculated by multiplying the DBH by twelve, with the exception of palms, other monocots, cycads and tree ferns, the TPZ of which have been calculated at one metre outside the crown projection. Additional information about the TPZ is included in appendix 3.

5.2 **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. The SRZ is calculated using the following formula; (DAB x 50) $^{0.42}$ x 0.64. There are several factors that can vary the SRZ which include height, crown area, soil type and soil moisture. It can also be influenced by other factors such as natural or built structures. Generally, work within the SRZ should be avoided. Soil level changes should also generally be avoided inside the SRZ of trees to be retained. Palms, other monocots, cycads and tree ferns do not have an SRZ. See the appendices for more information about the SRZ.

5.3 **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.

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

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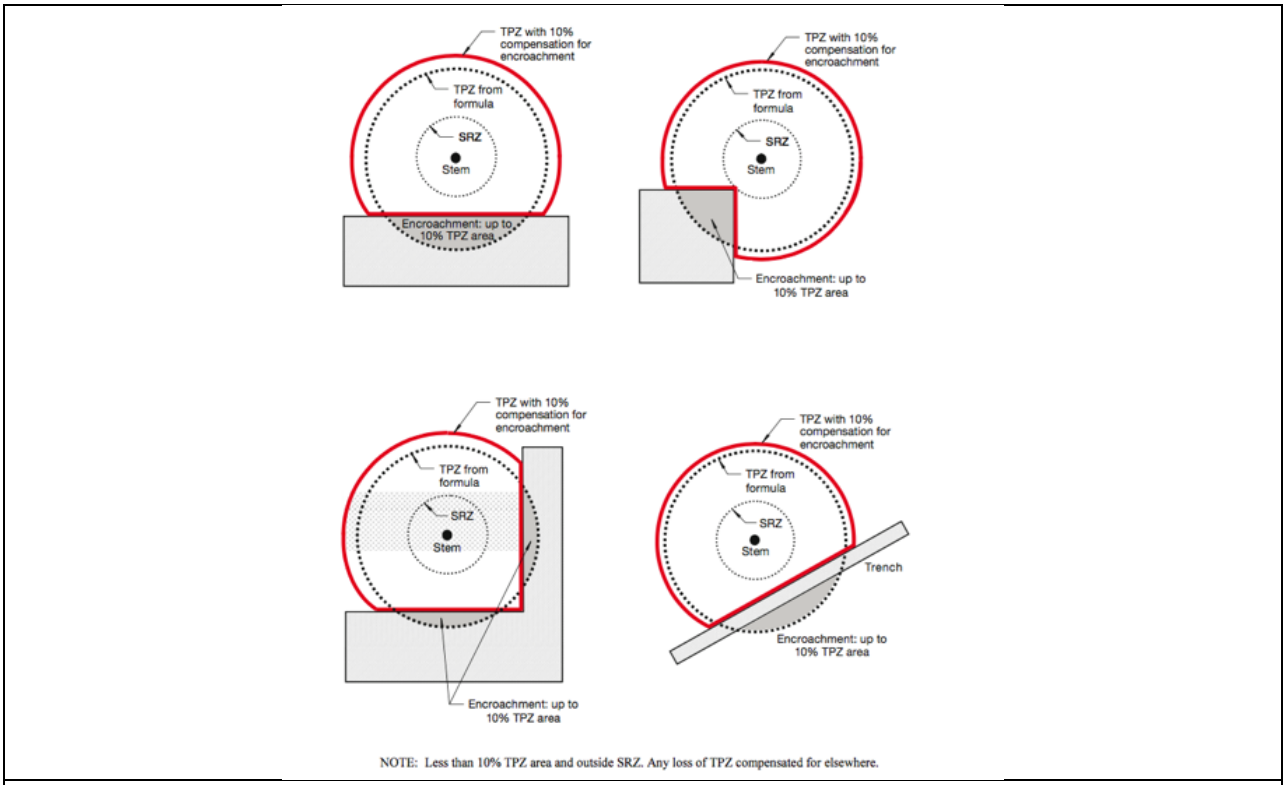

Image 1: Example minor TPZ encroachment from AS4970-2009.

5.4 **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 (see appendix 3 for more information in relation to root investigations).

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6. SITE LOCATION

6.1 The areas assessed in this report have been identified by John Holland Laing O'Rourke and have been listed below. Urban Arbor carried site inspections to identify significant trees within each area. In appendix 1 three site plans have been included that identify the location of each area that was assessed, and the location of the significant trees that were identified in each area. The location of the trees in the plans has been estimated based on the available information and if an accurate assessment of the trees is required, a registered surveyor should locate the trees. The tree information including canopy spread, TPZ and SRZ have been overlaid onto the site plans in appendix 1. The following areas were assessed for significant trees;

- Way Street Access
- Bolton Street Laydown
- Sydney Water Building

7. TREE OBSERVATIONS

7.1 **Tree information:** Details of each individual tree assessed, including the observations taken during the site inspection, can be found in the tree inspection schedule in appendix 2, where the indicative tree protection zone (TPZ) and Structural Root Zone (SRZ) has been calculated for each of the subject trees. The TPZ and SRZ should be measured in radius from the centre of the trunk. Each of the subject trees have been awarded a retention value based on the observations using the Tree AZ method. Tree AZ is used to identify higher value trees worthy of being a constraint to development and lower value trees that should generally not be a constraint to the development. The Tree AZ categories sheet (Barrell Tree Consultancy) has been included in appendix 3 to assist with understanding the retention values. The retention value that has been allocated to the subject trees in this report is not definitive and should only be used as a guideline.

8. ASSESSEMENT OF TREE IMPACTS BY AREA

8.1 **Way Street Access:** Six trees and one group of trees in this area are located within the footprint of a proposed material storage area and are to be removed to accommodate the development. The remaining ten trees in this area must be retained and protected for the duration of the development. The following trees have been identified in this area;

Tree ID	Species	Height (M)	Spread (M)	TPZ Radius (M)	SRZ Radius (m)	Landscape Value	SULE	Retention Value	Recommendation
1	*Casuarina glauca*	8	3	3.1	2.0	Medium	1. Long	A1	Remove
2	*Casuarina glauca*	10	2	4.3	2.3	Medium	1. Long	A1	Remove
3	*Eucalyptus robusta*	11	5	7.2	2.8	Medium	2. Medium	A2	Retain
4	*Casuarina glauca*	7	2	2.4	2.0	Medium	1. Long	A1	Retain
5	*Eucalyptus spp*	6	2	4.8	2.4	Low	4. Remove	Z4	Remove
6	*Eucalyptus pilularis*	15	6	7.2	2.8	High	1. Long	A1	Retain
7	*Eucalyptus robusta*	12	4	6.0	2.6	High	1. Long	A1	Retain
8	*Casuarina glauca*	9	2	2.4	1.8	Medium	1. Long	A1	Remove
9	*Casuarina glauca*	17	2	2.4	1.8	Medium	1. Long	A1	Remove
10	*Eucalyptus saligna*	17	6	10.8	3.3	High	1. Long	A1	Retain
11	*Eucalyptus robusta*	8	5	5.6	2.5	Medium	1. Long	A1	Retain
12	*Casuarina glauca*	14	4	5.5	2.5	High	1. Long	A1	Remove
13	*Casuarina glauca*	10	4	5.5	2.4	High	1. Long	A1	Retain
14	*Eucalyptus microcorys*	15	5	6.6	2.7	High	1. Long	A1	Retain
15	*Casuarina glauca*	14	4	5.4	2.5	High	1. Long	A1	Retain
16	*Casuarina glauca*	12	4	5.4	2.5	High	1. Long	A1	Retain
G1	*Casuarina glauca*	8	1	2.0	1.5	Low	5. Small/Young	Z1	Remove

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8.2 **Bolton Street Laydown:** Eighteen trees within this area are located within close proximity to essential services or are within the footprint of a proposed material storage area and are to be removed to accommodate the development. The following trees have been identified in this area;

Tree ID	Species	Height (M)	Spread (M)	TPZ Radius (M)	SRZ Radius (m)	Landscape Value	SULE	Retention Value	Recommendation
17	*Casuarina glauca*	6	1.5	2.0	1.8	Low	5. Small/Young	Z1	Remove
18	*Casuarina glauca*	5	0.5	2.0	1.5	Low	5. Small/Young	Z1	Remove
19	*Casuarina glauca*	4	0.5	2.0	1.5	Low	5. Small/Young	Z1	Remove
20	*Casuarina glauca*	8.5	2	3.7	2.2	Medium	1. Long	A1	Remove
21	*Casuarina glauca*	7	2	2.6	1.8	Low	3. Short	Z9	Remove
22	*Casuarina glauca*	6	2	2.0	1.8	Low	5. Small/Young	Z1	Remove
23	*Casuarina glauca*	5	1	2.0	1.6	Low	5. Small/Young	Z1	Remove
24	*Casuarina glauca*	5	1	2.0	1.7	Low	5. Small/Young	Z1	Remove
25	*Casuarina glauca*	7	1.5	2.0	1.6	Low	5. Small/Young	Z1	Remove
26	*Casuarina glauca*	6.5	1.5	2.0	1.6	Low	5. Small/Young	Z1	Remove
27	*Casuarina glauca*	9	2	3.6	2.1	Medium	1. Long	A1	Remove
28	*Casuarina glauca*	6	1	2.0	1.6	Low	5. Small/Young	Z1	Remove
29	*Casuarina glauca*	5	1	2.0	1.5	Low	5. Small/Young	Z1	Remove
30	*Celtis sinensis*	5	2	2.4	1.7	Low	5. Small/Young	Z3	Remove
31	*Celtis sinensis*	4.5	1	2.0	1.5	Low	5. Small/Young	Z3	Remove
32	*Celtis sinensis*	5	2	2.0	1.5	Low	5. Small/Young	Z3	Remove
33	*Casuarina glauca*	10	4	3.6	2.1	Medium	1. Long	A1	Remove
34	*Casuarina glauca*	12	5	6.6	2.7	High	1. Long	A1	Remove

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8.3 **Sydney Water Building:** Sixty-one trees within this area are located within the footprint (or within close proximity) of the proposed security fencing/works area and are to be removed to accommodate the development. The following trees have been identified in this area;

Tree ID	Species	Height (M)	Spread (M)	TPZ Radius (M)	SRZ Radius (m)	Landscape Value	SULE	Retention Value	Recommendation
3218	*Allocasuarina littoralis*	8	2	2.4	1.8	Medium	2. Medium	A1	Remove
3219	*Allocasuarina littoralis*	8	2	2.4	1.8	Medium	2. Medium	A1	Remove
3220	*Allocasuarina littoralis*	8	3	3.6	2.1	Medium	2. Medium	A1	Remove
3221	*Casuarina glauca*	14	4	4.8	2.4	High	1. Long	A1	Remove
3222	*Eucalyptus paniculata*	10	3	3.6	2.1	High	1. Long	A1	Remove
3223	*Angophora costata*	21	5	6.5	2.7	Very High	1. Long	A1	Remove
3224	*Casuarina glauca*	10	3	3.6	2.1	High	2. Medium	A1	Remove
3225	*Casuarina glauca*	17	3	4.0	2.2	High	1. Long	A1	Remove
3226	*Casuarina glauca*	17	3	3.4	2.1	Medium	1. Long	A1	Remove
3227	*Casuarina glauca*	18	2	3.4	2.1	Medium	1. Long	A1	Remove
3228	*Casuarina glauca*	10	1	2.0	1.5	Low	5. Small/Young	Z1	Remove
3229	*Angophora costata*	10	3	2.6	1.8	Medium	1. Long	A1	Remove
3230	*Angophora costata*	20	5	4.8	2.4	High	1. Long	A1	Remove
3231	*Casuarina glauca*	11	3	3.6	2.1	High	1. Long	A1	Remove
3232	*Casuarina glauca*	20	5	6.0	2.8	High	1. Long	A1	Remove
3388	*Casuarina glauca*	12	3	3.6	2.1	Medium	1. Long	A1	Remove
3389	*Casuarina glauca*	16	3	3.6	2.1	Medium	1. Long	A1	Remove
3390	*Angophora costata*	14	2	2.4	1.8	Medium	1. Long	A1	Remove
3391	*Casuarina glauca*	16	3	3.6	2.1	Medium	1. Long	A1	Remove
3392	*Casuarina glauca*	16	2	2.6	2.0	Medium	1. Long	A1	Remove
3393	*Casuarina glauca*	16	2	2.9	2.1	Medium	1. Long	A1	Remove
3394	*Cinnamomum camphora*	5	2	2.0	1.5	Very Low	5. Small/Young	Z3	Remove
3395	*Angophora costata*	10	3	3.1	2.0	Medium	1. Long	A1	Remove
3396	*Casuarina glauca*	18	5	5.4	2.6	High	1. Long	A1	Remove
3397	*Casuarina glauca*	16	2	2.8	2.0	Medium	1. Long	A1	Remove
3398	*Casuarina glauca*	10	2	2.5	1.8	Medium	1. Long	A1	Remove
3399	*Casuarina glauca*	17	2	2.6	2.1	Medium	1. Long	A1	Remove
3400	*Casuarina glauca*	14	1	2.0	1.6	Low	5. Small/Young	Z1	Remove
3401	*Casuarina glauca*	12	1	2.2	2.1	Low	5. Small/Young	Z1	Remove
3402	*Casuarina glauca*	9	1	2.0	1.5	Low	5. Small/Young	Z1	Remove
3403	*Angophora costata*	12	3	3.6	2.0	High	1. Long	A1	Remove
3404	*Casuarina glauca*	20	2	4.3	2.4	High	1. Long	A1	Remove
3405	*Casuarina glauca*	10	1	2.0	1.6	Low	5. Small/Young	Z1	Remove
3406	*Acacia spp*	7	3	4.2	2.4	Medium	4. Remove	Z4	Remove
3407	*Acacia parramattensis*	6	2	2.5	1.9	Low	5. Small/Young	Z1	Remove
3408	*Acacia parramattensis*	6	1	2.0	1.6	Low	5. Small/Young	Z1	Remove

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Tree ID	Species	Height (M)	Spread (M)	TPZ Radius (M)	SRZ Radius (m)	Landscape Value	SULE	Retention Value	Recommendation
3409	*Acacia parramattensis*	6	2	2.2	1.8	Low	5. Small/Young	Z1	Remove
3410	*Acacia parramattensis*	6	2	2.0	1.6	Low	5. Small/Young	Z1	Remove
3411	*Acacia parramattensis*	6	1	2.0	1.5	Low	5. Small/Young	Z1	Remove
3412	*Acacia parramattensis*	5	1	2.0	1.5	Low	5. Small/Young	Z1	Remove
3413	*Celtis sinensis*	5	1	2.0	1.5	Very Low	5. Small/Young	Z3	Remove
3414	*Celtis sinensis*	6	1	2.0	1.5	Very Low	5. Small/Young	Z3	Remove
3415	*Celtis sinensis*	7	2	2.6	1.9	Very Low	5. Small/Young	Z3	Remove
3416	*Casuarina glauca*	10	1	2.0	1.6	Low	5. Small/Young	Z1	Remove
3417	*Acacia parramattensis*	5	1	2.0	1.5	Low	5. Small/Young	Z1	Remove
3418	*Casuarina glauca*	6	1	2.0	1.8	Low	5. Small/Young	Z1	Remove
3419	*Cinnamomum camphora*	5	1	2.0	1.5	Very Low	5. Small/Young	Z3	Remove
3420	*Acacia parramattensis*	5	1	2.0	1.5	Low	5. Small/Young	Z1	Remove
3421	*Acacia parramattensis*	5	1	2.0	1.5	Low	5. Small/Young	Z1	Remove
3422	*Acacia spp*	5	1	2.0	1.6	Low	4. Remove	Z4	Remove
3423	*Casuarina glauca*	16	3	3.2	2.1	Medium	1. Long	A1	Remove
3424	*Celtis sinensis*	6	2	2.0	1.7	Very Low	5. Small/Young	Z3	Remove
3425	*Casuarina glauca*	16	2	2.9	1.9	Medium	1. Long	A1	Remove
3426	*Casuarina spp*	5	2	2.5	1.8	Low	4. Remove	Z4	Remove
3427	*Angophora costata*	16	4	4.2	2.3	High	1. Long	A1	Remove
3428	*Phoenix canariensis*	5	2	3.0	NA	Very Low	5. Small/Young	Z3	Remove
3429	*Casuarina glauca*	18	4	4.3	2.3	High	1. Long	A1	Remove
3430	*Casuarina glauca*	15	2	3.0	2.1	Medium	1. Long	A1	Remove
3431	*Casuarina glauca*	8	1	2.0	1.6	Low	3. Short	Z4	Remove
3432	*Casuarina glauca*	12	2	2.4	1.9	Medium	1. Long	A1	Remove
3433	*Casuarina glauca*	8	1	2.0	1.5	Low	5. Small/Young	Z1	Remove

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9. CONCLUSIONS

9.1 **Table 2:** Summary of the impact to trees by the development;

Impact	Reason	Category A	Category Z	Total
		A	Z	
Trees recommended to be removed	Building construction, new surfacing and/or proximity, trees in poor condition or low value trees to be removed and replaced	1, 2, 8, 9, 12, 20, 27, 33, 34, 3218, 3219, 3220, 3221, 3222, 3223, 3224, 3225, 3226, 3227, 3229, 3230, 3231, 3232, 3388, 3389, 3390, 3391, 3392, 3393, 3395, 3396, 3397, 3398, 3399, 3403, 3404, 3423, 3425, 3427, 3429, 3430, 3432 (Forty-two trees)	5, 17, 18, 19, 21, 22, 23, 24, 25, 26, 28, 29, 30, 31, 32, 3228, 3394, 3400, 3401, 3402, 3405, 3406, 3407, 3408, 3409, 3410, 3411, 3412, 3413, 3414, 3415, 3416, 3417, 3418, 3419, 3420, 3421, 3422, 3424, 3426, 3428, 3431, 3433, G1 (Forty-three trees and One group of trees)	**85 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 trees viability	3, 4, 6, 7, 10, 11, 13, 14, 15, 16 (Ten trees)	None	**10 trees**

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10. RECOMMENDATIONS

10.1 This report assesses the impact of a proposed development to ninety-five (95) trees and one (1) group of trees that are located within three selected areas within the development site.

10.2 Eighty-five (85) trees and one (1) group of trees have been recommended for removal to accommodate the development. Forty-two (42) of these trees are higher value category A retention value trees including tree 1, 2, 8, 9, 12, 20, 27, 33, 34, 3218, 3219, 3220, 3221, 3222, 3223, 3224, 3225, 3226, 3227, 3229, 3230, 3231, 3232, 3388, 3389, 3390, 3391, 3392, 3393, 3395, 3396, 3397, 3398, 3399, 3403, 3404, 3423, 3425, 3427, 3429, 3430 and 3432. Forty-three (43) of these trees and one (1) group of trees are lower value category Z retention value trees that generally should not be a constraint to the development, including tree 5, 17, 18, 19, 21, 22, 23, 24, 25, 26, 28, 29, 30, 31, 32, 3228, 3394, 3400, 3401, 3402, 3405, 3406, 3407, 3408, 3409, 3410, 3411, 3412, 3413, 3414, 3415, 3416, 3417, 3418, 3419, 3420, 3421, 3422, 3424, 3426, 3428, 3431, 3433 and G1.

10.3 The remaining ten (10) trees are to be retained and protected, including tree 3, 4, 6, 7, 10, 11, 13, 14, 15 and 16. Each of these trees should be protected in accordance with AS4970-2009, details of which are included in section 11.

10.4 Three site plans have been included in appendix 1 to identify tree locations. The following site plans are included in appendix 1;

- Appendix 1A: Way Street Access Plan
- Appendix 1B: Bolton Street Laydown Plan
- Appendix 1C: Sydney Water Building Plan

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11. TREE PROTECTION REQUIREMENTS

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

11.2 **Project Arborist:** Prior to any works commencing at the site a project Arborist should be appointed. The project Arborist should be qualified to a minimum AQF level 5 and/or equivalent qualifications and experience, and should assist with any development issues relating to trees that may arise. If at any time it is not feasible to carryout works in accordance with this, an alternative must be agreed in writing with the project Arborist.

11.3 **Tree work:** All tree work should be carried out by a qualified and experienced Arborist with a minimum of AQF level 3 in arboriculture, in accordance with NSW Work Cover Code of Practice for the Amenity Tree Industry (1998) and AS4373 Pruning of amenity trees (2007).

11.4 **Initial site meeting/on-going regular inspections:** The project Arborist is to hold a pre-construction site meeting with 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. Site inspections are recommended on a monthly frequency throughout the development.

11.5 **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	Tree Species	TPZ Radius (m)	SRZ Radius (m)	Recommendations
1	*Casuarina glauca*	3.1	2.0	Remove.
2	*Casuarina glauca*	4.3	2.3	Remove.
3	*Eucalyptus robusta*	7.2	2.8	Retain and protect. Tree protection fencing is to create an exclusion zone for tree 3, 4, 6, 7, 10, 11, 13, 14, 15 and 16. See appendix 1A - Way Street Access Plan for tree protection fencing location. Ground protection is required in all remaining areas of the TPZ where material storage is proposed. See section 11.6.5 for ground protection specifications. Fencing is only to be moved under the approval of the project arborist.
4	*Casuarina glauca*	2.4	2.0	Retain. See tree protection for tree 3.
5	*Eucalyptus spp*	4.8	2.4	Remove.
6	*Eucalyptus pilularis*	7.2	2.8	Retain. See tree protection for tree 3.
7	*Eucalyptus robusta*	6.0	2.6	Retain. See tree protection for tree 3.

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Tree ID	Tree Species	TPZ Radius (m)	SRZ Radius (m)	Recommendations
8	*Casuarina glauca*	2.4	1.8	Remove.
9	*Casuarina glauca*	2.4	1.8	Remove.
10	*Eucalyptus saligna*	10.8	3.3	Retain. See tree protection for tree 3.
11	*Eucalyptus robusta*	5.6	2.5	Retain. See tree protection for tree 3.
12	*Casuarina glauca*	5.5	2.5	Remove.
13	*Casuarina glauca*	5.5	2.4	Retain. See tree protection for tree 3.
14	*Eucalyptus microcorys*	6.6	2.7	Retain. See tree protection for tree 3.
15	*Casuarina glauca*	5.4	2.5	Retain. See tree protection for tree 3.
16	*Casuarina glauca*	5.4	2.5	Retain. See tree protection for tree 3.
G1	*Casuarina glauca*	2.0	1.5	Remove.
17	*Casuarina glauca*	2.0	1.8	Remove.
18	*Casuarina glauca*	2.0	1.5	Remove.
19	*Casuarina glauca*	2.0	1.5	Remove.
20	*Casuarina glauca*	3.7	2.2	Remove.
21	*Casuarina glauca*	2.6	1.8	Remove.
22	*Casuarina glauca*	2.0	1.8	Remove.
23	*Casuarina glauca*	2.0	1.6	Remove.
24	*Casuarina glauca*	2.0	1.7	Remove.
25	*Casuarina glauca*	2.0	1.6	Remove.
26	*Casuarina glauca*	2.0	1.6	Remove.
27	*Casuarina glauca*	3.6	2.1	Remove.
28	*Casuarina glauca*	2.0	1.6	Remove.
29	*Casuarina glauca*	2.0	1.5	Remove.
30	*Celtis sinensis*	2.4	1.7	Remove.
31	*Celtis sinensis*	2.0	1.5	Remove.
32	*Celtis sinensis*	2.0	1.5	Remove.
33	*Casuarina glauca*	3.6	2.1	Remove.
34	*Casuarina glauca*	3.0	1.9	Remove.
3218	*Allocasuarina littoralis*	2.4	1.8	Remove.
3219	*Allocasuarina littoralis*	2.4	1.8	Remove.
3220	*Allocasuarina littoralis*	3.6	2.1	Remove.
3221	*Casuarina glauca*	4.8	2.4	Remove.
3222	*Eucalyptus paniculata*	3.6	2.1	Remove.
3223	*Angophora costata*	6.5	2.7	Remove.
3224	*Casuarina glauca*	3.6	2.1	Remove.
3225	*Casuarina glauca*	4.0	2.2	Remove.
3226	*Casuarina glauca*	3.4	2.1	Remove.
3227	*Casuarina glauca*	3.4	2.1	Remove.
3228	*Casuarina glauca*	2.0	1.5	Remove.
3229	*Angophora costata*	2.6	1.8	Remove.
3230	*Angophora costata*	4.8	2.4	Remove.
3231	*Casuarina glauca*	3.6	2.1	Remove.
3232	*Casuarina glauca*	6.0	2.8	Remove.
3388	*Casuarina glauca*	3.6	2.1	Remove.
3389	*Casuarina glauca*	3.6	2.1	Remove.

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Tree ID	Tree Species	TPZ Radius (m)	SRZ Radius (m)	Recommendations
3390	*Angophora costata*	2.4	1.8	Remove.
3391	*Casuarina glauca*	3.6	2.1	Remove.
3392	*Casuarina glauca*	2.6	2.0	Remove.
3393	*Casuarina glauca*	2.9	2.1	Remove.
3394	*Cinnamomum camphora*	2.0	1.5	Remove.
3395	*Angophora costata*	3.1	2.0	Remove.
3396	*Casuarina glauca*	5.4	2.6	Remove.
3397	*Casuarina glauca*	2.8	2.0	Remove.
3398	*Casuarina glauca*	2.5	1.8	Remove.
3399	*Casuarina glauca*	2.6	2.1	Remove.
3400	*Casuarina glauca*	2.0	1.6	Remove.
3401	*Casuarina glauca*	2.2	2.1	Remove.
3402	*Casuarina glauca*	2.0	1.5	Remove.
3403	*Angophora costata*	3.6	2.0	Remove.
3404	*Casuarina glauca*	4.3	2.4	Remove.
3405	*Casuarina glauca*	2.0	1.6	Remove.
3406	*Acacia spp*	4.2	2.4	Remove.
3407	*Acacia parramattensis*	2.5	1.9	Remove.
3408	*Acacia parramattensis*	2.0	1.6	Remove.
3409	*Acacia parramattensis*	2.2	1.8	Remove.
3410	*Acacia parramattensis*	2.0	1.6	Remove.
3411	*Acacia parramattensis*	2.0	1.5	Remove.
3412	*Acacia parramattensis*	2.0	1.5	Remove.
3413	*Celtis sinensis*	2.0	1.5	Remove.
3414	*Celtis sinensis*	2.0	1.5	Remove.
3415	*Celtis sinensis*	2.6	1.9	Remove.
3416	*Casuarina glauca*	2.0	1.6	Remove.
3417	*Acacia parramattensis*	2.0	1.5	Remove.
3418	*Casuarina glauca*	2.0	1.8	Remove.
3419	*Cinnamomum camphora*	2.0	1.5	Remove.
3420	*Acacia parramattensis*	2.0	1.5	Remove.
3421	*Acacia parramattensis*	2.0	1.5	Remove.
3422	*Acacia spp*	2.0	1.6	Remove.
3423	*Casuarina glauca*	3.2	2.1	Remove.
3424	*Celtis sinensis*	2.0	1.7	Remove.
3425	*Casuarina glauca*	2.9	1.9	Remove.
3426	*Casuarina spp*	2.5	1.8	Remove.
3427	*Angophora costata*	4.2	2.3	Remove.
3428	*Phoenix canariensis*	3.0	NA	Remove.
3429	*Casuarina glauca*	4.3	2.3	Remove.
3430	*Casuarina glauca*	3.0	2.1	Remove.
3431	*Casuarina glauca*	2.0	1.6	Remove.
3432	*Casuarina glauca*	2.4	1.9	Remove.
3433	*Casuarina glauca*	2.0	1.5	Remove.

11.6 **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.

11.6.1 Protective fencing: The protective fencing must be constructed of 1.8 metre 'cyclone chainmesh fence'. The fencing should only be removed for the landscaping phase and this should be approved by the project Arborist. 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. Any modifications to the fencing locations must be approved by the project Arborist.

11.6.2 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

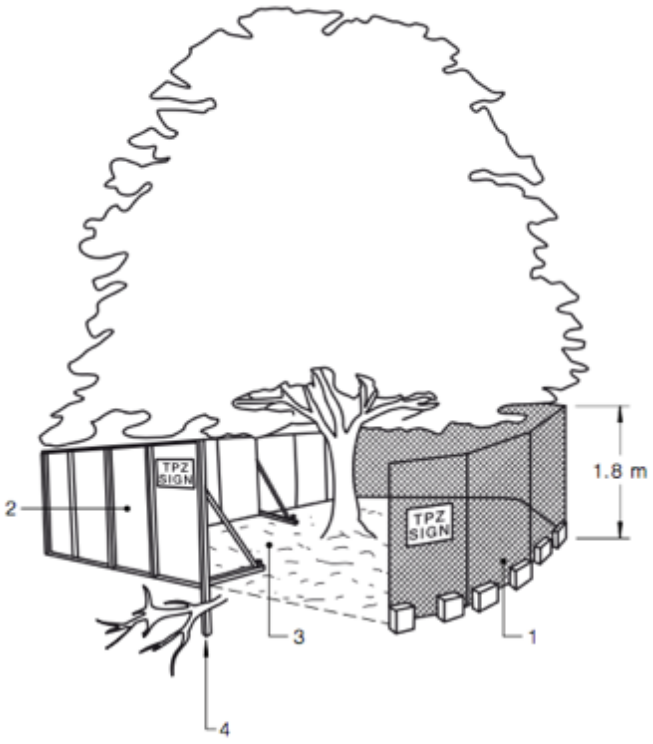
11.6.3 Trunk and Branch Protection: The trunk must be protected by wrapped hessian or similar material to limit damage. Timber planks (50mm x 100mm or similar) should then be placed around tree trunk. The timber planks should be spaced at 100mm intervals, and must be fixed against the trunk with tie 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.

11.6.4 Mulch: Any areas of the TPZ located inside the subject site must be mulched to a depth of 75mm with good quality mulch. Mulch must not be built-up around the trunk the trees as it can cause collar rot.

11.6.5 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.

11.6.6 Temporary irrigation: Temporary irrigation should distribute water evenly throughout the area of the TPZ. The irrigation should be used for at minimum one hour daily throughout all stages of the development.



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,[5] with example tree protection.

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

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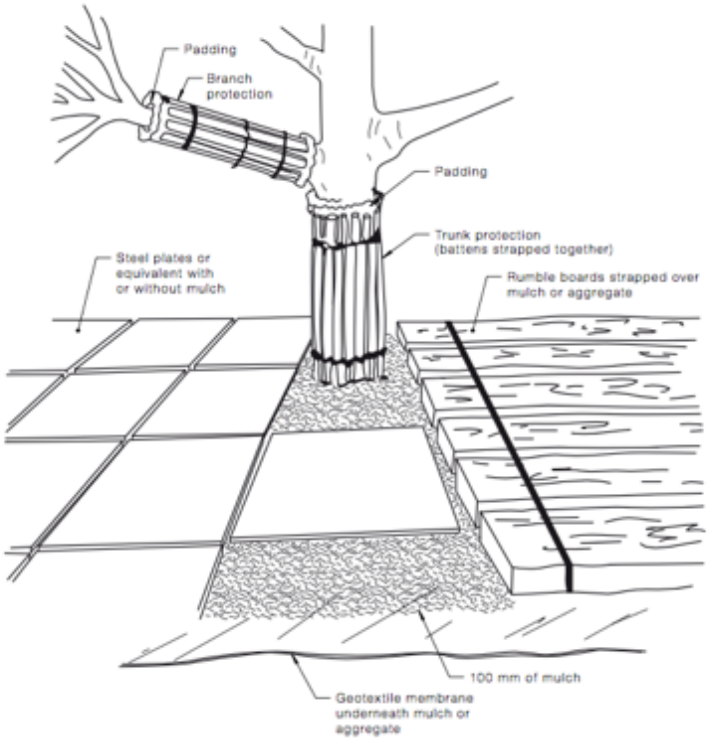

NOTES:

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,[6] with example tree protection.

11.7 **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) Refuelling.
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.

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

11.8 **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.

11.9 **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 30mm 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).[7] The tree root is to be pruned back to a branch root if possible. Make a clean cut and leave as small a wound as possible.

11.10 **Sediment and Contamination:** All contamination run off from the development such as but not limited to concrete, sediment and toxic wastes must be prevented from entering the TPZ at all times.

11.11 **Tree Wounding/Injury:** Any wounding or injury that occurs to a tree during the construction process will require the project Arborist to be contacted for an assessment of the injury and provide mitigation/remediation advice. It is generally accepted that trees may take many years to decline and eventually die from root damage. All repair work is to be carried out by the project Arborist, at the contractor's expense.

11.12 **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.

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

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12. CONSTRUCTION HOLD POINTS FOR TREE PROTECTION

12.1 **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 implementing 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.	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. Site inspection are recommended on a monthly 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 30mm 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	
Project Arborist to approve relocation of tree protection for landscaping. 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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13. BIBLIOGRAPHY/REFERENCES

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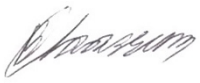
14. LIST OF APPENDICES

The following are included in the appendices:

- Appendix 1A: Way Street Access Plan
- Appendix 1B: Bolton Street Laydown Plan
- Appendix 1C: Sydney Water Building Plan
- Appendix 2: Tree Inspection Schedule
- Appendix 3: Further Information of Methodology



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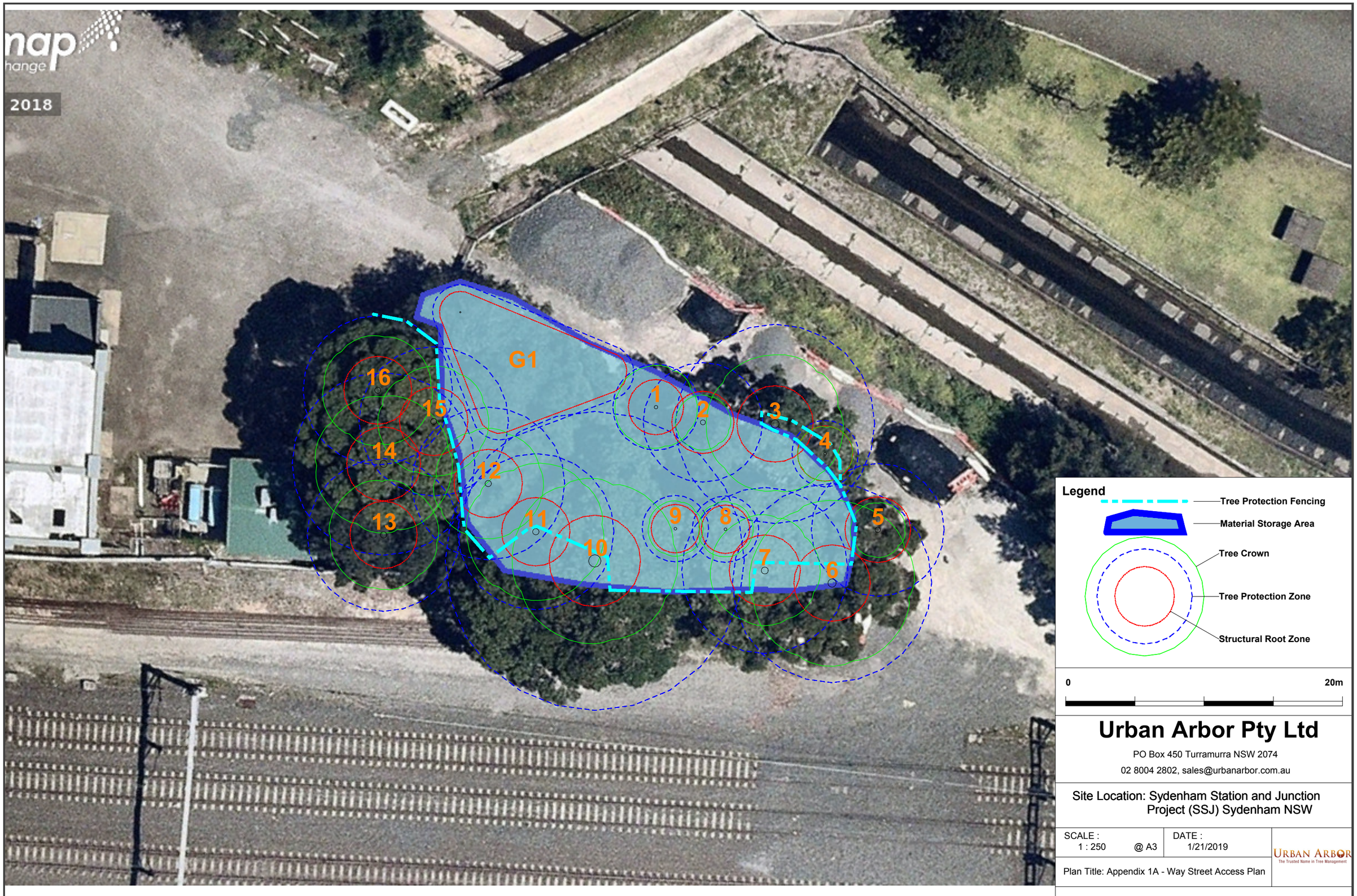


Legend

- Tree Protection Fencing
- Material Storage Area
- Tree Crown
- Tree Protection Zone
- Structural Root Zone

0 — 20m

Urban Arbor Pty Ltd

PO Box 450 Turramurra NSW 2074

02 8004 2802, sales@urbanarbor.com.au

Site Location: Sydenham Station and Junction Project (SSJ) Sydenham NSW

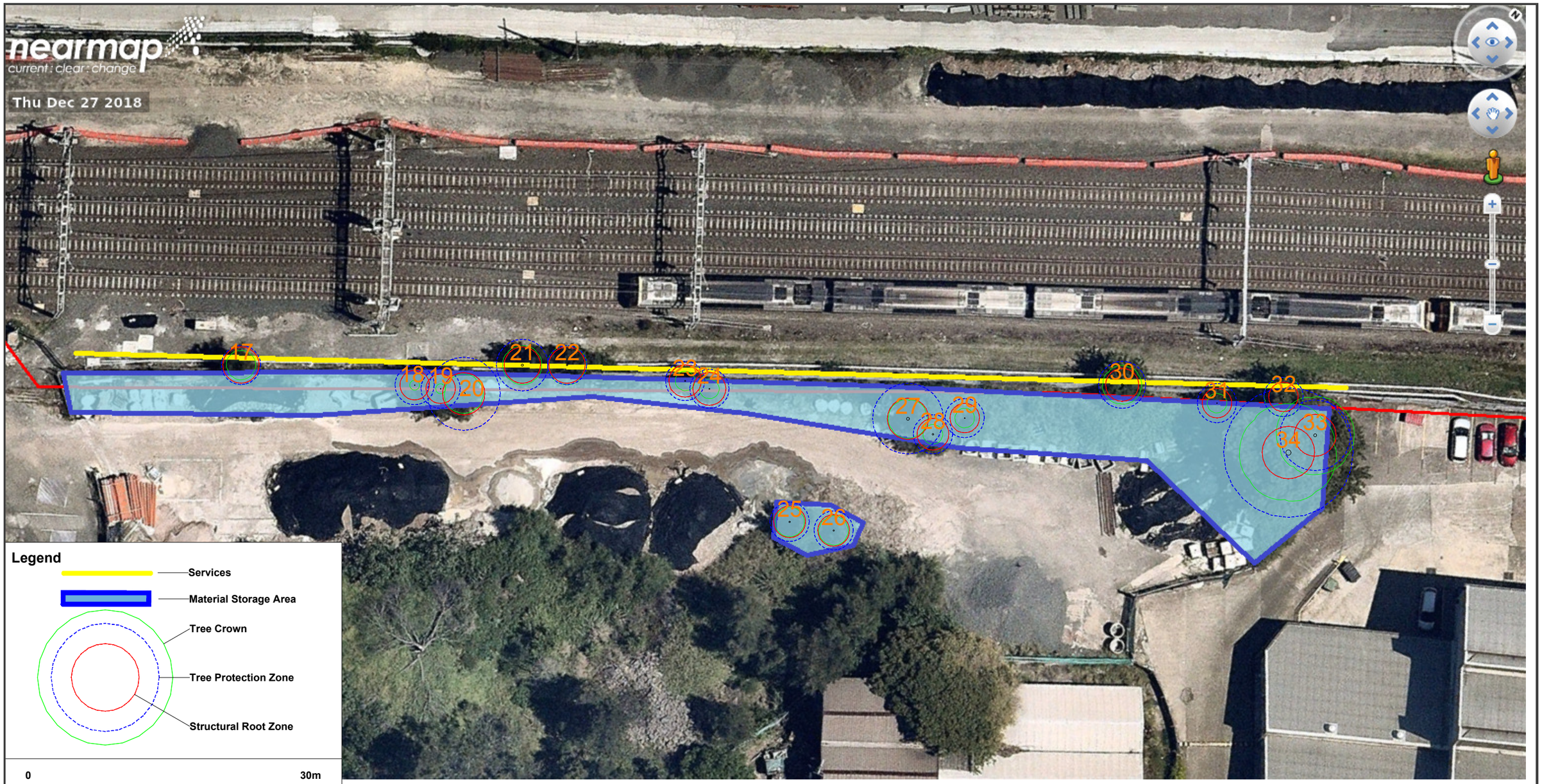
SCALE :	DATE :
1 : 250 @ A3	1/21/2019

URBAN ARBOR
The Trusted Name in Tree Management

Plan Title: Appendix 1A - Way Street Access Plan

Ref: 19/01/21/SSJ

Prepared by: Bryce Claassens



Legend

- Services
- Material Storage Area
- Tree Crown
- Tree Protection Zone
- Structural Root Zone

0 — 30m

Urban Arbor Pty Ltd

PO Box 450 Turramurra NSW 2074

02 8004 2802, sales@urbanarbor.com.au

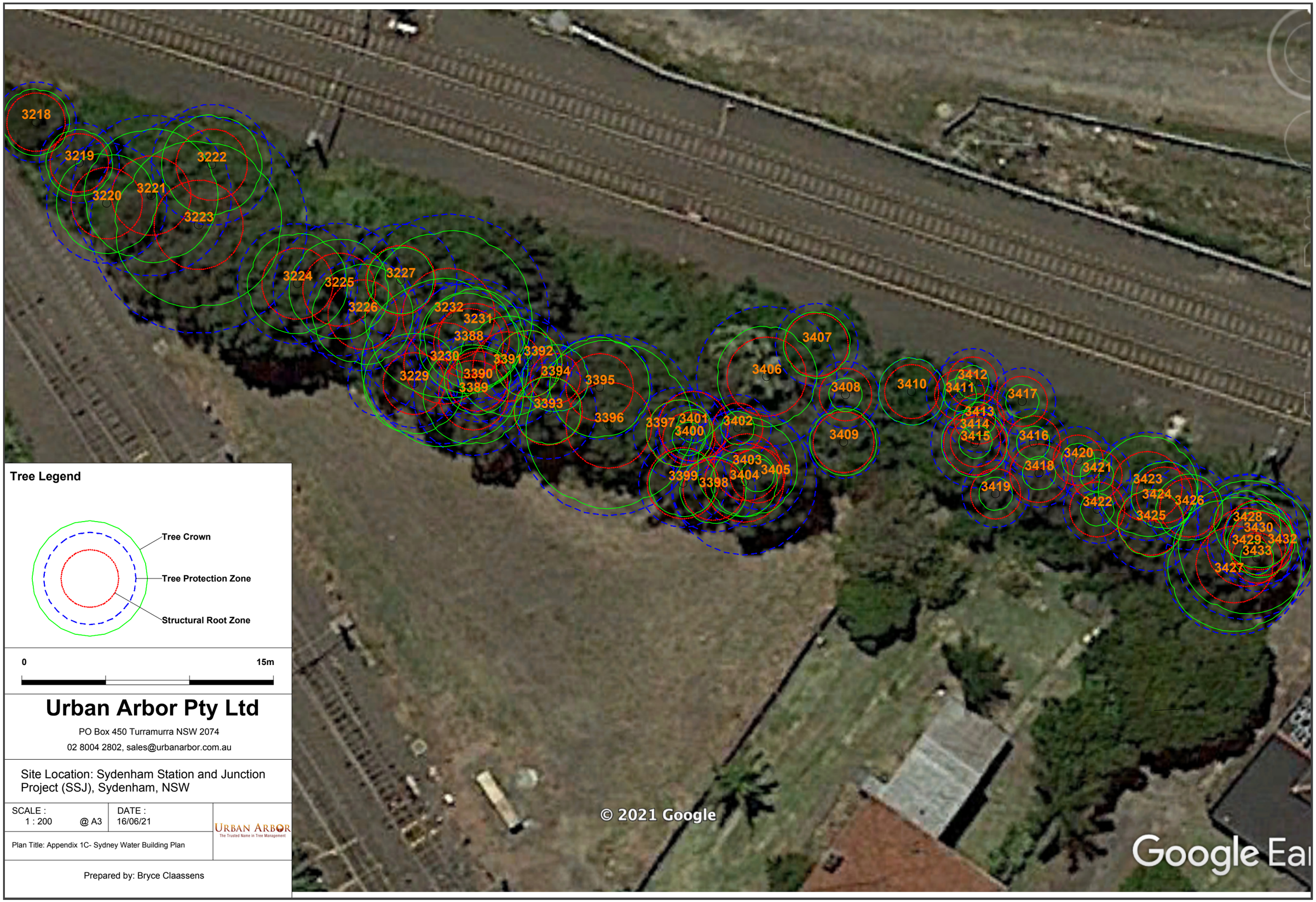
Site Location: Sydenham Station and Junction Project (SSJ) Sydenham NSW

SCALE :	DATE :
1 : 400 @ A3	1/21/2019

URBAN ARBOR
The Trusted Name in Tree Management

Plan Title: Appendix 1B - Bolton Street Laydown Plan

Ref: 19/01/21/SSJ
Prepared by: Bryce Claassens



Tree Legend

Tree Crown

Tree Protection Zone

Structural Root Zone

0 15m

Urban Arbor Pty Ltd

PO Box 450 Turramurra NSW 2074

02 8004 2802, sales@urbanarbor.com.au

Site Location: Sydenham Station and Junction Project (SSJ), Sydenham, NSW

SCALE : 1 : 200 @ A3	DATE : 16/06/21	URBAN ARBOR The Trusted Name in Tree Management
Plan Title: Appendix 1C- Sydney Water Building Plan		

Prepared by: Bryce Claassens

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	Swamp She-oak	*Casuarina glauca*	Mature	8	3	260					260	300	Good	Good	Medium	1. Long	A1	3.1	2.0	Way Street access East.
2	Swamp She-oak	*Casuarina glauca*	Mature	10	2	360					360	400	Good	Good	Medium	1. Long	A1	4.3	2.3	Way Street access East.
3	Swamp Mahogany	*Eucalyptus robusta*	Mature	11	5	600					600	650	Good	Fair	Medium	2. Medium	A2	7.2	2.8	Way Street access East. 20% cambium dieback near base of tree.
4	Swamp She-oak	*Casuarina glauca*	Mature	7	2	200					200	300	Good	Good	Medium	1. Long	A1	2.4	2.0	Way Street access East.
5	Gum	*Eucalyptus spp*	Dead	6	2	400					400	450	Dead	Poor	Low	4. Remove	Z4	4.8	2.4	Way Street access East. Dead tree.
6	Blackbutt	*Eucalyptus pilularis*	Mature	15	6	600					600	650	Good	Good	High	1. Long	A1	7.2	2.8	Way Street access East.
7	Swamp Mahogany	*Eucalyptus robusta*	Mature	12	4	500					500	550	Good	Good	High	1. Long	A1	6.0	2.6	Way Street access East.
8	Swamp She-oak	*Casuarina glauca*	Mature	9	2	200					200	220	Good	Good	Medium	1. Long	A1	2.4	1.8	Way Street access East.
9	Swamp She-oak	*Casuarina glauca*	Mature	17	2	200					200	220	Good	Good	Medium	1. Long	A1	2.4	1.8	Way Street access East.
10	Sydney Blue Gum	*Eucalyptus saligna*	Mature	17	6	900					900	990	Good	Good	High	1. Long	A1	10.8	3.3	Way Street access East.
11	Swamp Mahogany	*Eucalyptus robusta*	Mature	8	5	470					470	500	Good	Good	Medium	1. Long	A1	5.6	2.5	Way Street access East.Supressed by adjacent tree.
12	Swamp She-oak	*Casuarina glauca*	Mature	14	4	460					460	500	Good	Good	High	1. Long	A1	5.5	2.5	Way Street access East.
13	Swamp She-oak	*Casuarina glauca*	Mature	10	4	460					460	480	Good	Good	High	1. Long	A1	5.5	2.4	Way Street access East.
14	Tallowwood	*Eucalyptus microcorys*	Mature	15	5	550					550	600	Good	Good	High	1. Long	A1	6.6	2.7	Way Street access East.
15	Swamp She-oak	*Casuarina glauca*	Mature	14	4	450					450	500	Good	Good	High	1. Long	A1	5.4	2.5	Way Street access East.
16	Swamp She-oak	*Casuarina glauca*	Mature	12	4	450					450	490	Good	Good	High	1. Long	A1	5.4	2.5	Way Street access East.
G1	Swamp She-oak	*Casuarina glauca*	Semi-mature	8	1	100					100	120	Good	Good	Low	5. Small/Young	Z1	2.0	1.5	Way Street access East. Group of approximately 20 small Casuarina glauca.
17	Swamp She-oak	*Casuarina glauca*	Semi-mature	6	1.5	120	100				156	250	Good	Fair	Low	5. Small/Young	Z1	2.0	1.8	Bolton St Laydown.
18	Swamp She-oak	*Casuarina glauca*	Young	5	0.5	80					80	90	Good	Good	Low	5. Small/Young	Z1	2.0	1.5	Bolton St Laydown.
19	Swamp She-oak	*Casuarina glauca*	Young	4	0.5	50					50	70	Good	Good	Low	5. Small/Young	Z1	2.0	1.5	Bolton St Laydown.
20	Swamp She-oak	*Casuarina glauca*	Mature	8.5	2	310					310	360	Good	Good	Medium	1. Long	A1	3.7	2.2	Bolton St Laydown.
21	Swamp She-oak	*Casuarina glauca*	Semi-mature	7	2	220					220	250	Good	Fair	Low	3. Short	Z9	2.6	1.8	Bolton St Laydown. Topped at 0.5m with regrowth.
22	Swamp She-oak	*Casuarina glauca*	Semi-mature	6	2	100	100				141	250	Good	Fair	Low	5. Small/Young	Z1	2.0	1.8	Bolton St Laydown. Multi stem tree.
23	Swamp She-oak	*Casuarina glauca*	Young	5	1	80	80	50			124	190	Good	Good	Low	5. Small/Young	Z1	2.0	1.6	Bolton St Laydown.
24	Swamp She-oak	*Casuarina glauca*	Young	5	1	40	50	80			102	200	Good	Good	Low	5. Small/Young	Z1	2.0	1.7	Bolton St Laydown.
25	Swamp She-oak	*Casuarina glauca*	Semi-mature	7	1.5	150					150	180	Good	Good	Low	5. Small/Young	Z1	2.0	1.6	Bolton St Laydown.
26	Swamp She-oak	*Casuarina glauca*	Semi-mature	6.5	1.5	150					150	180	Good	Good	Low	5. Small/Young	Z1	2.0	1.6	Bolton St Laydown.
27	Swamp She-oak	*Casuarina glauca*	Mature	9	2	300					300	340	Good	Good	Medium	1. Long	A1	3.6	2.1	Bolton St Laydown.
28	Swamp She-oak	*Casuarina glauca*	Young	6	1	160					160	180	Good	Fair	Low	5. Small/Young	Z1	2.0	1.6	Bolton St Laydown. Co-dominant stems.
29	Swamp She-oak	*Casuarina glauca*	Young	5	1	70					70	90	Good	Good	Low	5. Small/Young	Z1	2.0	1.5	Bolton St Laydown.
30	Chinese Celtis	*Celtis sinensis*	Semi-mature	5	2	200					200	200	Good	Fair	Low	5. Small/Young	Z3	2.4	1.7	Bolton St Laydown. Exempt species.
31	Chinese Celtis	*Celtis sinensis*	Semi-mature	4.5	1	80					80	100	Good	Good	Low	5. Small/Young	Z3	2.0	1.5	Bolton St Laydown. Exempt species.
32	Chinese Celtis	*Celtis sinensis*	Semi-mature	5	2	80					80	100	Good	Good	Low	5. Small/Young	Z3	2.0	1.5	Bolton St Laydown. Exempt species.
33	Swamp She-oak	*Casuarina glauca*	Mature	10	4	300					300	350	Good	Good	Medium	1. Long	A1	3.6	2.1	Bolton St Laydown.
34	Swamp She-oak	*Casuarina glauca*	Mature	12	5	550					550	600	Good	Good	High	1. Long	A1	6.6	2.7	Bolton St Laydown.
3218	Black She Oak	*Allocasuarina littoralis*	Semi-mature	8	2	200					200	220	Good	Fair	Medium	2. Medium	A1	2.4	1.8	Located within corridor. DBH estimated.
3219	Black She Oak	*Allocasuarina littoralis*	Semi-mature	8	2	200					200	220	Good	Fair	Medium	2. Medium	A1	2.4	1.8	Located within corridor. DBH estimated.
3220	Black She Oak	*Allocasuarina littoralis*	Mature	8	3	300					300	350	Good	Fair	Medium	2. Medium	A1	3.6	2.1	Located within corridor. DBH estimated.
3221	Swamp Oak	*Casuarina glauca*	Mature	14	4	400					400	450	Good	Good	High	1. Long	A1	4.8	2.4	Located within corridor. DBH estimated.
3222	Grey Ironbark	*Eucalyptus paniculata*	Mature	10	3	300					300	350	Good	Good	High	1. Long	A1	3.6	2.1	Located within corridor. DBH estimated.
3223	Smooth Barked Apple	*Angophora costata*	Mature	21	5	450	300				541	600	Good	Good	Very High	1. Long	A1	6.5	2.7	Located within corridor. DBH estimated.
3224	Swamp Oak	*Casuarina glauca*	Mature	10	3	300					300	350	Good	Fair	High	2. Medium	A1	3.6	2.1	Located within corridor. Asymmetric crown shape due to adjacent trees.
3225	Swamp Oak	*Casuarina glauca*	Mature	17	3	330					330	370	Good	Good	High	1. Long	A1	4.0	2.2	Located within corridor.

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
3226	Swamp Oak	*Casuarina glauca*	Semi-mature	17	3	280					280	330	Good	Good	Medium	1. Long	A1	3.4	2.1	Located within corridor.
3227	Swamp Oak	*Casuarina glauca*	Semi-mature	18	2	280					280	330	Good	Good	Medium	1. Long	A1	3.4	2.1	Located within corridor.
3228	Swamp Oak	*Casuarina glauca*	Semi-mature	10	1	130					130	160	Good	Good	Low	5. Small/Young	Z1	2.0	1.5	Located within corridor.
3229	Smooth Barked Apple	*Angophora costata*	Semi-mature	10	3	220					220	250	Good	Good	Medium	1. Long	A1	2.6	1.8	Located within corridor.
3230	Smooth Barked Apple	*Angophora costata*	Mature	20	5	400					400	480	Good	Good	High	1. Long	A1	4.8	2.4	Located within corridor.
3231	Swamp Oak	*Casuarina glauca*	Mature	11	3	300					300	350	Good	Good	High	1. Long	A1	3.6	2.1	Located within corridor.
3232	Swamp Oak	*Casuarina glauca*	Mature	20	5	500					500	650	Good	Good	High	1. Long	A1	6.0	2.8	Located within corridor adjacent to tracks.
3388	Swamp Oak	*Casuarina glauca*	Mature	12	3	300					300	330	Good	Good	Medium	1. Long	A1	3.6	2.1	None.
3389	Swamp Oak	*Casuarina glauca*	Mature	16	3	300					300	330	Good	Good	Medium	1. Long	A1	3.6	2.1	None.
3390	Smooth Barked Apple	*Angophora costata*	Semi-mature	14	2	170	110				202	230	Good	Good	Medium	1. Long	A1	2.4	1.8	None.
3391	Swamp Oak	*Casuarina glauca*	Mature	16	3	300					300	330	Good	Good	Medium	1. Long	A1	3.6	2.1	None.
3392	Swamp Oak	*Casuarina glauca*	Semi-mature	16	2	220					220	300	Good	Good	Medium	1. Long	A1	2.6	2.0	None.
3393	Swamp Oak	*Casuarina glauca*	Semi-mature	16	2	240					240	320	Good	Good	Medium	1. Long	A1	2.9	2.1	None.
3394	Camphor Laurel	*Cinnamomum camphora*	Young	5	2	120					120	150	Good	Fair	Very Low	5. Small/Young	Z3	2.0	1.5	Exempt species.
3395	Smooth Barked Apple	*Angophora costata*	Semi-mature	10	3	260					260	310	Good	Good	Medium	1. Long	A1	3.1	2.0	None.
3396	Swamp Oak	*Casuarina glauca*	Mature	18	5	450					450	550	Good	Good	High	1. Long	A1	5.4	2.6	None.
3397	Swamp Oak	*Casuarina glauca*	Semi-mature	16	2	230					230	300	Good	Good	Medium	1. Long	A1	2.8	2.0	None.
3398	Swamp Oak	*Casuarina glauca*	Semi-mature	10	2	210					210	240	Good	Good	Medium	1. Long	A1	2.5	1.8	Asymmetric crown.
3399	Swamp Oak	*Casuarina glauca*	Semi-mature	17	2	220					220	350	Good	Good	Medium	1. Long	A1	2.6	2.1	None.
3400	Swamp Oak	*Casuarina glauca*	Young	14	1	150					150	170	Good	Good	Low	5. Small/Young	Z1	2.0	1.6	None.
3401	Swamp Oak	*Casuarina glauca*	Young	12	1	180					180	330	Good	Good	Low	5. Small/Young	Z1	2.2	2.1	None.
3402	Swamp Oak	*Casuarina glauca*	Young	9	1	100					100	150	Good	Good	Low	5. Small/Young	Z1	2.0	1.5	None.
3403	Smooth Barked Apple	*Angophora costata*	Mature	12	3	210	210				297	300	Good	Good	High	1. Long	A1	3.6	2.0	None.
3404	Swamp Oak	*Casuarina glauca*	Mature	20	2	360					360	450	Good	Good	High	1. Long	A1	4.3	2.4	None.
3405	Swamp Oak	*Casuarina glauca*	Young	10	1	170					170	190	Good	Good	Low	5. Small/Young	Z1	2.0	1.6	None.
3406	Wattle	*Acacia spp*	Dead	7	3	350					350	450	Dead	Poor	Medium	4. Remove	Z4	4.2	2.4	Dead stag.
3407	Parramatta Wattle	*Acacia parramattensis*	Semi-mature	6	2	100	180				206	260	Good	Fair	Low	5. Small/Young	Z1	2.5	1.9	None.
3408	Parramatta Wattle	*Acacia parramattensis*	Young	6	1	150					150	170	Good	Fair	Low	5. Small/Young	Z1	2.0	1.6	None.
3409	Parramatta Wattle	*Acacia parramattensis*	Semi-mature	6	2	180					180	240	Good	Good	Low	5. Small/Young	Z1	2.2	1.8	Lopped stem with cambium damage.
3410	Parramatta Wattle	*Acacia parramattensis*	Young	6	2	130					130	180	Good	Good	Low	5. Small/Young	Z1	2.0	1.6	None.
3411	Parramatta Wattle	*Acacia parramattensis*	Young	6	1	100					100	120	Good	Good	Low	5. Small/Young	Z1	2.0	1.5	None.
3412	Parramatta Wattle	*Acacia parramattensis*	Young	5	1	100					100	120	Good	Fair	Low	5. Small/Young	Z1	2.0	1.5	None.
3413	Chinese Celtis	*Celtis sinensis*	Young	5	1	90					90	120	Good	Fair	Very Low	5. Small/Young	Z3	2.0	1.5	Celtis sinensis. Exempt species.
3414	Chinese Celtis	*Celtis sinensis*	Young	6	1	100					100	120	Good	Fair	Very Low	5. Small/Young	Z3	2.0	1.5	Celtis sinensis. Exempt species.
3415	Chinese Celtis	*Celtis sinensis*	Semi-mature	7	2	220					220	260	Good	Good	Very Low	5. Small/Young	Z3	2.6	1.9	Celtis sinensis. Exempt species.
3416	Swamp Oak	*Casuarina glauca*	Semi-mature	10	1	170					170	180	Good	Good	Low	5. Small/Young	Z1	2.0	1.6	None.
3417	Parramatta Wattle	*Acacia parramattensis*	Young	5	1	90					90	100	Good	Fair	Low	5. Small/Young	Z1	2.0	1.5	None.
3418	Swamp Oak	*Casuarina glauca*	Young	6	1	170					170	220	Good	Fair	Low	5. Small/Young	Z1	2.0	1.8	None.
3419	Camphor Laurel	*Cinnamomum camphora*	Young	5	1	90	100				135	120	Good	Good	Very Low	5. Small/Young	Z3	2.0	1.5	Exempt species.
3420	Parramatta Wattle	*Acacia parramattensis*	Young	5	1	90					90	100	Good	Fair	Low	5. Small/Young	Z1	2.0	1.5	None.
3421	Parramatta Wattle	*Acacia parramattensis*	Young	5	1	90					90	100	Good	Fair	Low	5. Small/Young	Z1	2.0	1.5	None.
3422	Wattle	*Acacia spp*	Dead	5	1	170					170	190	Dead	Poor	Low	4. Remove	Z4	2.0	1.6	Dead stag.
3423	Swamp Oak	*Casuarina glauca*	Mature	16	3	270					270	330	Good	Good	Medium	1. Long	A1	3.2	2.1	None.
3424	Chinese Celtis	*Celtis sinensis*	Young	6	2	170					170	200	Good	Fair	Very Low	5. Small/Young	Z3	2.0	1.7	Celtis sinensis. Exempt species.
3425	Swamp Oak	*Casuarina glauca*	Semi-mature	16	2	240					240	280	Good	Good	Medium	1. Long	A1	2.9	1.9	None.
3426	She Oak	*Casuarina spp*	Dead	5	2	210					210	220	Dead	Poor	Low	4. Remove	Z4	2.5	1.8	Dead tree.

Appendix 2 - Tree Inspection Schedule

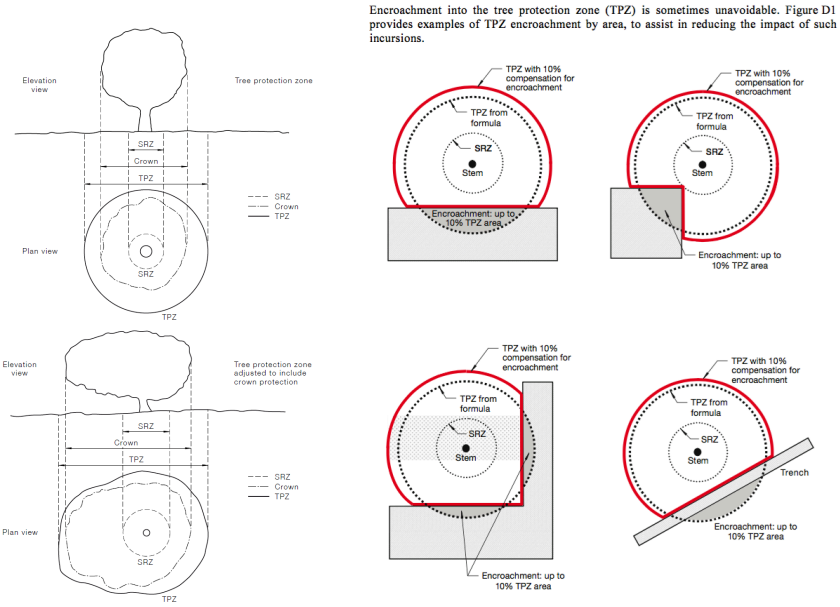
Tree ID	Common Name	Botanical Name	Age Class	Height (m)	Canopy Spread Radius (m)	Stem 1	Stem 2	Stem 3	Stem 4	Stem 5	DBH (mm)	DAB (mm)	Health	Structure	Amenity Value	SULE	Retention Value	TPZ Radius (m)	SRZ Radius (m)	Notes
3427	Smooth Barked Apple	*Angophora costata*	Mature	16	4	350					350	420	Good	Good	High	1. Long	A1	4.2	2.3	None.
3428	Canary Palm	*Phoenix canariensis*	Young	5	2	250					250	NA	Good	Fair	Very Low	5. Small/Young	Z3	3.0	NA	Exempt species.
3429	Swamp Oak	*Casuarina glauca*	Mature	18	4	360					360	440	Good	Good	High	1. Long	A1	4.3	2.3	None.
3430	Swamp Oak	*Casuarina glauca*	Semi-mature	15	2	250					250	330	Good	Good	Medium	1. Long	A1	3.0	2.1	None.
3431	Swamp Oak	*Casuarina glauca*	Young	8	1	150					150	180	Fair	Fair	Low	3. Short	Z4	2.0	1.6	Low foliage density for species. In decline.
3432	Swamp Oak	*Casuarina glauca*	Semi-mature	12	2	200					200	260	Good	Good	Medium	1. Long	A1	2.4	1.9	None.
3433	Swamp Oak	*Casuarina glauca*	Young	8	1	130					130	150	Good	Good	Low	5. Small/Young	Z1	2.0	1.5	None.

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) - $(DAB \times 50)^{0.42} \times 0.64$. 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.
Retention Value: Tree AZ, see appendix 3 for categories.

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.

TreeAZ is designed by Barrell Tree Consultancy (www.barrelltreecare.co.uk) and is reproduced with their permission

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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

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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