REPORT: **Arboricultural Impact Assessment**
Our Ref: 20213 V5c

REPORT COMMISSIONED FOR:

McNally Management
Mr Logendra Pillay

15 Jubilee Avenue, Warriewood
New South Wales 2102

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7th of August 2020

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1.0 ABSTRACT

1.1 An Arboricultural Impact Assessment was commissioned by Mr Logendra Pillay in relation to the proposed bus depot at 15 Jubilee Avenue, Warriewood NSW 2102. Thirteen (13) trees in the surrounding area of the proposed works on and adjacent the site were assessed.

1.2 Thirteen (13) trees have been assessed on the site and five (5) trees are of very low retention value, three (3) trees have a low retention value and five (5) trees are of moderate-high retention value.

1.3 The proposed bus depot will require the removal seven (7) trees on site numbered 1, 2, 3, 4, 5, 11 and 12, which includes five (5) exempt trees numbered 2, 3, 4, 5 and 12. Replenishment of two (2) 45 litre potted species listed in Appendix F is required on site.

1.4 Trees to be retained on site and protected using Tree Protection Fencing are numbered 6 and 7. Four (4) trees adjacent the site numbered 8, 9, 10 and 13 are to be retained and protected using the existing boundary fence as Tree Protection Fencing and Tree Trunk Protection for the street tree. There must be no work within the SRZ of the retained trees and all excavations within the TPZ of retained trees must be under supervision of an AQF level 5 Arborist.

1.5 Tree Protection Systems are required and must be installed, prior to the commencement of the development for all retained trees and certified compliant by an AQF level 5 arborist.

REFERENCES

Pittwater 21 Development Control Plan 2019.
Noxongiffen. Plan-Proposed Site: NGA-S2002-DWG-DA11. Dated July 2020.

2.0 INTRODUCTION

2.1 An Arboricultural Impact Assessment was commissioned in relation to the proposed bus depot at 15 Jubilee Avenue, Warriewood NSW 2102. Thirteen (13) trees in the surrounding area of the proposed development were assessed by Caryssa Jones B.Bio.Cons MQ, Dip Arb AQF L5, Tree Risk Assessor under supervision of Jim McArdle B.Ed. Sc ACU, Dip Arb AQF L5 Ryde, QTRA, TRA Assessor and TCAA President whom attended site on the 19th of June 2020.

2.2 The retention value of thirteen (13) trees have been assessed on the site to be:
Five (5) trees are of moderate-high retention value, numbered 1, 6, 7, 8, & 9.
Three (3) trees are of low retention value, numbered 10, 11 & 13.
Five (5) trees are of very low retention value, numbered 2, 3, 4, 5 & 12, as they are exempt.

2.3 The proposed bus depot will require the removal of seven (7) trees on site numbered 1, 2, 3, 4, 5, 11 and 12, which includes five (5) trees numbered 2, 3, 4, 5 & 12 which are exempt according to the Northern Beaches Council. Replenishment of two (2) 45 litre potted species listed in Appendix F is required on site.

2.4 Retention and Protection measures will be required of six (6) trees numbered 6, 7, 8, 9, 10 & 13. Any excavations required within the TPZ of these trees must be carried out under the supervision of an AQF level 5 Arborist. Any roots required to be cut within the TPZ of Tree 9 that are greater than 40mm in diameter must have consent by an AQF level 5 Arborist. Pruning may be required for clearance of trees 9 and 10 which must be carried out in accordance with the Australian Standards 4373-2007 *Pruning of Amenity Trees*.

2.5 Tree Protection Fencing is required for trees 6 and 7 while the existing boundary fence will act as Tree Protection Fencing for neighbouring trees. Tree Trunk Protection is to be used for Tree 8. The TPZ of retained trees that encroaches onto the site requires ground protection which must be 75mm depth of Eucalyptus species mulch.

2.6 McArdle Arboricultural Consultancy Pty Ltd prepared the report. The Arboricultural Impact Assessment report is developed to assess the trees at the above address for health and status. Ms Caryssa Jones B.Bio.Cons MQ, Dip Arb AQF L5, Tree Risk Assessor under the supervision of Mr James McArdle B.Ed. Sc ACU, Dip Arb AQF L5 Ryde, QTRA, Tree Risk Assessor and TCAA President, conducted the evaluation using Visual Tree Assessment (VTA) according to Claus Mattheck and Breloer (1994) method for biological and lower level mechanical functions. The systems are in accordance with industry best practice and impact assessments are based upon the Australian Standards AS4970-2009 *Protection of Trees on Development Sites* and Australian Standards 4373-2007 *Pruning of Amenity Trees.*

3.0 AIMS

The aim of the report is to:

3.1 To assess thirteen (13) trees at 15 Jubilee Avenue, Warriewood NSW 2102 according to the methodologies presented in this report.

3.2 To give recommendations for management and protection during the proposed development. Protection measures will be referenced from *Australian Standards AS4970 2009 Tree Protection on Development Sites.*

4.0 METHODOLOGY

4.1 This arborist impact assessment uses a ground Visual Tree Assessment (VTA) method employed in this report. The VTA system is based on the theory of tree biology, physiology and tree architecture and structure and is a method used to identify visible signs on trees that indicate health and potential hazards.

4.2 The collection of data is performed in the field by an AQF Level 5 arborist. The assessment summaries the species, height and diameter, the trees health and structural condition for each trees, hazards, and retention categories were assigned to each tree.

4.3 Testing on site may include, mallet sounding, non-invasive testing for hollows, probing cavities, white ant infestation. Invasive tests will determine the depth of decay around cavities. All testing is ground based, options may include further investigation.

4.4 Planning guidelines and specific legislation has been reviewed concerning the vegetation for the site.

4.5 Impact assessment data was recorded in a Tree Survey Table with various assessment methods, setbacks are calculated according to *Australian Standards AS 4970 2009 Protection of Trees on Development Sit*es. Including:

Appendix A: Tree Useful Life Expectancy TULE 2014. Gives extra assessment life expectancy categories range to no potential for life expectancy. *Adapted from Jeremy Barrell 2014*

Appendix A1: TreeAZ Risk Categories Assesses the importance of trees on development sites. Version 10.04-ANZ 2010 Barrell.

Appendix B: Health & Structural Condition of Tree Assessment. This describes the vigour and vitality of the tree. *Mattheck 1994 The Body Language of Trees.*

Appendix C: Retention Values. Some trees have special restrictions including cultural, scientific, historical or threatened category and may be reviewed as part of this report or further reporting. *Morton, 2006 Determining Landscape Significance Rating.*

Appendix D: Tree Protection. Details of Tree Protection Zones and minimum setback, distances for each numbered tree. *Australian Standards AS 4970 2009 Protection of Tree on Development Sites.*

Appendix E: Tree Planting Specifications. Plants supplied must council compliant and be in the container sizes and within the approved plant heights specified. *Australian Standards AS 2303 2018 Tree Stock for Landscape Use.*

Appendix F: Indigenous Tree Replenishment. Planting of locally occurring native tree species will be a requirement.

5.0 PLANNING GUIDELINES AND SPECIFIC LEGISLATION

5.1 Tree management measures are in place for Northern Beaches Council under the provisions of the trees and vegetation preservation for properties covered under Pittwater 21 Development Control Plan 2019.

5.2 Land Zoning is **Business Park: B7** according to the NSW Planning Portal with **Acid Sulfate Soils: Class 5**.

5.3 A search of local and state heritage registers, tree registers and determination of landscape significance were carried out for the site, noting no heritage conservation area related to this site.

5.4 **SIGNIFICANCE IN THE ENVIRONMENT** Trees are subject to the following legislation:

Biodiversity Conservation Act NSW (BIO Act 2016)
provides provisions for conserving biodiversity.

Environmental Protection and Biodiversity Conservation Act NSW (EPBC Act 1999) provides provision to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places.

Biosecurity Act NSW (BIO Act 2015)
refers to the protection of native plant communities, reducing the risk to human's health and the risk to agricultural production from invasive weeds.

5.5 SIGNIFICANCE IN THE LANDSCAPE

Trees are generally categorised as either:

- Significant in the landscape; based on a broad landscape perspective, including streetscape.
- HIGH retention value.
- Significant in the landscape; based on a neighbourhood perspective. Retained due to its status but may have some conditions or health issues. HIGH retention value.
- Significant in the landscape; based on an adjacent area surrounding the site. HIGH retention value.
- Good and worthy of preservation; retained due to its status, but may have minor conditions or health issues. MODERATE retention value.
- Worthy of preservation; retained due to its status, but may have major conditions or health issues. MODERATE retention value. According to TULE.
- Retain if Possible LOW retention value.
- Exempt VERY LOW retention value.

Retention Values Tables based on Melanie Howden and Andrew Morton.
Tree Useful Life Expectancy TULE Adapted from Jeremy Barrell for use by TCAA consultant arborists. Tree Contractor's Association of Australia TCAA.

6.0 ANALYSIS OF MAPPING CONTROLS

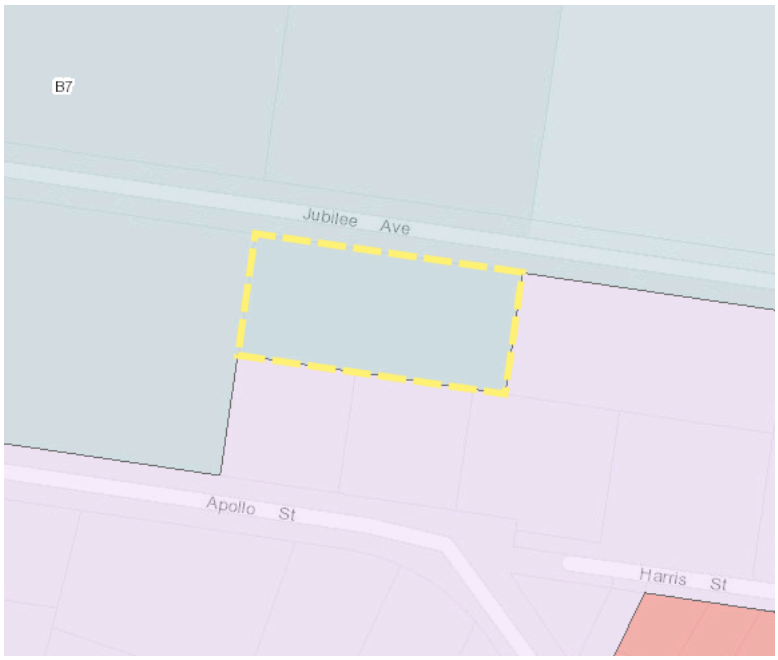


Figure 1. Land Zoning: *Business Park: B7.*

Figure 2. Acid Sulfate Soils: *Class 5.*

7.0 THE SITE

7.1 The site is 15 Jubilee Avenue, Warriewood NSW 2102. The site slopes west and is relatively protected. The site has been previously cleared and there is little remaining vegetation on site.

7.2 The collection of survey data was limited, and an inspection was conducted on the 19th of June 2020.

7.3 SCALED SITE MAP

Figure 3. Aerial map of the site, 15 Jubilee Avenue, Warriewood NSW 2102 (within yellow boundary). Courtesy of Near Maps. Scale 1cm:10m.

8.0 TREE SURVEY TABLE 1

Table 1: Tree Survey Table. This table summarises the results of the ground VTA.

Tree no.	Location	Scientific& Common name	Crown Spread (m)	Height (m)	Diam (cm)	TPZ SRZ (m)	Condition of tree & failure potential (health &structure) (defects and measurements)	Tule	AZ Value	Retention Value	Works
1	Southern boundary	*Eucalyptus grandis* Flooded Gum	15	20	30/22* 50	4.46 2.47	Immature, secondary leader base west, unbalanced canopy north, growing against neighbouring building, moderate condition.	2a	A2	Moderate-High	Remove & Replenish
2	South-west corner	*Populus deltoides* Eastern Cottonwood	6	22	36* 40	4.32 2.25	Mature, severe lean east, unbalanced canopy east.	3d	Z3	Very Low	Remove Exempt Species
3	South-west corner	*Populus deltoides* Eastern Cottonwood	12	23	48/21* 63	6.29 2.725	Mature, twin stem, second eastern leader leaning east previously lopped at 10m, epicormics, western leader lean west, epicormics along trunk.	3d	Z3	Very Low	Remove Exempt Species
4	South-west corner	*Populus deltoides* Eastern Cottonwood	12	25	55* 62	6.6 2.71	Mature, multiple attachment point 8m, epicormics along trunk, previous failed leader 9m decaying, lean west, unbalanced canopy, previously pruned, crown lifted.	3d	Z3	Very Low	Remove Exempt Species
5	South-west corner	*Populus deltoides* Eastern Cottonwood	10	25	49* 52	5.88 2.51	Mature, lean east, unbalanced east, fracture and cavity 10m along branch 30x10cm, branch losing structural stability.	3d	Z3	Very Low	Remove Exempt Species
6	North-west corner	*Eucalyptus robusta* Swamp Mahogany	10	18	70 60	8.4 2.67	Semi mature, moderate condition, unbalanced canopy south east, termites, epicormics at failed branch, branch east 5m, swelling base, damaged and minor cavity west base.	2d	A2	Moderate-High	Retain & Protect
7	North-west corner	*Eucalyptus robusta* Swamp Mahogany	20	15	94/35 92	12.04 3.195	Semi mature, multiple stems at base, termites, unbalanced canopy north west, lean north, dead wood, moderate condition. Canopy 5m on site at 4m height.	2d	A2	Moderate-High	Retain & Protect
8	Street Tree	*Eucalyptus robusta* Swamp Mahogany	12	15	84 87	10.08 3.12	Semi mature, lean north, unbalanced canopy north east, union twin stem 2m, epicormics, previously pruned, rubbing branch 6m east leader, failed branch 4m north.	2d	A2	Moderate-High	Retain & Protect
9	Eastern neighbours	*Eucalyptus nicholii* Black Peppermint	20	16	70* 86	8.4 3.106	Mature, good condition, epicormics, minor deadwood, canopy 10m west on site, 5m crown lifted, multiple stems at 2m, sparse brown foliage on northern leader, significant dead branch north 10m and south west 7m 20cm cut, unbalanced canopy north. Declining with age.	3d-2d	A2	Moderate-High	Retain & Protect
10	Southern neighbours	*Phoenix canariensis* Phoenix Palm	4	7	25 30	3 2	Immature, moderate condition, growing in a confined space, unbalanced canopy east.	3d	Z12	Low	Retain & Protect
11	Western boundary	*Eucalyptus species* x5	2-4	7-12	10-12 12-15	2 1.5	Juvenile, lean east, moderate condition.	3d	Z1	Low	Remove & Replenish
12	South-east corner	*Banksia integrifolia* Coastal Banksia	2	4	8 10	2 1.5	Juvenile, slight lean, moderate condition.	2a	Z1	Very Low	Remove Exempt Undersize
13	Western neighbours	*Eucalyptus species* x2	3	4-7	10-12 12-15	2 1.5	Juvenile, slight lean, moderate condition.	3d	Z1	Low	Retain & Protect

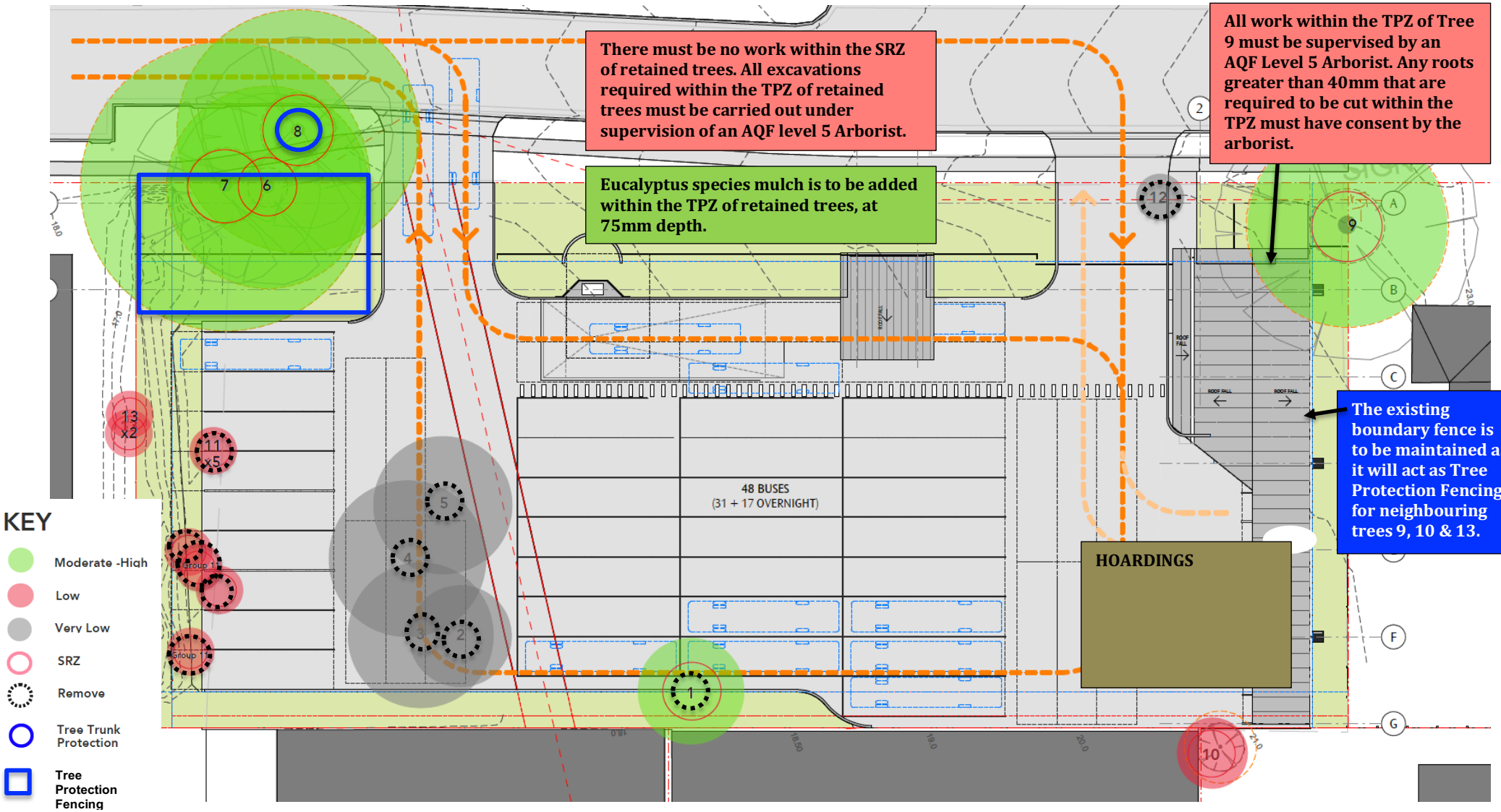
9.0 FINDINGS

Plate 1. Tree 1 *Eucalyptus grandis* and trees 2-5 *Populus deltoides.*

Plate 2. Trees 6-8 *Eucalyptus robusta*.

Plate 3. Eastern neighbouring tree, Tree 9 *Eucalyptus nicholii*.

10.0 RETENTION VALUE MAP WITH TPZ & TREE MANAGEMENT PLAN



11.0 DISCUSSION

11.1 Thirteen (13) trees were assessed on site at 15 Jubilee Avenue, Warriewood NSW 2102.

11.2 The retention value of thirteen (13) trees have been assessed on the site to be:
Five (5) trees are of moderate-high retention value, numbered 1, 6, 7, 8, & 9.
Three (3) trees are of low retention value, numbered 10, 11 & 13.
Five (5) trees are of very low retention value, numbered 2, 3, 4, 5 & 12.

11.3 The proposed bus depot will require the removal of seven (7) trees on site which are numbered 1, 2, 3, 4, 5, 11 & 12. Of these trees, four (4) numbered 2, 3, 4 & 5 are *Populus deltoides* which are an exempt species while one (1) tree numbered 12 is under size and is exempt according to the Northern Beaches Council. Therefore, trees numbered 2, 3, 4, 5 and 12 and may be removed without a permit. Tree 1 *Eucalyptus grandis* is moderate-high valued and is located along the southern boundary and is required to be removed as it has a 50% impact by the proposed works. The low valued group of trees numbered 11 are juvenile trees which are growing on a sloped embankment and leaning east and are located also impacted more than 50% by the proposed bus depot.

11.4 The site will require a minimum of two (2) replenishment plantings to be of 45 litre potted species listed in Appendix F on site.

11.5 Retention and Protection measures will be required of six (6) trees numbered 6, 7, 8, 9, 10 and 13. Trees numbered 6, 7, 8, 9, 10 and 13 have minor impacts by the proposed bus depot which range from <5% to 9.85%. As these impacts are less than 10%, they are considered minimal according to the Australian Standards and the trees are viable for retention. Any excavations required within the TPZ of retained trees must be carried out under the supervision of an AQF level 5 Arborist. There must be no work carried out within the SRZ of these trees as any impacts within the SRZ would be detrimental to the tree's health.

11.6 Tree 9 has a 9.85% impact by the proposed shed which is considered a minor impact. However, as the tree is mature and has dieback within the canopy it is recommended that all excavations are carried out under the supervision of an AQF level 5 Arborist and any roots greater than 40mm that require to be cut has consent by the arborist. This will ensure that the proposed impacts are not detrimental to the trees health and that the root system is not significantly damaged. There must be no work carried out within the SRZ of Tree 9.

11.7 Neighbouring trees numbered 9 and 10 have canopies that encroach onto the site. These canopies may be required to be crown lifted for clearance or pruned for clearance of the office and decking. Pruning of these trees must be carried out by an AQF level 3 licensed arborist and must work in accordance with *Australian Standards AS/4743-2007 Pruning of Amenity Trees*. If pruning required is more than 10% of the canopy then an AQF level 5 Arborist must supervise all pruning.

11.8 Tree Protection Fencing is required for trees 6 and 7, while the existing boundary fence will act as Tree Protection Fencing for retained trees; street Tree 8 will require Tree Trunk Protection. The TPZ of retained trees that encroaches onto site requires ground protection which must be 75mm depth of Eucalyptus species mulch.

11.9 To assist in competent removal and pruning of trees, contractors must be AQF level 3 licensed arborists and must work in accordance with *Australian Standards AS/4743-2007 Pruning of Amenity Trees* and *SafeWork NSW Guide to Managing Risks Tree Trimming Removal.* A registered current member of Tree Contractors Association Australia (TCAA) or Arboriculture Australia (AA) must complete the works.

12.0 TREE IMPACTS TABLE 2

Tree No.	Species	Retention Value	Impact	Works Required
1	*Eucalyptus grandis* Flooded Gum	Moderate-High	50%	**Remove & Replenish** Impacts too great to retain tree. Replenish with 45 litre potted species listed in Appendix F.
2	*Populus deltoides* Eastern Cottonwood	Very Low	Exempt	**Remove**
3	*Populus deltoides* Eastern Cottonwood	Very Low	Exempt	**Remove**
4	*Populus deltoides* Eastern Cottonwood	Very Low	Exempt	**Remove**
5	*Populus deltoides* Eastern Cottonwood	Very Low	Exempt	**Remove**
6	*Eucalyptus robusta* Swamp Mahogany	Moderate-High	<5%	**Retain & Protect** Tree Protection Fencing. 75mm depth of Eucalyptus species mulch within TPZ. An AQF level 5 Arborist is required to supervise all excavations within the TPZ.
7	*Eucalyptus robusta* Swamp Mahogany	Moderate-High	<5%	**Retain & Protect** Tree Protection Fencing. 75mm depth of Eucalyptus species mulch within TPZ. An AQF level 5 Arborist is required to supervise all excavations within the TPZ.
8	*Eucalyptus robusta* Swamp Mahogany	Moderate-High	6.74%	**Retain & Protect** Tree Trunk Protection for street tree. An AQF level 5 Arborist is required to supervise all excavations within the TPZ.
9	*Eucalyptus nicholii* Black Peppermint	Moderate-High	9.85%	**Retain & Protect** Maintain existing boundary fence to act as Tree Protection Fencing for neighbouring trees. 75mm depth of Eucalyptus species mulch within TPZ. An AQF level 5 Arborist is required to supervise all excavations within the TPZ.
10	*Phoenix canariensis* Phoenix Palm	Low	7.93%	**Retain & Protect** Maintain existing boundary fence to act as Tree Protection Fencing for neighbouring trees. An AQF level 5 Arborist is required to supervise all excavations within the TPZ.
11	*Eucalyptus species* x5	Low	20-80%	**Remove & Replenish** Impacts too great to retain tree. Replenish with 45 litre potted species listed in Appendix F.
12	*Banksia integrifolia* Coastal Banksia	Very Low	Exempt	**Remove**
13	*Eucalyptus species* x2	Low	<5%	**Retain & Protect** Maintain existing boundary fence to act as Tree Protection Fencing for neighbouring trees. An AQF level 5 Arborist is required to supervise all excavations within the TPZ.

13.0 **HOLDING POINTS** - Retention and Protection of Trees

13.1 Any pruning required for trees 9 and 10 will need to be cut cleanly by an AQF Level 3 certified Arborist in accordance to *Australian Standards AS4373 2007 Pruning of Amenity Trees*. This will include clearances and crown canopy modification of any type.

13.2 Retention and protection of six (6) trees numbered 6, 7, 8, 9, 10 & 13 using Tree Protection Fencing and Tree Trunk Protection. Eucalyptus species mulch is required within the encroaching TPZ of retained trees at 75mm depth.

13.3 All excavations required within the TPZ of retained trees must be carried out under the supervision of an AQF level 5 Arborist. There must be no work within the SRZ of retained trees. Any roots required to be cut within the TPZ of Tree 9 that are greater than 40mm in diameter must have consent by an AQF level 5 Arborist.

13.4 Removal of seven (7) trees numbered 1, 2, 3, 4, 5, 11 & 12 which includes five (5) exempt trees numbered 2, 3, 4, 5 & 12. Replenishment is required of two (2) trees, to be of 45 litre potted volume species listed in Appendix F.

13.5 An AQF level 5 Arborist must install or supervise Tree Protection. The tree protection found in the Tree Management Plan is to be installed prior to any demolition, construction or re-landscaping.

13.6 No changes in soil level within the TPZ of retained trees unless the consent authority has agreed and is supervised by an AQF level 5 arborist. Soil must not be stockpiled into the TPZ of preserved trees.

13.7 Any roots greater than 40mm to be cut within the TPZ of retained trees must be carried out using a clean, sharp hand tool and must be given consent by an AQF level 5 arborist.

13.8 Certification of tree protection as per Tree Management Plan prior to any demolition, construction or re-landscaping and replenishment plantings by an AQF level 5 Arborist.

13.9 Prohibitions listed in Appendix D are to be complied with and certified by an AQF level 5 Arborist.

14.0 RECOMMENDATION

14.1 Six (6) trees are to be retained and protected numbered 6, 7, 8, 9, 10 & 13.

14.2 Any pruning required for trees 9 and 10 must be by an AQF level 3 arborist, ensuring pruning is done in accordance to *Australian Standards AS4373 2007 Pruning of Amenity Trees.*

14.3 Retained trees will require Tree Protection Fencing or Tree Trunk Protection, with the existing neighbouring fence protecting neighbouring trees. No work within the TPZ of retained trees unless under the supervision of an AQF level 5 certified arborist.

14.4 All excavations required within the TPZ of retained trees must be carried out under the supervision of an AQF level 5 Arborist. There must be no work within the SRZ of retained trees. Any roots required to be cut within the TPZ of Tree 9 that are greater than 40mm in diameter must have consent by an AQF level 5 Arborist.

14.5 Removal is required of seven (7) trees numbered 1, 2, 3, 4, 5, 11 and 12, which includes five (5) exempt trees according to the Northern Beaches Council. Replenishment of two (2) 45 litre potted volume species selected from Appendix F is required on site.

14.6 To assist in competent removal and pruning of trees, contractors must be AQF level 3 licensed arborists and must work in accordance with *Australian Standards AS4790-2009 Protection of Trees in Development Sites* and *Australian Standards AS/4743-2007 Pruning of Amenity Trees* and *SafeWork NSW Guide to Managing Risks Tree Trimming Removal.* A registered current member of Tree Contractors Association Australia (TCAA) or Arborists Australia (AA) must complete the works.

14.7 Holding points 13.1-13.9 will be compliant by an AQF level 5 arborist.

14.8 To reduce the compaction of the soil around the retained trees, it is recommended the Eucalyptus species mulch is placed within the TPZ at 75mm depth.

15.0 GLOSSARY

Borer: larvae beetles, moths or wasps that cause damage within the phloem/cambium, sapwood and heartwood of the tree. Borers generally attack weakened trees or stressed trees.

Cambium: The layer of cells between the exterior bark and the inner wood which control cell division, hence stem, branch and shoot expansion.

Cavity: A void, initiated by a wound within the trunk, branches or roots. These voids are referred to as hollows.

Co-dominant: Stems or branches equal in size and relative importance.

Crown: The width of the foliage in the upper canopy of the assessed tree to the four cardinal points.

Crown lifting: The removal of the lower branches of the tree.

Crown thinning: The portion of the tree consisting of branches and leaves and any part of the stem from which branches arise.

Drip line: Where the canopy releases water shed from the foliage during precipitation.

DBH/Diameter: Diameter of trunk at 1.4meters in height of assessed tree.

Dead wooding: The removal dead branches from a tree.

Dieback: Tree deterioration where the branches and leaves die.

Existing impacts: Historic or impacts other than those associated with the development but existing at the time of development.

Flush cut: A cut that damages or removes the branch collar or removes the branch and stem tissue and is inconsistent with the branch attachment as indicated by the bark branch ridge.

Genus/ Species: Identified using its scientific name. Where the species name is not known, species is used. The common name for trees may vary considerably in each area of geographical differences and so will not be used in the field survey.

Height: Height has been estimated to + / - 2 meters.

Maturity: Tree age, Assessed as over mature (last 1/3 of life expectancy), mature (1/3 to 2/3 life expectancy) and semi mature (less than 1/3 life expectancy).

Remedial (restorative) pruning: includes: Removing damaged, deadwood; trimming diseased or infested branches. Trimming branches back to undamaged tissue in order to induce the production of shoots from latent or adventitious buds, from which a new crown will be established.

Structural Integrity: Describes the internal supporting timber. (Substantial to frail)

SRZ- Structural Root Zone: An area within the trees root zone in which roots stabilize the tree. Roots cut in this zone can cause instability and lead to anchorage loss.

Target: risk targets are people, property or activities that could injure, damage or disrupted.

TPZ- Tree Protection Zone: An area surrounding the tree which is to be protected on development sites and is to protect both roots and crown spread simultaneously.

Tree Numbering: All trees listed in the tree survey have been numbered and plotted.

TULE- Tree Useful Life Expectancy: An estimation of the trees useful life expectancy using appropriate industry methods with an inspection regime.

Vigour: This is an indication of the tree health. Trees have either been assessed as Good Vigour, Normal Vigour or Low Vigour.

16.0 BIBLIOGRAPHY

Australian Standards AS 4970-2009. *Protection of Trees on Development Sites* Sydney: Standards Australia.
Australian Standards AS 4373 (2007) *Pruning of Amenity Trees*. Sydney: Standards Australia.
Barrel, J (2012). Balancing tree benefits against tree security: The duty holder's dilemma, Arboricultural journal. The International Journal of Urban Forestry, 34:1,29-44.
Barrell, J. (1993-95) 'Pre-planning Tree Surveys: Safe Useful Life Expectancy (SULE) is the Natural Progression' Arboricultural Journal V.
CSIRO Boland et al *Forest Trees of Australia*; Nelson University Press. *Australia:* 1984
Hadlington P.W. & Johnston I A. *Australian Trees*. *Australia:* NSW University press: *1983.*
Hadlington P.W & Johnston I A. *Australian Insects. Australia:* NSW University press: *1983.*
Matheny, N.P. & Clarke, J.R. *Trees and Development a Technical Guide to Preservation of Trees During Land Development.* Savoy, Illinois. ISA: 1998.
Mattheck, C *Updated Field Guide for Visual Tree Assessment,* Karlsruhe Research Centre: 2007
Mattheck Dr.; Claus R & Breloer Helge. *The Body Language of Trees - A Handbook for Failure Analysis 6th Edition:* London. England. The Stationery Office: 1995.
E. Thomas Smiley, Nelda Matheny, and Sharon Lilly (2011) Tree Risk Assessment & Principles. ISA Printed USA.
Watson et al (2014) Up by the Roots. ISA USA.

WEBSITE

www.asris.csiro.au/mapping/viewer.htm
www.dpi.nsw.gov.au
maps.six.nsw.gov.au/
www.safeworkaustralia.gov.au
www.maps.au.nearmap.com/
https://www.northernbeaches.nsw.gov.au/

APPENDIX A TREE USEFUL LIFE EXPECTANCY - TULE

Adapted from Jeremy Barrell (SULE) 2014 for TCAA Consultant Arborists						
	1 Long TULE Trees that appeared to be retainable at the time of assessment for more than 40 years with low level of risk	**2 Medium TULE** Trees that appeared to be retainable at the time of assessment for 15 to 40 years with and with low to medium level risk	**3 Short TULE** Trees that appeared to be retainable at the time of assessment for 5 to 15 years with medium to high level of risk	**4 Remove** Trees that should be removed within the next 5 years High to Very high level of risk	**5.No Potential for Retention REMOVE IMMEDIATELY** Trees that must be removed immediately. Very high to Extreme level of risk	**6 Small, Young or Regularly clipped** Trees that can be easily transplanted or replaced.
A	Structurally sound trees located in positions that can accommodate future growth	Trees that may only live for between 15 and 40 more years	Trees that may only live for between 5 and 15 more years	Dead, dying, suppressed or declining trees through disease or inhospitable conditions.	Dead, dying or declining trees diseased or inhospitable conditions.	Small trees less than 5 meters in height
B	Trees that could be made suitable for retention in the long term by Intervention Works.	Trees that may live for more than 40 years, but would need to be removed for safety or Nuisance reasons	Trees that may live for more than 15 years, but would need to be removed for safety or nuisance reasons	Dangerous trees through instability or recent loss of adjacent trees	Dangerous trees through instability or recent loss of adjacent trees	Young trees less than 15 years old but over 5 meters in height
C	Trees of special significance for historical, commemorative or rarity reasons that would warrant extraordinary efforts to secure their long term retention	Trees that may live for more than 40 years, but should be removed to prevent interference with more suitable individuals or to provide space for new planting	Trees that may live for more than 15 years, but should be removed to prevent interference with more suitable individuals or to provide space for new planting	Dangerous trees through structural defects including cavities, decay, included bark, wounds or poor form	Dangerous trees through structural defects including cavities, decay, included bark, wounds or poor form	Trees that have been regularly pruned to artificially control growth
D		Trees that could be made suitable for retention in the medium term by Intervention Works.	Trees that require substantial Intervention Works, and are only suitable for retention in the short term	Damaged trees that are clearly not safe to retain	Damaged trees that are clearly not safe to retain and must be removed immediately	
E				Trees that may live for more than 5 years, but should be removed to prevent interference with more suitable individuals or to provide space for new planting	High Toxicity Allegan trees, asthmatic and poisonous trees and must be removed immediately.	
F				Trees that may cause damage to existing structures within 5 years	OTHER with legitimate explanation to be removed immediately	
G				Trees that will become dangerous after removal of other trees for reasons given in 1A-1F		
INSPECTION FREQUENCY	Inspection frequency 1-5 Years by competent inspector unless event monitored.	Inspection frequency 1-5 Years by competent inspector unless event monitored.	Inspection frequency 1-3 years by competent inspector unless event monitored.	Inspection frequency to 1 year by competent inspector unless event monitored.	1-7 days by competent inspector and event monitored	Inspection frequency Biannually by competent inspector

APPENDIX A1 TREE A-Z CATEGORIES

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.

APPENDIX B HEALTH & STRUCTURAL CONDITION OF TREE
Visual

KEY	Health & Structural Condition of Tree
1.	Maturity: J- Juvenile; Im- Immature; SM-Semi- Mature; M-Mature
2.	Excellent Condition
3.	Good Condition but Poor Development 3b Moderate
4.	Dieback is more than 20%. 4b Epicormics
5.	Sparse Foliage Crown 5b Unbalanced Canopy
6.	Physical Damage
7.	Insect Damage 7b Borers
8.	Fungal Attack
9.	Cavity
10.	Termite Damage Inclusions
11.	Lean
12.	Heavily Pruned 12b Dying
13.	Damage to roots 13b Encroachment
14.	Parasitic Vine Present
15.	Damage by Climbing Plant
16.	inclusions
17.	Habitat Tree
18.	Endangered Species

Mattheck The Body Language of Trees 1994 adapted; Hornsby Shire Council

APPENDIX C RETENTION VALUES

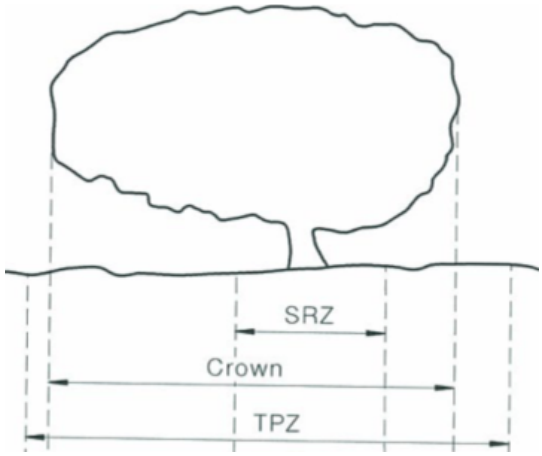
DETERMINING LANDSCAPE SIGNIFICANCE RATING MORTON, A 2006			
RATING	HERITAGE VALUE	ECOLOGICAL VALUE	AMENITY VALUE
1. SIGNIFICANT	The subject tree is listed as a Heritage Item under the Local Environment Plan (LEP) with a local, state or national level of significance or is listed on Council's Significant Tree Register.	The subject tree is scheduled as a Threatened Species as defined under the Threatened Species Conservation Act 1995 (NSW) or the Environmental Protection and Biodiversity Conservation Act 1999.	The subject tree has a very large live crown size exceeding 300m^2 with normal to dense foliage cover, is located in a visually prominent position in the landscape, exhibits very good form and habit typical of the species.
	The subject tree forms part of the curtilage of a Heritage Item (building/structure/artefact as defined under the LEP) and has a known or documented association with that item.	The tree is a locally indigenous species, representative of the original vegetation of the area and is known as an important food, shelter or nesting tree for endangered or threatened fauna species.	The subject tree makes a significant contribution to the amenity and visual character of the area by creating a sense of place or creating a sense of identity.
	The subject tree is a Commemorative Planting having been planted by an important historical person (s) or to commemorate an important historical event.	The subject tree is a Remnant Tree, being a tree in existence prior to development of the area.	The tree is visually prominent in view from surrounding areas, being a landmark or visible from a considerable distance.
2. VERY HIGH	The tree has a strong historical association with a heritage item (building/structure/artefact/garden etc.) within or adjacent the property and/or exemplifies a particular era or style of landscape design associated with the original development of the site.	The tree is a locally indigenous species, representative of the original vegetation of the area and is a dominant or associated canopy species of an Endangered Ecological Community (EEC) formerly occurring in the area occupied by the site.	The subject tree has a very large live crown size exceeding 200m^2, a crown density exceeding 70% (normal-dense), is a very good representative of the species in terms of its form and branching habit or is aesthetically distinctive and makes a positive contribution to the visual character and the amenity of the area.
3. HIGH	The tree has a suspected historical association with a heritage item or landscape supported by anecdotal or visual evidence.	The tree is a locally indigenous species and representative of the original vegetation of the area and the tree is located within a defined Vegetation Link/Wildlife Corridor or has known wildlife habitat value.	The subject tree has a large live crown size exceeding 100m^2; The tree is a good representative of the species in terms of its form and branching habit with minor deviations from normal (e.g. Crown distortion/suppression) with a crown density of at least 70% (normal); The subject tree is visible from the street and surrounding properties and makes a positive contribution to the visual character and the amenity of the area.
4. MODERATE	The tree has no known or suspected historical association, but does not detract or diminish the value of the item and is sympathetic to the original era of planting.	The subject tree is a non-local native or exotic species that is protected under the provisions of this DCP.	The subject tree has a medium live crown size exceeding 40m^2; The tree is a fair representative of the species, exhibiting moderate deviations from typical form (distortion/suppression etc.) with a crown density of more than 50% (thinning to normal); and
			The tree is visible from surrounding properties, but is not visually prominent – view may be partially obscured by other vegetation or built forms. The tree makes a fair contribution to the visual character and amenity of the area.
5. LOW	The subject tree detracts from heritage values or diminishes the value of a heritage item.	The subject tree is scheduled as exempt (not protected) under the provisions of this DCP due to its species, nuisance or position relative to building or other structures.	The subject tree has a small live crown size of less than 40m^2 and can be replaced within the short term (5-10 years) with new tree planting.
6. VERY LOW	The subject tree is causing significant damage to a heritage Item.	The subject tree is listed as an Environment Weed Species in the relevant Local Government Area, being invasive, or is a known nuisance species.	The subject tree is not visible from surrounding properties (visibility obscured) and makes a negligible contribution or has a negative impact on the amenity and visual character of the area. The tree is a poor representative of the species, showing significant deviations from the typical form and branching habit with a crown density of less than 50% (sparse).
7. INSIGNIFICANT	The tree is completely dead and has no visible habitat value.	The tree is a declared Noxious Weed under the Noxious Weeds Act (NSW) 1993 within the relevant Local Government Area.	The tree is completely dead and represents a potential hazard.

APPENDIX C Continued

RETENTION VALUES: MORTON, A 2006 Determining landscape Significant Ratings	
RETENTION VALUE	RECOMMENDED ACTION
High	• These trees considered worthy of preservation; as such careful consideration should be given to their retention as a priority. • Proposed site design and placement of buildings and infrastructure should consider the Tree Protection Zones as discussed in the following section to minimise any adverse impact. • In addition to Tree Protection Zones, the extent of the canopy (canopy dripline) should also be considered, particularly in relation to a high-rise development. Significant pruning of the trees to accommodate the building envelope or temporary scaffolding is generally not acceptable.
Moderate	• The retention of these trees is desirable. • These trees should be retained as part of any proposed development if possible, however these trees are considered less critical for retention. • If these trees must be removed, replacement planting should be considered in accordance with Council's Tree Replacement Policy to compensate for loss of amenity.
Low	• These trees are not considered to be worthy of any special measures to ensure their preservation, due to current health, condition or suitability. They do not have any special ecological, heritage or amenity value, or these values are substantially diminished due to their SULE. • These trees should not be considered as a constraint to the future development of the site.
Very Low	• These trees are considered potentially hazardous or very poor specimens, or may be environmental or noxious weeds. • The removal of these trees is therefore recommended regardless of the implications of any proposed development.

APPENDIX D TREE PROTECTION

Extract from *Australian Standard AS4970 2009 Protection of Trees on Development Sites*



D.1 STRUCTURAL ROOT ZONE (SRZ)

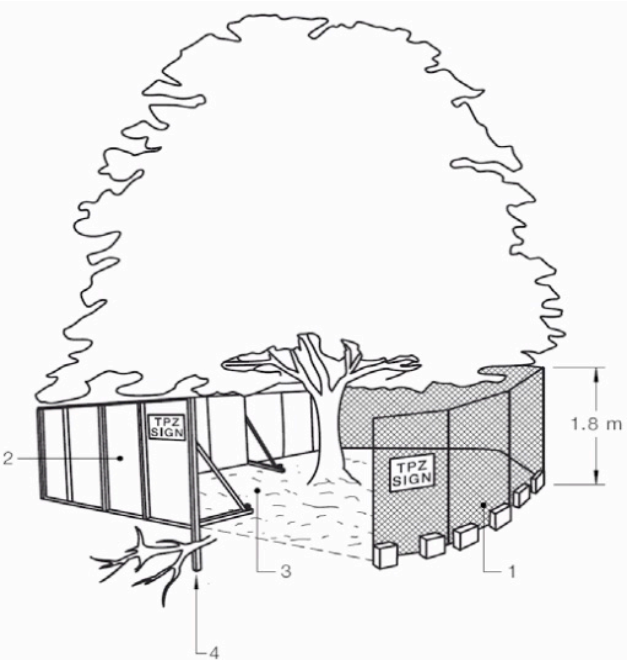
"The SRZ is the area considered essential for tree stability. Temporary tree protection fencing shall be erected around the perimeter of all tree protection zones.

D.2 OTHER TREE PROTECTION MEASURES

When tree protection fencing cannot be installed due to restricted access e.g. tree located along side an access way or requires temporary removal, other tree protection measure should be used, including those set out below;

D.3 PROTECTIVE FENCING

It shall be installed prior to any demolition, clearing, Chain wire mesh panel 1.8-meter cyclone fencing or star pickets at 2m intervals, connected by a continuous highly-visible barrier/hazard mesh at the height of 1.8 meters. Alternative plywood or wooden paling fence panels. This fencing material also prevents building material soil entering the TPZ. Mulch installation across surface of TPZ. Bracing is permissible within the TPZ. Avoid damaging roots. This fencing will remain in place until all the construction work has been completed.



D.4 TREE PROTECTION ZONES

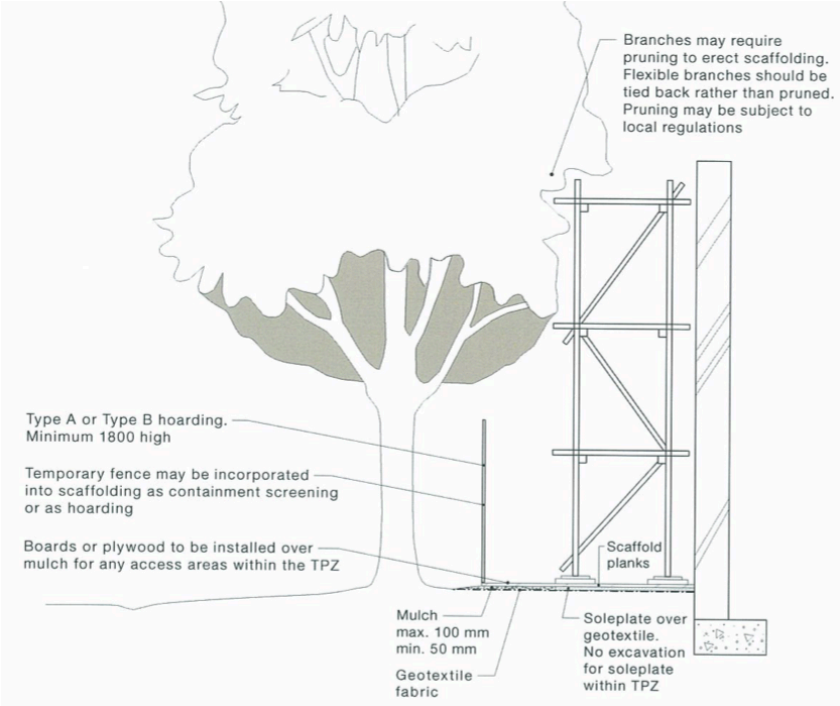
Signage shall be attached to the fence at regular intervals. Signage shall read "TREE PROTECTION ZONE. NO ENTRY EXCEPT TO AUTHORISED PERSONNEL. FINES

D.5 GROUND PROTECTION

If temporary access for machinery is required within the TPZ, ground protection measure will be required to prevent compaction in the root zone. Measures may include permeable membrane such as geotextile fabric beneath a layer of mulch 100mm maximum and 50mm minimum or crushed rock below rumble boards as per

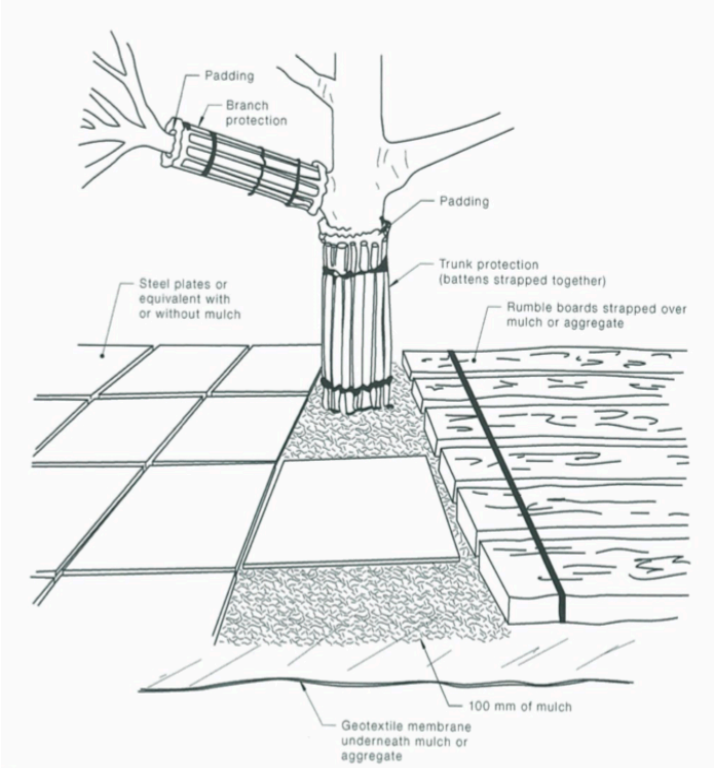
D.6 INSTALLING UNDERGROUND SERVICES WITHIN TPZ

All services should be routed outside the TPZ. If underground services must be routed within the TPZ, they should be installed by directional drilling or in manually excavated trenches. The directional drilling bore should be at least 600 mm deep. The project arborist should assess the likely impacts of boring and bore pits on retained trees. For manual excavation trenches the project arborist should advise on roots to be retained and should monitor the works. Manual excavation may include the use of pneumatic and hydraulic tools.



D.7 TRUNK AND BRANCH PROTECTION

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. Rumble boards should be a suitable thickness to prevent soil compaction and root damage.



D.8 EXCAVATION REQUIRED for the insertion of supports posts for tree protection fencing should not involve the severance of any roots greater than 20mm in diameter, without the prior approval of the project arborist.

APPENDIX D.9 PROHIBITIONS

FOR TREE PROTECTION ZONES

D.10 The following activities shall not be carried out within any Tree Protection Zone:

a. Disposal of chemicals and liquids (including concrete and mortar slurry, solvents, paint, fuel or oil);
b. Stockpiling, storage or mixing of materials;
c. Refuelling, parking, storing, washing and repairing tools, equipment, machinery and vehicles;
d. Disposal of building materials and waste;

D.11 The following activities shall not be carried out within any Tree Protection Zone unless under the supervision of the Project Arborist:

a. Increasing or decreasing soil levels (including cut and fill);
b. Soil cultivation, excavation or trenching;
c. Placing offices or sheds;
d. Erection of scaffolding or hoardings; and/or
e. Any other act that may adversely affect the vitality or structural condition of the tree.

D.12 All work undertaken within or above a Tree Protection Zone shall be supervised by the Project Arborist.

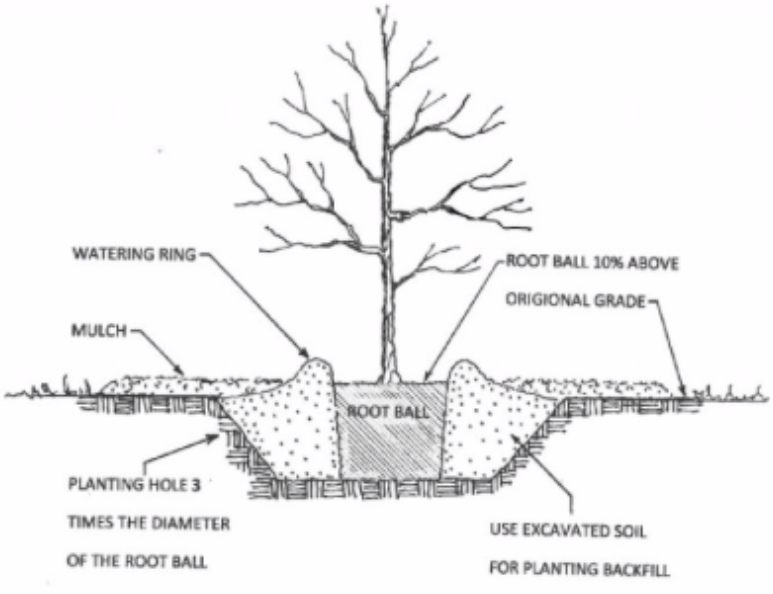
D.13 Excavation within the Tree Protection Zone of any tree to be retained shall:

a. Be undertaken using non-destructive methods (e.g. an Air-spade or by hand) to ensure no roots greater than 40mm in diameter are damaged, pruned or removed.
b. All care shall be taken to preserve and avoid damaging roots; excavation should not occur within the Structural Root Zone.

APPENDIX E TREE PLANTING SPECIFICATIONS AND MAINTENANCE

Australian Standards AS 2303 2018 Tree Stock for Landscape Use.

E.1 Careful consideration should be given to the location of trees and shrubs to minimise future problems. A basic guide for planting follows:
E.2 Don't plant too close to buildings or in-ground pools or plant large trees too close together: Determine the height and canopy of trees when fully grown. Allow room for root growth (at least twice the height of the tree). Large trees should be planted at least three meters from buildings.
Check when planting under wires or over drainage lines: Determine the mature size of the tree and the size and nature of its root system.
E.3 Consider your neighbours when choosing plants: Consider the effect on neighbouring properties (i.e. shading, loss of views, impact on foundations, fences and services).
E.4 Use trees to provide your home with summer shade and/or winter sun: Plant deciduous trees (suitable to the climate and soils of this Shire). Consider the summer and winter shadows of evergreen trees.
E.5 Don't grow climbers on trees: Climbers can strangle trees, leading to the tree's eventual death. Retain and protect as many trees as possible when building or extending your home. (This will be a Council requirement).
E.6 Use locally native and non-invasive species in your garden: Increase the success rate of your garden. Attract native fauna to your garden. Reduce the amount of watering required.
E.7 Don't excavate or alter the ground level around trees: Can cause root damage or starving of the roots. Can cause limb drop, instability or tree death. Substantially altering soil level within three meters of the trunk is in breach of the Tree Preservation Order.
E.8 When buying plants, check their characteristics: Check on mature size, shade characteristics, potential for roots to cause damage, flowers, fruits and pollen, to determine their suitability.
E.9 Mature trees do need maintenance: Remove or trim misshapen branches. Check for fungal rots or other diseases. If in doubt, contact Council for a tree inspection or contact an experienced Arborist. Indiscriminate lopping can be dangerous to your safety and the health of the tree.
Staking of trees and mulch should be carried out similar to the diagrams.



APPENDIX F INDIGENOUS TREE REPLENISHMENT

F.1 Check local Council's community nursery for suitable trees and possible free native tree giveaways. For suitable community plants in addition to this the following species should be considered for replenishment.

F.2 Recommended Replacement Species *

Botanical Name	Common Name	Height (m) at maturity	Crown Spread (m) at maturity
**Acmena smithii*	Lilly Pilly	10	8
**Tristaniopsis laurina*	Water Gum	7	6
Corymbia exemia	Yellow Bloodwood	12	9
Backhousia citriodora	Lemon Scented Myrtle	8	6
**Elaeocarpus reticulatus*	Blueberry Ash	7	5
**Waterhousia floribunda*	Weeping Lilly Pilly	8	5
**Syzygium leuhmannii*	Riberry	8	5
**Hymenosporum flavum*	Native Frangipani	8	6
Eucalyptus haemastoma	Scribbly Gum	15	7
**Eucalyptus robusta*	Swamp Mahogany	20	16
**Lophostemon confertus*	Brush Box	12-20	16

DISCLAIMER

McArdle Arboricultural Consultancy Pty Ltd does not assume responsibility for liability associated with the tree on or adjacent to this project site, their future demise and/or any damage, which may result therefrom.

McArdle Arboricultural Consultancy Pty Ltd takes care to obtain all information from reliable sources. All data has been verified insofar as possible; however, the consultant can neither guarantee nor be responsible for the accuracy of information provided by others.
McArdle Arboricultural Consultancy Pty Ltd cannot be held responsible for any consequences as a result of work carried out outside specifications, not in compliance with Australian Standards or by inappropriately qualified staff.

Sketches, diagrams, graphs, and photographs in this report, being intended as visual aids, are not necessarily to scale.

LIMITS OF OBSERVATION

McArdle Arboricultural Consultancy Pty Ltd makes every effort to accurately identify current tree health and safety issues. Results may or may not correlate to actual tree structural integrity. There are many factors that may contribute to limb or total tree failure. Not all these symptoms are visible. There can be hidden defects that may result in a failure even though it would seem that other, more obvious defects would be the likely cause of failure. All standing trees have an element of unpredictable risk.

Consulting Arborist
Jim McArdle

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QTRA, Tree Risk Management Assessor,
Tree Contractors Association of Australia President