



Tree Management Strategies

Arboricultural Impact Assessment



BROOKVALE OVAL
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Summary

Tree Management Strategies have been commissioned on behalf of Manly Warringah Sea Eagles by SLR Consulting Australia to provide an Arboricultural Impact Assessment (AIA) and an incorporated Tree Management Plan for seventy-five trees at Brookvale Oval. The subject site is located on Pittwater Road, Brookvale and is legally described as Lot 1 DP 784268, Lot 1 on DP 114027, Lot B on DP966128, and Lot 6 on DB 785409 shown in figure 1.

The proposed development consists of a new grandstand and Centre of Excellence proposed at the northern end of the site, utilising existing site access and an additional ten parking spaces are proposed in addition to the existing parking arrangements on the western side of the grandstand.

This report aims to:

- Assess the Health, Condition and Retention Value of seventy-five trees on the subject site.
- Calculate the impact the Proposed Development will have on all trees assessed.
- Suggest design modifications if feasible to retain high to medium value trees on the subject site.
- Suggest sensitive construction methods to retain high to medium value trees on the subject site.
- Recommend the retention or removal of trees on the subject site.
- Recommend Tree Protection Measures to ensure the long-term health of trees to be retained.

Trees 1 to 61 and 72 to 75 assessed are nominated heritage items under the Warringah Local Environmental Plan 2011 (WLEP 2011).

A site inspection was conducted on the 7th of August 2019, to assess the health and condition of seventy-five trees potentially affected by the proposed development. The tree location, tree data, health, condition and retention value are shown in the Tree Data Schedule (Appendix 1) and the Tree Location Plan (Appendix 2). The incursions to the theoretical Tree Preservation Zones (TPZ) and Structural Root Zones (SRZ) potentially affecting trees assessed on the subject site are shown on the Tree Impact Plan (Appendix 3) with the total incursion percentages detailed in the Tree Data Schedule (Appendix 1).

Seven developmental impact categories affecting trees are explored in Section 3.2 of this report.

The Tree Management Plan (Section 4) offers detailed design modifications or sensitive construction methods and a step by step timeline for Tree Protection Measures to protect the retained trees.

Conclusions

The major incursions to the Structural Root Zone (SRZ) and Tree Protection Zone (TPZ) of Tree 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, and 46 are required to be removed as part of the proposed development. The Landscape Plan prepared by HASSELL proposes the replanting of Eleven 200-750Lt (*Lophostemon confertus*) Brush Box and Tuckeroos to compensate for the removal of these trees.

Tree 2, 3, 4, 5, 6, 7, 8, 9, 32, 33, 34, 35, 47, 48, 49, 50, 70, 74 and 75 on the subject site will remain healthy throughout construction with the implementation of tree protection measures outlined in the Tree Management Plan.

Root mapping is required to properly understand the size and quantity of roots potentially affecting Tree 47, 48, 49 and 69 by the proposed stormwater line installation. Root mapping is recommended by non-destructive methods such as pneumatic air spade or vacuum excavation. The results of the root mapping will determine the construction methods used for the stormwater line installation.

The tree impacts detailed in Section 3.2 are based on the plans referenced in Section 5 of this document. Amendments to this report or additional Arboricultural Impact Assessments may be required following final detailed plans.

There are some aspects of the development that require more detailed construction specifications, location of services such as: HV and LV electrical lines, potable water, fire and gas plans. Accurate plans of these services were not supplied and will require further impact assessment following development consent approval.

Recommendations

1. Remove Tree 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, and 46. Tree removal work to be undertaken in accordance with *AS 4373 Pruning of Amenity Trees*, using a qualified Arborist (minimum Australian Qualification Framework (AQF3) Level Arborist).
2. Adhere to the Tree Management Plan (Section 4) of this report to ensure all trees to be retained remain healthy and viable into the future.

Other options to compensate for the removal of heritage items may include:

- The use of wood from heritage trees removed for artwork, woodwork, seating and or mulched onsite for existing or new landscaping.
- The collection of seed or cuttings to regrow trees to ensure the heritage value of the trees is not lost. Trees that are regrown may be planted in the local area as replacement street trees or in parks.

1. Introduction

Tree Management Strategies have been commissioned on behalf of Manly Warringah Sea Eagles by SLR Consulting Australia to provide an Arboricultural Impact Assessment (AIA) and an incorporated Tree Management Plan for Seventy- Five trees at Brookvale Oval. The subject site is located on Pittwater Road, Brookvale and is legally described as Lot 1 DP 784268, Lot 1 on DP 114027, Lot B on DP966128, and Lot 6 on DB 785409 shown in figure 1.

The proposed development consists of a new grandstand and Centre of Excellence proposed at the northern end of the site, utilising existing site access. An additional 10 parking spaces are proposed in addition to the existing parking arrangements on the western side of the stand.

1.1 Proposal

The proposal seeks development consent for a Centre of Excellence. A state-of-the-art facility to be used by professional sports persons in conjunction with the community. A 3,000 covered seat grandstand will be constructed to deliver an improved experience for spectators attending the site. The proposal will support the operations of the Manly Warringah Sea Eagles (MWSE) and ensure the business's viability into the future. The project represents a significant investment into Rugby League in the region and is being jointly funded by the Federal Government, New South Wales State Government, and the MWSE. Once completed, the Project will:

- Consolidate the Manly Warringah Sea Eagles (MWSE) training and administration bases at one location.
- Provide improved training facilities for all players (from community to elite level). To support the development of professional players skills through access to high performance training facilities.
- Provide spectators with additional covered seating that delivers the highest quality viewing and entertainment experience possible at MWSE home games.
- The proposed Centre of Excellence will have a footprint of approximately 1,800sqm, and span over 2 levels.
- A cantilevered roof will extend over the seating area.

1.2 Heritage Items

Trees 1 to 61 and 72 to 75 assessed are nominated heritage items under the Warringah Local Environmental Plan 2011. These trees were assessed as a part of the Arboricultural Impact Assessment with the heritage status being considered throughout the assessment (WLEP 2011). Figure 2 is the Schedule 5 listing of Environmental Heritage in the Warringah Local Environmental Plan 2011 and Figure 3 outlines the boundary where Trees 1 to 61 and 72 to 75 are located.

Figure 2

Brookvale	Brush Box and Camphor Laurel trees surrounding Brookvale Park	Pine Avenue, Alfred Street, unmade section of Federal Parade and Pittwater Road (near Pine Street intersection)
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Figure 2: Schedule 5 listing Environmental Heritage in the Warringah Local Environmental Plan 2011

Figure 3

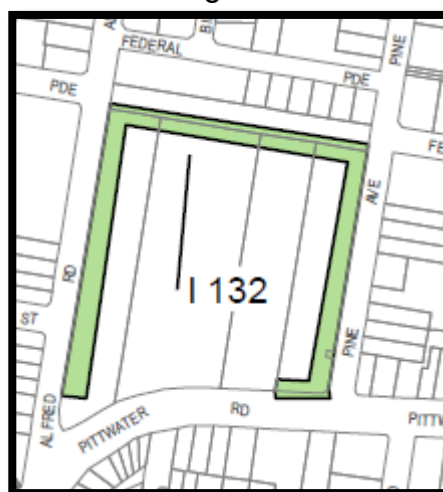


Figure 3: Mapped Location of Heritage Trees Schedule 5 Environmental Heritage in the Warringah Local Environmental Plan 2011

1.1 Aim

This report aims to:

- Assess the Health, Condition and Retention value of seventy-five trees on the subject site.
- Calculate the impact the proposed development will have on all trees assessed.
- Suggest design modifications if feasible to retain high to medium value trees on the subject site.
- Suggest sensitive construction methods to retain high to medium value trees on the subject site.
- Recommend the retention or removal of trees on the subject site.
- Recommend tree protection measures to ensure the long-term health of trees to be retained.

2. Method

2.1 Site Assessment

From the ground, the following information was recorded and displayed in the Tree Data Schedule (Appendix 1).

- Tree genus and species.
- Approximate height spread if deemed applicable.
- Trunk diameter at breast height and above the buttress.
- Age class: young, semi mature, mature, over mature.
- Health.
- Condition.

Observations were recorded and trees photographed.

2.2 Research

The following legislation, documents or websites were reviewed:

- Warringah Local Environmental Plan (LEP) 2011.
- Warringah Development Control Plan (DCP) 2011.

2.3 Tree Data Schedule Method

The Health and Condition of seventy-five trees are shown in the Tree Data Schedule (**Appendix 1**) with the methods explained below:

Tree Health

Overall Health (Vigour/Vitality)	Tree vigour is exhibited by crown density, crown cover, leaf colour, leaf size, leaf texture, presence of epicormic growth, ability to withstand predation by pest and disease, resistance and degree of dieback.
Good (Excellent)	Good tree vigour exhibited by no decline in overall health and vigour, height and shape. The specimen is observed to be of excellent condition displaying characteristics that is known for that particular species (what would be the expected condition for that particular species of that age in that location), 0% dieback, full crown density, leaf health, no pest or disease present.
Fair	Fair tree vigour exhibited by moderate decline in overall health and vigour, height and shape. The specimen is observed to be of moderate condition by not displaying characteristics adequately that is known for that particular species (what would be expected for that particular species of that age in that location), less than 10% dieback, 90% of crown foliage density, more than 90% leaf health, acceptable level of pest or disease is evident for the assessing arborist (where it is considered the tree's overall health or condition will not be affected or lead to irreversible decline from pest or disease).
Fair/Poor	Fair to poor tree vigour exhibited by considerable decline in overall health and vigour, height and shape. The specimen is observed to be of less than acceptable condition by not displaying characteristics adequately that is known for that particular species (what would be expected for that particular species of that age in that location), 10-20% dieback, considerable foliage deficiencies, 70-90% foliage density, 70-90% leaf health, pest or disease infestation at acceptable thresholds for the assessing arborist (where it is considered the tree's overall health or condition will not be affected or lead to irreversible decline from pest or disease).
Poor	Poor vigour exhibited by substantial decline in overall health and vigour, height and shape. The specimen is observed to be of poor condition by not displaying characteristics adequately that is known for that particular species (what would be expected for that particular species of that age in that location), 20-30% dieback, considerable foliage deficiencies, 50-70% leaf health, pest or disease infestation at unacceptable infestation level that exceeds thresholds for the assessing arborist (where

	it is considered the tree's overall health or condition will be affected or lead to irreversible decline from pest or disease).
Very Poor	Very poor vigour exhibited by irreversible decline in overall health and vigour, height and shape. The specimen is observed to be of less than acceptable condition by not displaying characteristics adequately that is known for that particular species (what would be expected for that particular species of that age in that location), 15-50% dieback; severe foliage deficiencies; 30-50% density; 30-50% leaf health; pest or disease infestation at severe infestation level that exceeds thresholds for the assessing arborist (where it is considered the tree's overall health or condition will be affected or lead to irreversible decline from pest or disease).
Dead	Dead tree vigour exhibited by complete decline in overall health and vigour, height and shape. The specimen is observed to be dead by not displaying any characteristics adequately that is known for that particular species (what would be expected for that particular species of that age in that location), tree holds less than 15% foliage; branching is dead throughout canopy, pest or disease infestation at severe infestation level that exceeds thresholds for the assessing arborist (where it is considered the tree's overall health or condition will be affected or lead to irreversible decline from pest or disease).

Tree Condition

Overall Condition (Structure/Stability)	The tree condition as identified by the arborist in regard to defects in structure and stability.
Good (Exceptional specimen)	No damage or decay observed to the root plate, visible basal and /or root flare, stable in ground, well tapered branches with sound open unions. All characteristics within thresholds for the assessing arborist.
Fair (Standard tree – no observable major defects to suggest that there is an increased likelihood of tree or part of tree failure)	Minor damage or decay observed to root plate, trunk or primary branches or branch unions (1 st or 2 nd branch order or scaffolding branch), well-formed branch unions, minor branch end weight or over-extensions within thresholds for the assessing arborist.
Fair/Poor	Moderate damage or decay observed to root plate, trunk or primary branches or branch unions (1 st or 2 nd branch order or scaffolding branch); minimal basal/root flare; acute branch; past branch failure(s); moderate branch end-weight or over-extension approaching thresholds for the assessing arborist.
Poor	Major damage or decay observed to root plate, trunk or primary branches or branch unions (1 st or 2 nd branch order or scaffolding branch) no observable basal and /or root flare; acute branch unions starting to include bark; major branch end-weight or over-extension at or exceeds thresholds for the assessing arborist.
Very Poor	Excessive damage or decay observed to root plate, trunk, primary branch or branch unions (1 st or 2 nd branch order or scaffolding branch), excessive decay or hollows compromising the structural integrity, unstable in ground, excessive branch end-weight, included-bark unions, exceeding thresholds for assessing arborist. Failure probable.
Failed	Failure of root plate or trunk or primary branch or branch unions (1 st or 2 nd branch order or scaffolding branch) or active split between branch unions or severe damage to primary tree structure.

2.4 Tree Retention Value Method

IACA Significance of a Tree, Assessment Rating System (STARS) © (IACA 2010) ©

In the development of this document IACA acknowledges the contribution and original concept of the Footprint Green Tree Significance & Retention Value Matrix, developed by Footprint Green Pty Ltd in June 2001.

The landscape significance of a tree is an essential criterion to establish the importance that a particular tree may have on a site. However, rating the significance of a tree becomes subjective and difficult to ascertain in a consistent and repetitive fashion due to assessor bias. It is therefore necessary to have a rating system utilising structured qualitative criteria to assist in determining the retention value for a tree. To assist this process all definitions for terms used in the Tree Significance - Assessment Criteria and Tree Retention Value - Priority Matrix, are taken from the IACA Dictionary for Managing Trees in Urban Environments 2009.

This rating system will assist in the planning processes for proposed works, above and below ground where trees are to be retained on or adjacent a development site. The system uses a scale of High, Medium and Low significance in the landscape. Once the landscape significance of an individual tree has been defined, the retention value can be determined.

Tree Significance - Assessment Criteria



High Significance in landscape

- The tree is in good condition and good vigour. The tree has a form typical for the species.
- The tree is a remnant or is a planted locally indigenous specimen and/or is rare or uncommon in the local area or of botanical interest or of substantial age.
- The tree is listed as a Heritage Item, Threatened Species or part of an Endangered Ecological Community or listed on a council's Significant Tree Register.
- The tree is visually prominent and visible from a considerable distance when viewed from most directions within the landscape due to its size and scale and makes a positive contribution to the local amenity.
- The tree supports social and cultural sentiments or spiritual associations, reflected by the broader population or community group or has commemorative values.
- The tree's growth is unrestricted by above and below ground influences, supporting its ability to reach dimensions typical for the taxa in situ - tree is appropriate to the site conditions.

Medium Significance in landscape

- The tree is in fair to good condition and good or low vigour.
- The tree has form typical or atypical of the species.
- The tree is a planted locally indigenous or a common species with its taxa commonly planted in the local area.
- The tree is visible from surrounding properties, although not visually prominent as partially obstructed by other vegetation or buildings when viewed from the street.
- The tree provides a fair contribution to the visual character and amenity of the local area.
- The tree's growth is moderately restricted by above or below ground influences, reducing its ability to reach dimensions typical for the taxa in situ.

Low Significance in landscape

- The tree is in fair to poor condition and good or low vigour.
- The tree has form atypical of the species.
- The tree is not visible or is partly visible from surrounding properties as obstructed by other vegetation or buildings.
- The tree provides a minor contribution or has a negative impact on the visual character and amenity of the local area.
- The tree is a young specimen which may or may not have reached dimension to be protected by local Tree Preservation orders or similar protection mechanisms and can easily be replaced with a suitable specimen.
- The tree's growth is severely restricted by above or below ground influences, unlikely to reach dimensions typical for the taxa in situ - tree is inappropriate to the site conditions.
- The tree is listed as exempt under the provisions of the local Council Tree Preservation Order or similar protection mechanisms.
- The tree has a wound or defect that has potential to become structurally unsound.
- Environmental Pest/Noxious Weed Species.
- The tree is an Environmental Pest Species due to its invasiveness or poisonous/allergenic properties.
- The tree is a declared noxious weed by legislation.
- Hazardous and or Irreversible Decline.
- The tree is structurally unsound and/or unstable and is considered potentially dangerous.
- The tree is dead, or is in irreversible decline, or has the potential to fail or collapse in full or part in the immediate to short term.

The tree is to have a minimum of three (3) criteria in a category to be classified in that group.


Note: The assessment criteria are for individual trees only, however, can be applied to a mono-cultural stand in entirety.

Useful Life Expectancy (ULE)

Useful life expectancy (ULE) is a measure of a trees remaining lifespan regarding its health, condition and locality ULE categories were measured as:

- a) Long (greater than 40 years)
- b) Medium (between 15 and 40 years)
- c) Short (between 1 and 15 years)
- d) Dead

Tree Retention Value - Priority Matrix

		Significance				
		1. High Significance in Landscape	2. Medium Significance in Landscape	Significance in Landscape	3. Low Environmental Pest / Noxious Weed Species	Hazardous / Irreversible Decline
Estimated Life Expectancy	1. Long >40 years					
	2. Medium 15-40 Years					
	3. Short <1-15 Years					
	Dead					
<p><u>Legend for Matrix Assessment</u></p> 						
	<p>Priority for Retention (High) - These trees are considered important for retention and should be retained and protected. Design modification or re-location of building/s should be considered to accommodate the setbacks as prescribed by the Australian Standard AS4970 Protection of trees on development sites. Tree sensitive construction measures must be implemented e.g. pier and beam etc if works are to proceed within the Tree Protection Zone.</p>					
	<p>Consider for Retention (Medium) - These trees may be retained and protected. These are considered less critical; however their retention should remain priority with removal considered only if adversely affecting the proposed building/works and all other alternatives have been considered and exhausted.</p>					
	<p>Consider for Removal (Low) - These trees are not considered important for retention, nor require special works or design modification to be implemented for their retention.</p>					
	<p>Priority for Removal - These trees are considered hazardous, or in irreversible decline, or weeds and should be removed irrespective of development.</p>					

REFERENCES

Australia ICOMOS Inc. 1999, *The Burra Charter – The Australian ICOMOS Charter for Places of Cultural Significance*, International Council of Monuments and Sites, www.icomos.org/australia

Draper BD and Richards PA 2009, *Dictionary for Managing Trees in Urban Environments*, Institute of Australian Consulting Arboriculturist (IACA), CSIRO Publishing, Collingwood, Victoria, Australia.

Footprint Green Pty Ltd 2001, *Footprint Green Tree Significance & Retention Value Matrix*, Avalon, NSW Australia, www.footprintgreen.com.au

2.5 Tree Protection Zone and Structural Root Zone Method

Following the VTA, The Tree Preservation Zones and Structural Root zones were calculated and added to the Tree Data Schedule (Appendix 1) and the Tree Location Plan (Appendix 2) with the methods explained below:

The Structural Root Zone (SRZ) is the area around the base of a tree required for its stability. The woody root growth and soil cohesion in this area are necessary to hold the tree upright; therefore, there are no variations to its size. The SRZ is normally circular with the trunk at its centre and is expressed by its radius in metres (AS – 4970). Due to the potential of causing instability of a tree, it is highly recommended that no roots within its SRZ are pruned or removed. SRZ, which is the area required for tree stability, was calculated as follows: SRZ radius = $(D \times 50) 0.42 \times 0.64$.

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 that requires protection. It is an area isolated from construction disturbance, so that the tree remains viable (AS – 4970). The radius of the TPZ is calculated for each tree by multiplying its DBH x 12. TPZ = DBH x 12 (DBH = trunk diameter measured at 1.4m above ground level). The radius of the TPZ is measured from COT (Centre of the trunk).

Variations to the Tree Protection Zone (TPZ)

General

It may be possible to encroach into or make variations to the standard TPZ. Encroachment Includes excavation, compacted fill and machine trenching.

Minor encroachment

If the proposed encroachment is less than 10% of the area of the TPZ and is outside the SRZ, detailed root investigations should not be required. The area lost to this encroachment should be compensated for elsewhere and contiguous with the TPZ. Variations must be made by the project arborist considering relevant factors. (Figure 4) demonstrates some examples of possible encroachment into the TPZ up to 10% of the area.

Major encroachment

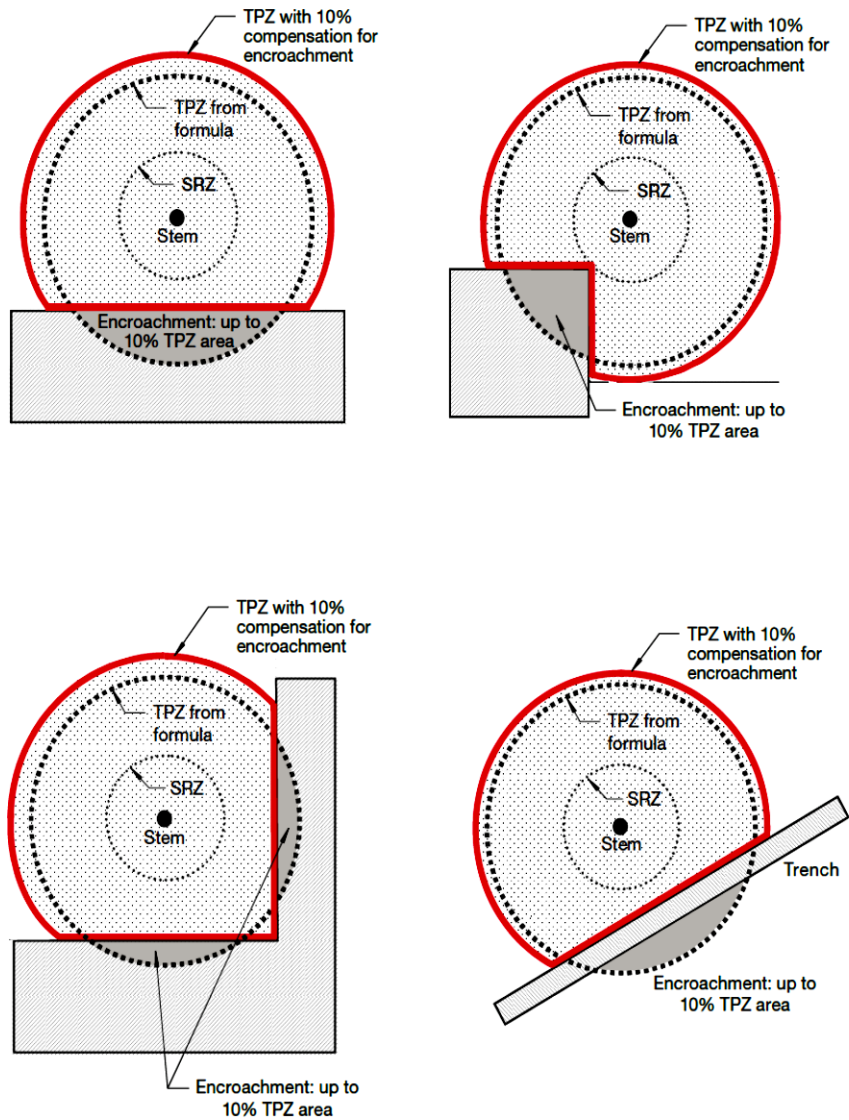
If the proposed encroachment is greater than 10% of the TPZ or inside the SRZ the project arborist must demonstrate that the tree(s) would remain viable. The area lost to this encroachment should be compensated for elsewhere and contiguous with the TPZ. This may require root investigation by non-destructive methods and consideration of relevant factors listed in the Clause.

Figure 4

ENCROACHMENT INTO TREE PROTECTION ZONE

(Informative)

Encroachment into the tree protection zone (TPZ) is sometimes unavoidable. Figure D1 provides examples of TPZ encroachment by area, to assist in reducing the impact of such incursions.



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

3. Developmental Impacts/Observations

3.1 General observations (Heritage Trees)

A site inspection was conducted on the 7th of August 2019, to assess the health and condition of seventy-five trees potentially affected by the proposed development.

The trees listed as heritage items under Warringah Local Environmental Plan 2011 are a mixture of *Cinnamomum camphora* (Camphor Laurel) and *Lophostemon confertus* (Brush Box) trees, refer to the Tree Data Schedule (Appendix 1). Figure 5 and 6 give an indicative habit photo of the trees, the assumption is made that their form has been modified by lopping probably in an earlier stage of life or juvenile stage of growth. Lopping (pruning the top out of a tree) was a standard practice in the past with the ensuing formative pruning forming generally well-structured trees. The close proximity of plantings has modified the growth of certain trees inhibiting their health, growth habit and consequently their retention value rating, refer to the Tree Data Schedule (Appendix 1).

The remaining trees not listed as heritage items are a mixture of genus with varying health, condition and retention value, refer to the Tree Data Schedule (Appendix 1) and the Tree Location Plan (Appendix 2).

Figure 5



Figure 2: Depicts the form and modified growth habit of Camphor Laurel trees along Pine Avenue to the East of the subject site.

Figure 6



Figure 3: Depicts the form and modified growth habit of Brush Box trees to the north of the subject site.

3.2 Developmental Impacts

The tree impacts detailed below are based on the plans referenced in Section 5 of this document. Amendments to this report or additional Arboricultural Impact Assessments may be required following final detailed plans.

There are some aspects of the development that require more detailed construction specifications, location of services such as: HV and LV electrical lines, potable water, fire and gas plans. Accurate plans of these services were not available at the time of writing and will require further impact assessment following development consent approval.

The incursions to the theoretical Tree Preservation Zones (TPZ) and Structural Root Zones (SRZ) potentially affecting trees assessed on the subject site are shown on the Tree Impact Plan (Appendix 3) with the total incursion percentages detailed in the Tree Data Schedule (Appendix 1).

The tree impacts are in seven developmental impact categories:

- Building envelope
- Storm water
- Sewer
- Electrical Substation location
- Proposed ten space carpark
- Waste
- Landscape

These impact categories are explored below.

Building envelope

Tree 36, 38, 39, 40, 41, 43, 45, and 46 within the subject site are given a high retention value as per IACA Significance of a Tree, Assessment Rating System (STARS) © (IACA 2010) © and have major incursions to the SRZ and TPZ by the proposed building envelope, refer to the Tree Impact Plan (Appendix 3) with the percentage of incursion detailed below. The major incursions require the trees removal to support the proposed development.

Tree 37, 42 and 44 within the subject site are given a medium retention value as per IACA Significance of a Tree, Assessment Rating System (STARS) © (IACA 2010) © and have major incursions to the SRZ and TPZ by the proposed building envelope, refer to the Tree Impact Plan (Appendix 3) with the percentage of incursion detailed below. The major incursions require the trees removal to support the proposed development.

Tree 47 has an acceptable minor incursion of 2.5% to its TPZ and can be retained and remain healthy with Tree Protection measures implemented.

Tree Number	SRZ incursion %	TPZ incursion %	Minor/Major incursion
36	65.6%	54.7%	Major
37	77.9%	59.2%	Major
38	60.4%	53.5%	Major
39	66.8%	56.1%	Major
40	59.7%	54.0%	Major
41	36.8%	45.5%	Major
42	69.9%	58.4%	Major
43	69.8%	56.4%	Major
44	77.4%	63.6%	Major
45	81.1%	43.9%	Major
46	23.2%	21.8%	Major

Design modifications: N/A

Tree Sensitive construction: N/A

Tree Protection measures: Trunk protection is recommended for Tree 47 as detailed in the Tree Management Plan (Section 4) of this report.

Recommendations:

- Remove and Replace Trees 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, and 46.
- Protect Tree 47.

Storm Water

Tree 47, 48 and 49 within the subject site are given a high retention value as per IACA Significance of a Tree, Assessment Rating System (STARS) © (IACA 2010) © and have minor and major incursions to the TPZ by the proposed stormwater line, refer to the Tree Impact Plan (Appendix 3) with the percentage of incursion detailed below.

Tree 69 within the subject site is given a medium retention value as per IACA Significance of a Tree, Assessment Rating System (STARS) © (IACA 2010) © and has major incursions to the TPZ by the proposed stormwater line, refer to the Tree Impact Plan (Appendix 3) with the percentage of incursion detailed below.

Tree 42, 43, 44, 45 and 46 are not considered as being impacted by the construction of the stormwater line as the trees are required to be removed for the building envelope to proceed.

Tree Number	SRZ incursion %	TPZ incursion %	Minor/Major incursion
47	0	1.1%	Minor
48	0	12.3%	Major
49	0	23.3%	Major
69	0	13.9%	Major

Design modifications: N/A

Tree Sensitive construction: To be advised following root mapping.

Tree Protection measures: Trunk protection is recommended for Tree 47, 48, 49 and 69 as detailed in the Tree Management Plan (Section 4) of this report.

Comments: To properly understand the size and quantity of roots potentially affected by the proposed stormwater line installation. Root mapping is recommended by non-destructive methods including pneumatic air spade or vacuum excavation. The results of root mapping will determine the construction methods used for the stormwater line installation.

Recommendations:

- Retain and protect Tree 47, 48, 49 and 69.
- Detailed root mapping to be undertaken.

Sewer

Tree 72, 74 and 75 within the subject site are given a high retention value as per IACA Significance of a Tree, Assessment Rating System (STARS) © (IACA 2010) © and have major and minor incursions to the SRZ and TPZ by the proposed sewer line, refer to the Tree Impact Plan (Appendix 3) with the percentage of incursion detailed below.

Tree 47 has a minor incursion of 1.1% and will be unaffected by the impact.

Incursions

Tree Number	SRZ incursion %	TPZ incursion %	Minor/Major incursion
47	0	1.1%	Minor
72	0	1.0%	Minor
74	25.3%	43.6%	Major
75	0	14.3%	Major

Design modifications: N/A

Tree Sensitive construction: Under-boring or directional drilling is recommended to retain trees 72, 74 and 75. Refer to the Tree Management Plan (Section 4) for further detail.

Tree Protection measures: Trunk protection is recommended for Tree 74 and 75 as detailed in the Tree Management Plan (Section 4) of this report.

Recommendations: Retain and protect Tree 47, 72, 74 and 75.

Electrical Substation

Tree 32 and 33 within the subject site are given a high retention value as per IACA Significance of a Tree, Assessment Rating System (STARS) © (IACA 2010) © and have minor incursions to the TPZ by the proposed stormwater line, refer to the Tree Impact Plan (Appendix 3) with the percentage of incursion detailed below.

Tree Number	SRZ incursion %	TPZ incursion %	Minor/Major incursion
32	0	4.5%	Minor
33	0	3.5%	Minor

Design modifications: N/A

Tree Sensitive construction: N/A

Tree Protection measures:

- Trunk protection is recommended for Tree 32 and 33 as detailed in the Tree Management Plan (Section 4) of this report.
- A Project Arborist is to be onsite for the excavation of the proposed substation as detailed in the Tree Management Plan (Section 4) of this report.

Recommendations: Retain and Protect Tree 32 and 33.

Proposed Ten Space Carpark

Tree 2, 3, 6, 8 and 9 within the subject site are given a high retention value as per IACA Significance of a Tree, Assessment Rating System (STARS) © (IACA 2010) © and have minor and major incursions to the SRZ and TPZ by the proposed ten space carpark, refer to the Tree Impact Plan (Appendix 3) with the percentage of incursion detailed below.

Tree 4, 5, 7 and 70 within the subject site are given a medium retention value as per IACA Significance of a Tree, Assessment Rating System (STARS) © (IACA 2010) © and have minor and major incursions to the SRZ and TPZ by the proposed ten space carpark, refer to the Tree Impact Plan (Appendix 3) with the percentage of incursion detailed below.

Tree Number	SRZ incursion %	TPZ incursion %	Minor/Major incursion
2	16.6%	17.3%	Major
3	28.1%	35.7%	Major
4	20.5%	35.8%	Major
5	24.5%	38.8%	Major
6	22.5%	40.9%	Major
7	5.3%	23.7%	Major
8	1.5%	12.3%	Major
9	0	1.2%	Minor
70	0	2.4%	Minor

Design modifications: A permeable type of deconstructed granite gravel or similar is recommended for the Ten Space Carpark to allow for moisture to reach the root zone of trees affected. This will maintain the health and vitality of the trees, as detailed in the Tree Management Plan (Section 4) of this report.

Tree Sensitive Construction: No excavation is permitted within the TPZ of Tree 2, 3, 4, 5, 6, 7, 8, 9 and 70 as detailed in the Tree Management Plan (Section 4) of this report.

Tree Protection measures: Trunk protection is recommended for Tree 2, 3, 4, 5, 6, 7, 8, 9 and 70 as detailed in the Tree Management Plan (Section 4) of this report.

Recommendations: Retain and protect Tree 2, 3, 4, 5, 6, 7, 8, 9 and 70.

Waste Storage Area

Tree 34 and 35 within the subject site are given a high retention value as per IACA Significance of a Tree, Assessment Rating System (STARS) © (IACA 2010) © and have major incursions to the SRZ and TPZ by the proposed waste storage area, refer to the Tree Impact Plan (Appendix 3) with the percentage of incursion detailed below.

Tree Number	SRZ incursion %	TPZ incursion %	Minor/Major incursion
34	15.1%	5.3%	Major
35	18.7%	6.8%	Major

Design modifications: N/A

Tree Sensitive construction: No excavation is permitted within the SRZ and TPZ of Tree 34 and 35 as detailed in the Tree Management Plan (Section 4) of this report.

Tree Protection measures: Trunk protection is recommended for Tree 34 and 35 as detailed in the Tree Management Plan (Section 4) of this report.

Recommendations: Retain and protect Tree 34 and 35

Landscaping

As shown on the Tree Impact Plan (Appendix 3) Tree 34, 35, 47, 48, and 49 are potentially impacted by the proposed new concrete paving as part of the landscape design. The Landscape Plan indicates no changes to existing levels, however, to ensure no damage to roots within TPZ, no excavation is recommended to construct the new concrete paving.

Tree 47, 48, and 49 within the subject site are given a high retention value as per IACA Significance of a Tree, Assessment Rating System (STARS) © (IACA 2010) © and have minor and major incursions to their SRZ and TPZ by the proposed Landscape Plan (retaining wall construction), refer to the Tree Impact Plan (Appendix 3) with the percentage of incursion detailed below.

Retaining Wall Incursion

Tree Number	SRZ incursion %	TPZ incursion %	Minor/Major incursion
47	0	15.2%	Major
48	0	21.0%	Major
49	0	9.4%	Minor

Design modifications: N/A

Tree Sensitive construction: Pier and Beam type construction is recommended for the retaining wall within the TPZ of Tree 47, 48 and 49 as detailed in the Tree Management Plan (Section 4) of this report.

Tree Protection measures: Trunk protection is recommended for Tree 47, 48 and 49 as detailed in the Tree Management Plan (Section 4) of this report.

Recommendations: Retain and protect Tree 34, 35, 47, 48 and 49

4. Tree Management Plan

The Tree Management Plan is designed to offer detailed design modifications or sensitive construction methods and a step by step timeline for Tree Protection Measures.

Step 1: Confirm trees to be removed

The Project Arborist must confirm with a numbered tag and or florescent tape the trees to be removed.

Step 2: Trunk Protection

To ensure the protection of trees affected by the proposed development Trunk Protection is required for Tree 2, 3, 4, 5, 6, 7, 8, 9, 32, 33, 34, 35, 47, 48, 49, 50, 69, 70, 74 and 75 as per the detail outline in Figure 7.

The Project Arborist must certify the protection measures are installed to the required specifications prior to commencement of construction. The trunk protection should remain in place for the duration of construction

Figure 7

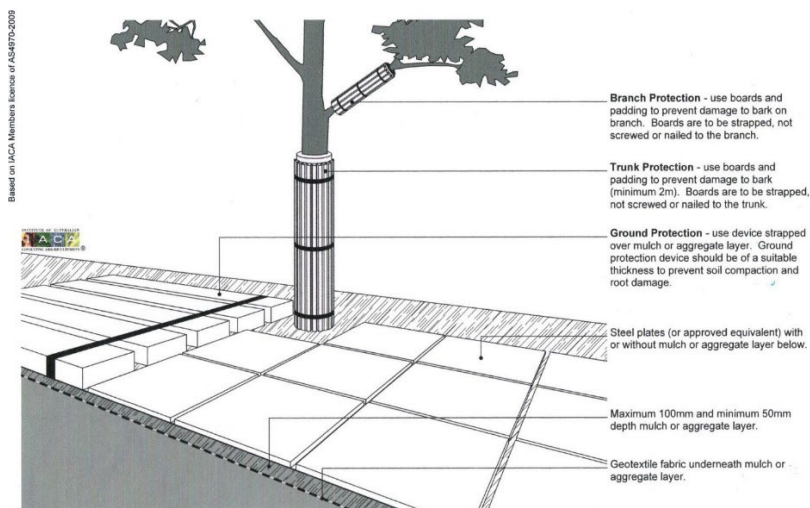


Figure 7: Example of Trunk Protection (CSA 2009).

Step 3: Erect Tree Protection Fence

As nominated on the Tree Protection Plan (Appendix 4) a tree protection fence is to be erected around trees 47, 48, 49, 50, 51, 63, 64, 65, 66, 67 and 68. The fence detailed in Figure 8 needs to be erected throughout construction and may be dismantled when landscaping begins. The Project Arborist must certify the protection measures are in the correct location and to specifications prior to commencement of construction.

Figure 8

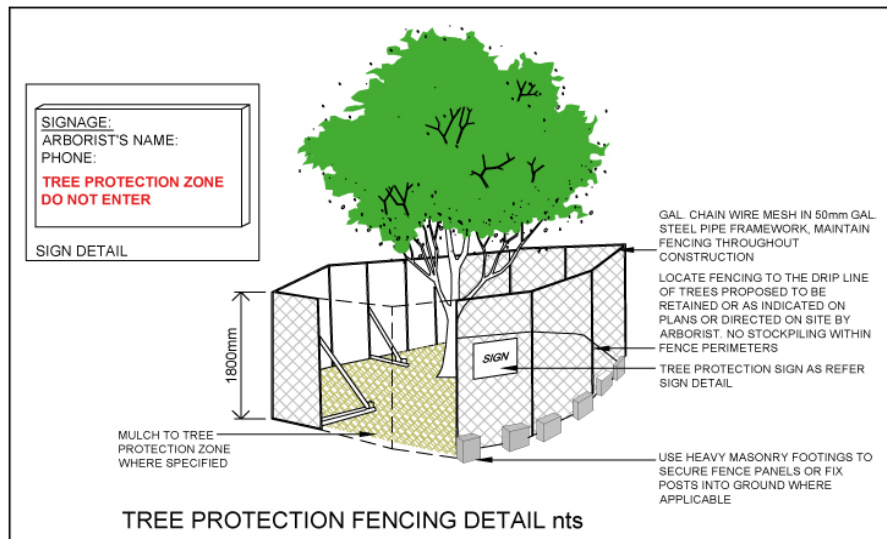


Figure 8: Tree Protection fence detail (CSA 2009).

Step 4: Excavation within the TPZ of Tree 47

The excavation required for the building envelope, sewer and stormwater line within the TPZ of Tree 47 must be carried out under the supervision of the Project Arborist to ensure no major root damage occurs. The Project Arborist needs to be on-site to identify roots larger than 50mm within and at the outer edge of the TPZ that require pruning. The roots should be pruned with a final cut to undamaged wood. Pruning cuts should be made with sharp tools such as secateurs, pruners, handsaws or chainsaws. Pruning wounds should not be treated with dressings or paints. It is not acceptable for roots within the TPZ to be 'pruned' with machinery such as backhoes or excavators (CSA 2009).

Step 5: Proposed Ten Space Carpark

A permeable type of deconstructed granite gravel is recommended within the SRZ and TPZ of Tree 2, 3, 4, 5, 6, 7, 8, 9 and 70 to allow for moisture to reach the root zone of trees affected. This will allow the trees to maintain their health and vitality. No excavation is permitted within the SRZ and TPZ of Tree 2, 3, 4, 5, 6, 7, 8, 9 and 70. The Project Arborist must ensure no root damage occurs throughout construction of the proposed carpark.

Step 6: Waste Storage Design and installation.

The location of the proposed waste storage facility has a major incursion to the SRZ and TPZ of Tree 34 and 35. The detailed design should ensure no excavation is required. The Project Arborist should be onsite to ensure trees are protected and undamaged (CSA 2009).

Step 7: Substation installation

The area nominated for the new substation is allocated within the TPZ of Tree 32 and 33. Excavation is required and this should be supervised by the Project Arborist. The Project Arborist needs to be on-site to identify roots larger than 50mm within and at the outer edge of the TPZ that require pruning. The roots should be pruned with a final cut to undamaged wood. Pruning cuts should be made with sharp tools such as secateurs, pruners, handsaws or chainsaws. Pruning wounds should not be treated with dressings or paints. It is not acceptable for roots within the TPZ to be 'pruned' with machinery such as backhoes or excavators.

Step 8: Sewer installation

To ensure the protection of trees 72, 74 and 75 directional drilling or under boring is recommended for the proposed sewer line installation. The directional drilling bore should be at a minimum of 600 mm deep with bore pits located outside of the TPZ where possible. The Project Arborist should be onsite to ensure trees are protected and undamaged (CSA 2009).

Step 9: Landscaping

Concrete Paving

A no dig type construction is recommended for the removal of existing concrete path and installation of proposed concrete paving within the TPZ of Tree 34, 35, 47, 48, and 49.

Retaining Wall

A pier and beam type construction method (Figure 9) is recommended for the construction of the retaining wall potentially effecting Tree 47, 48 and 49.

The footings must be hand dug under the supervision of the Project Arborist. Manual excavation needs to be carried out under the supervision of the Project Arborist to identify roots critical to tree stability. Relocation or redesign of works may be required. Where the Project Arborist identifies roots to be pruned within or at the outer edge of the TPZ, they should be pruned with a final cut to undamaged wood. Pruning cuts should be made with sharp tools such as secateurs, pruners, handsaws or chainsaws. Pruning wounds should not be treated with dressings or paints. It is not acceptable for roots within the TPZ to be 'pruned' with machinery such as backhoes or excavators (CSA 2009).

Figure 9

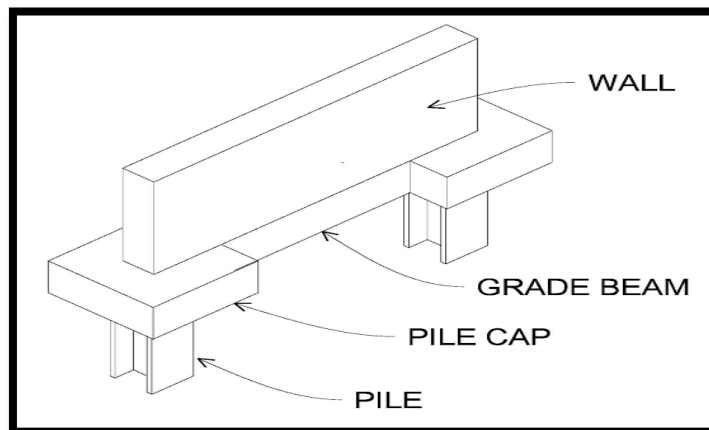


Figure 9: Indicative Pier and Beam detail.

Step 10: Monitoring

The Project Arborist must inspect all trees to be retained bi-monthly to ensure tree protection measures are being adhered to and the health of all trees is not being adversely affected.

Step 11: General Exclusions within the TPZ

The following activities shall be excluded within the TPZ:

- Excavation, compaction or disturbance of the existing soil.
- The movement or storage of materials, waste or fill.
- Soil level changes.
- Disposal and runoff of waste materials and chemicals including paint, solvents, cement slurry, fuel and oil.
- Other toxic liquids.
- Movement or storage of plant, machinery, equipment or vehicles.
- Any activity likely to damage the trunk, crown or root system of the trees.

The Project Arborist must be notified in the event any disturbance within the TPZ of trees to be retained is required.

Step 12: Final Certification

Upon completion of construction the Project Arborist will certify that the health and condition of all trees to be retained have not been adversely affected by the development.

Tree Protection Plan Table format

Hold Point	Task	Responsibility	Certification	Timing of Inspection
1.	Appoint a Project Arborist	Principal Contractor	Certifying body	Prior to Construction Certificate
2.	Nominate trees for removal	Principal Contractor	Project Arborist	As Required
3.	Inspect Trunk Protection for Tree 2, 3, 4, 5, 6, 7, 8, 9, 32, 33, 34, 35, 47, 48, 49, 50, 70, 74 and 75 is installed to specifications.	Principal Contractor	Project Arborist	Prior to the commencement of construction
4.	Inspect Tree Protection Fencing for Tree 47 to 50 and 63 to 68 is installed to specifications.	Principal Contractor	Project Arborist	Prior to the commencement of construction
5.	Supervise the excavation within the TPZ of Tree 47 for building envelope, sewer and stormwater	Principal Contractor	Project Arborist	As Required
6.	Supervise the construction of the Ten Space Carpark within the TPZ of Tree 2, 3,4, 5, 6, 7, 8, 9 and 70.	Principal Contractor	Project Arborist	As Required
7.	Supervise the construction of Waste Storage facility within the TPZ of Tree 34 and 35.	Principal Contractor	Project Arborist	As Required
8.	Supervise the Under boring required for proposed sewer line within the TPZ of Tree 74 and 75.	Principal Contractor	Project Arborist	As Required
9.	Supervise the excavation within the TPZ of Tree 32 and 33 for proposed substation.	Principal Contractor	Project Arborist	As Required
10.	Supervise the hand dug retaining wall footings within the TPZ of Tree 47, 48 and 49	Principal Contractor	Project Arborist	As required

11.	Monitoring: Inspection of trees to be retained throughout construction by the Project Arborist	Principal Contractor	Project Arborist	Bi-monthly during construction period
12.	Final inspection of trees by Project Arborist	Principal Contractor	Project Arborist	Prior to issue of interim/final Occupation Certificate

5. Referenced Documents

Plans that were used in the calculation and mapping of tree impacts for this report include:

Plan Title	Drawing Number	Consultant	Revision	Job/Project Number
Architectural Plans Concourse level	A-1001	HASSELL	J	14340
Survey	79059	Rygate Surveyors	9-9-19	79059
Civil	SKC05	TTW	P6	191326
Sewer	CS100	CSI Consultants	P4	19092
Landscape Plan	A-500	HASSELL	C	14340
Tree Location Plan	Appendix 2	SLR	11-11-19	630.12842
Tree Impact Plan	Appendix 3	SLR	21-11-19	630.12842
Tree Protection Plan	Appendix 4	SLR	11-11-19	630.12842

The following revisions of the above listed plans were reviewed in the preparation of this AIA but were not available at the time of writing for use in tree impact calculations. However, the amendments made to the listed plans were reviewed and are not likely to have any substantive changes to TPZ impacts and do not change the results of this AIA with regard to trees to be retained or removed.

Plan Title	Drawing Number	Consultant	Revision	Job/Project Number
Architectural Plans Concourse level	A-1001	HASSELL	L	14340
Landscape Plan	A-500	HASSELL	E	14340
Civil	SKC05	TTW	P11	191326

6. Conclusions & Recommendations

6.1 Conclusion

The major incursions to the Structural Root Zone (SRZ) and Tree Protection Zone (TPZ) of Tree 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, and 46 are required to be removed as part of the proposed development. The Landscape Plan prepared by HASSELL proposes the replanting of Eleven 200-750Lt (*Lophostemon confertus*) Brush Box and Tuckeroos to compensate for the removal of these trees.

Tree 2, 3, 4, 5, 6, 7, 8, 9, 32, 33, 34, 35, 47, 48, 49, 50, 70, 74 and 75 on the subject site will remain healthy throughout construction with the implementation of tree protection measures outlined in the Tree Management Plan.

Root mapping is required to properly understand the size and quantity of roots potentially affecting Tree 47, 48, 49 and 69 by the proposed stormwater line installation. Root mapping is recommended by non-destructive methods such as pneumatic air spade or vacuum excavation. The results of the root mapping will determine the construction methods used for the stormwater line installation.

The tree impacts detailed in Section 3.2 are based on the plans referenced in Section 5 of this document. Amendments to this report or additional Arboricultural Impact Assessments may be required following final detailed plans.

There are some aspects of the development that require more detailed construction specifications, location of services such as: HV and LV electrical lines, potable water, fire and gas plans. Accurate plans of these services were not supplied and will require further impact assessment following development consent approval.

6.2 Recommendations

1. Remove Tree 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, and 46. Tree removal work to be undertaken in accordance with *AS 4373 Pruning of Amenity Trees*, using a qualified Arborist (minimum Australian Qualification Framework (AQF3) Level Arborist).
2. Adhere to the Tree Management Plan (Section 4) of this report to ensure all trees to be retained remain healthy and viable into the future.

Other options to compensate for the removal of heritage items may include:

- The use of wood from heritage trees removed for artwork, woodwork, seating and or mulched onsite for existing or new landscaping.
- The collection of seed or cuttings to regrow trees to ensure the heritage value of the trees is not lost. Trees that are regrown may be planted in the local area as replacement street trees or in parks.

7. References

Shigo, A., 1986, *A New Tree Biology and Dictionary: facts, photos, and philosophies on trees and their problems and proper care*, Snohomish, WA

Council of Standards Australia (August 2009)
The Australian Standard for the Protection of Trees on Development Sites (AS 4970 – 2009).

Harris, R., Clark, J., Matheny, N., 2003, *Integrated Management of Landscape Trees, Shrubs, and Vines*, fourth edition, Prentice Hall, Australia

IACA, 2010, *IACA Significance of a Tree, Assessment Rating System (STARS)*, Institute of Australian Consulting Arboriculturists, Australia, www.iaca.org.au

Lonsdale, D. (1999). *Principles of Tree Hazard Assessment and Management*. Forestry Commission, London.

Mattheck, C and Breloer, H (1994) *The Body Language of Trees*. Research for Amenity Trees No.4, The Stationery Office, London.

Warringah Local Environmental Plan 2011, New South Wales Government <https://legislation.nsw.gov.au/#/view/EPI/2011/649/sch5> accessed 9/10/19.




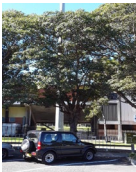

Disclaimer:

By the nature of their size, weight and miscellaneous structure, constant exposure to the weather and the elements, susceptibility to insects, pest and decay organisms, and trees always pose an inherent degree of hazard and risk from breakage or failure.

There is no guarantee, expressed or implied, that problems or deficiencies of the subject trees may not arise in the future. No responsibility will be accepted for partial or full failure of any tree. No responsibility will be accepted for any damage or injury caused by any tree or part thereof referred to in this report.






While great care is taken to accurately diagnose the condition of a tree, it is impossible to accurately determine the true structural condition of the entire tree and any diagnosis, opinions or recommendations expressed are based on several methods of determining tree health.

APPENDIX 1 Tree Data Schedule P1

No	Genus-Species	Common name	DAB metres (radius)	DBH metres (radius)	SRZ (radius)	TPZ (radius)	Height Metres	Age		Canopy Spread (Metres) (radius)				SRZ incursion	TPZ incursion	Health	Condition	Useful Life Expectancy	Landscape significance	Retention value	Observations/Comments	Photo
			Above buttress	Breast Ht	Metres	Metres		Metres	Young mature	Semi Mature	Over-mature	North	South	East	West	%	%	Good Fair Fair/Poor Poor Failed	Good Fair Fair/Poor Poor Failed	High Medium Low		
1	Lophostemon confertus	Brush Box	0.8	0.6	3.0	7.2	14.5		Mature	4	5	8	6			Fair/Poor	Fair/Poor	Medium	High	High	Form modified by light restriction. Tree previously lopped producing multiple stems or trunks.	
2	Lophostemon confertus	Brush Box	10.3	0.89	8.8	10.7	20		Mature	6	6	9	6	16.6	17.3	Fair	Fair	Medium	High	High	Tree previously lopped producing multiple stems or trunks.	
3	Lophostemon confertus	Brush Box	0.84	0.7	3.1	8.4	17		Mature	6	3	8	7	28.1	35.7	Fair/Poor	Fair/Poor	Medium	Medium	High	Tree previously lopped producing multiple stems or trunks.	
4	Lophostemon confertus	Brush Box	0.6	0.48	2.7	5.8	15		Mature	3	1	0	7	20.5	35.8	Poor	Poor	Medium	Medium	Medium	Tree has poor health and vigour. Trees form is modified by light restriction. Tree previously lopped producing multiple stems or trunks.	
5	Lophostemon confertus	Brush Box	0.67	0.54	2.8	6.5	11		Mature	2	3	6	6	24.5	38.8	Fair	Fair/Poor	Medium	Medium	Medium	Trees form is modified by light restriction. Tree previously lopped producing multiple stems or trunks.	






Tree Data Schedule P2



No	Genus-Species	Common name	DAB	DBH	SRZ	TPZ	Height	Age	Canopy Spread (Metres)				SRZ	TPZ	Health	Condition	Useful Life Expectancy	Landscape significance	Retention value	Comments	Photo		
			metres (radius)	metres (radius)	(radius)	(radius)			(radius)	(radius)	incurSION	incurSION	North	South								East	West
			Above buttress	Breast Ht	Metres	Metres	Metres	Young mature	Semi Mature	Over-mature					Good Fair Fair/Poor Poor Failed	Good Fair Fair/Poor Poor Failed	High Medium Low	High Medium Low	High Medium Low				
6	Lophostemon confertus	Brush Box	0.93	0.83	3.2	10.0	17	Mature			5	5	6	8	22.5	40.9	Fair	Fair/Poor	Medium	High	High	Tree previously lopped producing multiple stems or trunks.	
7	Lophostemon confertus	Brush Box	0.4	0.36	2.3	4.3	17	Semi mature			2	1	4	5	5.3	23.7	Fair	Fair/Poor	Medium	Medium	Medium		
8	Lophostemon confertus	Brush Box	0.51	0.47	2.5	5.6	18	Semi mature			3	4	6	6	1.5	12.3	Fair	Fair/Poor	Medium	High	High	Multi-stemmed tree on a slight lean to the south.	
9	Lophostemon confertus	Brush Box	0.47	0.4	2.4	4.8	15	Mature			2	3	5	5	15.1	1.2	Fair	Fair/Poor	Medium	High	High	Tree multi-stemmed from base with included bark, no risk expected.	
10	Lophostemon confertus	Brush Box	0.55	0.43	2.6	5.2	16	Mature			3	1	5	4			Fair	Poor	Medium	Medium	Medium	Multi-stemmed included branch attachment commencing at 2m.	






Tree Data Schedule P3



No	Genus-Species	Common name	DAB	DBH	SRZ	TPZ	Height	Age		Canopy Spread (Metres)				SRZ	TPZ	Health	Condition	Useful Life Expectancy	Landscape significance	Retention value	Comments	Photo
			metres (radius)	metres (radius)	(radius)	(radius)		metres	metres	metres	metres	metres	metres	metres	metres							
			Above buttress	Breast Ht	Metres	Metres	Metres	Young mature	Semi mature	North	South	East	West	%	%	Good Fair Fair/Poor Poor Failed	Good Fair Fair/Poor Poor Failed	High Medium Low	High Medium Low	High Medium Low		
11	Lophostemon confertus	Brush Box	0.54	0.46	2.6	5.5	16	Mature		4	4	3	4			Fair	Fair/Poor	Medium	High	High	Tree multi-stemmed from 1.5m with included bark, no risk expected.	
12	Lophostemon confertus	Brush Box	0.47	0.4	2.4	4.8	16	Mature		4	5	5	5			Fair	Fair	Medium	High	High		
13	Lophostemon confertus	Brush Box	0.17	0.13	1.6	1.6	6	Semi mature		2	2	2	2			Poor	Poor	Short	Low	Low	Tree in poor health and condion. Trees form is modified by light restriction.	
14	Lophostemon confertus	Brush Box	1.18	1.05	3.5	12.6	17.1	Mature		7	7	7	7			Fair	Fair/Poor	Medium	Medium	High	Tree previously lopped producing multiple stems or trunks.	
15	Lophostemon confertus	Brush Box	0.88	0.8	3.1	9.6	17	Mature		6	6	7	6			Fair	Fair/Poor	Medium	High	High	Tree previously lopped producing multiple stems or trunks.	






Tree Data Schedule P4



No	Genus-Species	Common name	DAB	DBH	SRZ	TPZ	Height	Age	Canopy Spread (Metres)				SRZ	TPZ	Health	Condition	Useful Life Expectancy	Landscape significance	Retention value	Comments	Photo		
			metres (radius)	metres (radius)	(radius)	(radius)			(radius)	(radius)	(radius)	(radius)	incurSION	incurSION								%	%
			Above buttress	Breast Ht	Metres	Metres	Metres	Young mature	Semi Mature	Over-mature	North	South	East	West			High Medium Low	High Medium Low	High Medium Low				
16	Lophostemon confertus	Brush Box	0.72	0.63	2.9	7.6	15	Mature			4	6	6	5			Fair	Fair/Poor	Medium	High	High	Tree previously lopped producing multiple stems or trunks.	
17	Lophostemon confertus	Brush Box	0.62	0.54	2.7	6.5	16	Mature			4	4	6	8			Fair	Fair/Poor	Medium	Medium	High	Tree previously lopped producing multiple stems or trunks.	
18	Lophostemon confertus	Brush Box	0.78	0.69	3.0	8.3	16	Mature			4	4	8	10			Fair/Poor	Fair/Poor	Medium	High	High	Tree previously lopped producing multiple stems or trunks. Small amount of epicormic growth observed.	
19	Lophostemon confertus	Brush Box	0.64	0.55	2.7	6.6	16	Mature			3	3	5	7			Fair	Fair/Poor	Medium	High	High	Tree previously lopped producing multiple stems or trunks.	
20	Lophostemon confertus	Brush Box	0.79	0.7	3.0	8.4	17	Mature			2	4	7	7			Fair	Fair/Poor	Medium	Medium	High	Tree previously lopped producing multiple stems or trunks.	






Tree Data Schedule P5



No	Genus-Species	Common name	DAB	DBH	SRZ	TPZ	Height	Age	Canopy Spread (Metres)				SRZ	TPZ	Health	Condition	Useful Life Expectancy	Landscape significance	Retention value	Comments	Photo		
			metres (radius)	metres (radius)	(radius)	(radius)			(radius)	(radius)	(radius)	(radius)	(radius)	(radius)								(radius)	(radius)
			Above buttress	Breast Ht	Metres	Metres	Metres	Young mature	Semi mature	Over-mature	North	South	East	West	%	%	Good Fair Fair/Poor Poor Failed	Good Fair Fair/Poor Poor Failed	High Medium Low	High Medium Low	High Medium Low		
21	Lophostemon confertus	Brush Box	0.9	0.8	3.2	9.6	16	Mature			5	4	7	12			Fair	Fair/Poor	Medium	High	High	Tree previously lopped producing multiple stems or trunks.	
22	Lophostemon confertus	Brush Box	0.67	0.55	2.8	6.6	17	Mature			4	2	6	8			Fair	Fair/Poor	Medium	High	High	Trees form is modified by light restriction. Tree previously lopped producing multiple stems or trunks.	
23	Lophostemon confertus	Brush Box	0.64	0.67	2.7	8.0	17	Mature			2	4	8	8			Fair	Fair/Poor	Medium	Medium	High	Trees form is modified by light restriction. Tree previously lopped producing multiple stems or trunks.	
24	Lophostemon confertus	Brush Box	1.09	0.95	3.4	11.4	16	Mature			4	6	9	12			Fair	Fair/Poor	Medium	High	High	Tree previously lopped producing multiple stems or trunks.	
25	Lophostemon confertus	Brush Box	0.76	0.63	2.9	7.6	21	Mature			4	2	5	12			Fair	Fair/Poor	Medium	High	High	Tree previously lopped producing multiple stems or trunks.	

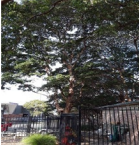




Tree Data Schedule P6



No	Genus-Species	Common name	DAB	DBH	SRZ	TPZ	Height	Age		Canopy Spread (Metres)				SRZ	TPZ	Health	Condition	Useful Life	Landscape	Retention	Comments	Photo
			metres (radius)	metres (radius)	(radius)	(radius)		metres	metres	metres	metres	metres	metres	metres	metres	metres	metres	metres	metres	metres		
			Above buttress	Breast Ht	Metres	Metres	Metres	Young	Semi	North	South	East	West	%	%	Good Fair Fair/Poor Poor Failed	Good Fair Fair/Poor Poor Failed	High Medium Low	High Medium Low	High Medium Low		
26	Lophostemon confertus	Brush Box	0.26	0.3	1.9	3.6	10	Semi mature		3	3	3	3			Fair/Poor	Poor	Medium	Low	Low	Tree in poor health and condion. Trees form is modified by light restriction.	
27	Lophostemon confertus	Brush Box	0.36	0.3	2.2	3.6	8	Semi mature		3	3	3	5			Fair/Poor	Poor	Medium	Low	Low	Tree in poor health and condion. Trees form is modified by light restriction.	
28	Lophostemon confertus	Brush Box	0.78	0.69	3.0	8.3	22	Mature								Fair	Fair/Poor	Medium	High	High	Tree previously lopped producing multiple stems or trunks. evidence of previous branch failure to 150mm.	
29	Angophora costata	Sydney Red Gum	0.55	0.45	2.6	5.4	8	Mature		0	4	0	13			Fair/Poor	Poor	Medium	Low	Low	Trees form is modified by light restriction.	
30	Angophora costata	Sydney Red Gum	0.93	0.77	3.2	9.2	20	Mature		8	8	8	8			Fair	Fair	Long	High	High	Cracker	






Tree Data Schedule P7



No	Genus-Species	Common name	DAB	DBH	SRZ	TPZ	Height	Age	Canopy Spread (Metres)				SRZ	TPZ	Health	Condition	Useful Life Expectancy	Landscape significance	Retention value	Comments	Photo			
			metres (radius)	metres (radius)	(radius)	(radius)			metres	metres	metres	metres	metres	metres								metres	metres	metres
			Above buttress	Breast Ht	Metres	Metres	Metres	Young mature	Semi mature	Over-mature	North	South	East	West	%	%	Good Fair Fair/Poor Poor Failed	Good Fair Fair/Poor Poor Failed	High Medium Low	High Medium Low	High Medium Low			
31	Lophostemon confertus	Brush Box	0.76	0.48	2.9	5.8	17	Mature			6	5	4	2			Fair	Fair/Poor	Medium	High	High	Tree previously lopped producing multiple stems or trunks.		
32	Lophostemon confertus	Brush Box	0.73	0.53	2.9	6.4	17	Mature			6	7	3	3		4.5	Fair	Fair/Poor	Medium	High	High	Tree previously lopped producing multiple stems or trunks.		
33	Lophostemon confertus	Brush Box	0.69	0.6	2.8	7.2	17	Mature			6	7	3	4		3.5	Fair	Fair/Poor	Medium	Medium	High	Tree previously lopped producing multiple stems or trunks.		
34	Lophostemon confertus	Brush Box	0.81	0.68	3.0	8.2	17	Mature			6	7	5	4		15.1	5.3	Fair	Fair/Poor	Medium	High	High	Tree previously lopped producing multiple stems or trunks.	
35	Lophostemon confertus	Brush Box	0.72	0.61	2.9	7.3	17	Mature			6	4	7	4		18.7	6.8	Fair	Fair/Poor	Medium	High	High	Tree previously lopped producing multiple stems or trunks.	






Tree Data Schedule P8



No	Genus-Species	Common name	DAB	DBH	SRZ	TPZ	Height	Age		Canopy Spread (Metres)				SRZ	TPZ	Health	Condition	Useful Life	Landscape	Retention	Comments	Photo
			metres (radius)	metres (radius)	(radius)	(radius)		metres	metres	metres	metres	metres	metres	metres	metres	metres	metres	metres	metres	metres		
			Above buttress	Breast Ht	Metres	Metres	Metres	Young mature	Semi Mature	North	South	East	West	%	%	Good Fair Fair/Poor Poor Failed	Good Fair Fair/Poor Poor Failed	High Medium Low	High Medium Low	High Medium Low		
36	Lophostemon confertus	Brush Box	1.1	0.96	3.4	11.5	18	Mature		6	9	6	9	65.6	54.7	Fair	Fair	Medium	High	High	Tree previously lopped producing multiple stems or trunks.	
37	Lophostemon confertus	Brush Box	1.07	0.9	3.4	10.8	18	Mature		5	6	6	6	77.9	59.2	Poor	Fair/Poor	Medium	Medium	Medium	Tree in decline, loss of vigour, 30% dieback observed. Trees health will not improve without remediation. Previously lopped producing multiple stems or trunks.	
38	Lophostemon confertus	Brush Box	0.9	0.8	3.2	9.6	18	Mature		6	5	3	7	60.4	53.5	Fair	Fair/Poor	Medium	Medium	High	Tree previously lopped producing multiple stems or trunks.	
39	Lophostemon confertus	Brush Box	0.79	0.7	3.0	8.4	18	Mature		5	4	4	4	66.8	56.1	Fair	Fair/Poor	Medium	High	High	Tree previously lopped producing multiple stems or trunks.	
40	Lophostemon confertus	Brush Box	0.73	0.58	2.9	7.0	18	Mature		5	7	4	2	59.7	54	Fair	Fair/Poor	Medium	High	High	Tree previously lopped producing multiple stems or trunks.	






Tree Data Schedule P9



No	Genus-Species	Common name	DAB	DBH	SRZ	TPZ	Height	Age	Canopy Spread (Metres)				SRZ	TPZ	Health	Condition	Useful Life Expectancy	Landscape significance	Retention value	Comments	Photo		
			metres (radius)	metres (radius)	(radius)	(radius)			metres (radius)	metres (radius)	metres (radius)	metres (radius)	metres (radius)	metres (radius)								metres (radius)	metres (radius)
			Above buttress	Breast Ht	Metres	Metres	Metres	Young mature	Semi mature	Over-mature	North	South	East	West	%	%	Good Fair Fair/Poor Poor Failed	Good Fair Fair/Poor Poor Failed	High Medium Low	High Medium Low	High Medium Low		
41	Lophostemon confertus	Brush Box	0.88	0.76	3.1	9.1	18	Mature			5	4	5	4	36.8	45.5	Fair	Fair/Poor	Medium	High	High	Tree previously lopped producing multiple stems or trunks.	
42	Lophostemon confertus	Brush Box	0.7	0.56	2.8	6.7	16	Mature			6	2	0	7	69.9	58.4	Fair/Poor	Poor	Medium	Medium	Medium	Tree showing signs of decline. Previously lopped producing multiple stems or trunks. Trees form modified by light restriction.	
43	Lophostemon confertus	Brush Box	0.96	0.86	3.3	10.3	18	Mature			6	9	6	8	69.8	56.4	Fair	Fair/Poor	Medium	High	High	Tree previously lopped producing multiple stems or trunks.	
44	Lophostemon confertus	Brush Box	0.63	0.47	2.7	5.6	16	Mature			3	2	1	3	77.4	63.6	Fair/Poor	Fair/Poor	Medium	Medium	Medium	Tree previously lopped producing multiple stems or trunks. Basal wound and decay observed. Tree in decline, form restricted from lack of light.	
45	Lophostemon confertus	Brush Box	0.94	0.78	3.2	9.4	20	Mature			5	6	2	3	81.1	50.3	Fair	Fair/Poor	Medium	High	High	Tree previously lopped producing multiple stems or trunks.	






Tree Data Schedule P10



No	Genus-Species	Common name	DAB	DBH	SRZ	TPZ	Height	Age		Canopy Spread (Metres)				SRZ	TPZ	Health	Condition	Useful Life	Landscape	Retention	Comments	Photo
			metres (radius)	metres (radius)	(radius)	(radius)		metres	metres	metres	metres	metres	metres	metres	metres	metres	metres	metres	metres	metres		
			Above buttress	Breast Ht	Metres	Metres	Metres	Young mature	Semi mature	North	South	East	West	%	%	Good Fair Fair/Poor Poor Failed	Good Fair Fair/Poor Poor Failed	High Medium Low	High Medium Low	High Medium Low		
46	Lophostemon confertus	Brush Box	0.8	0.68	3.0	8.2	21	Mature		6	3	9	3	23.2	35	Fair	Fair/Poor	Medium	High	High	Tree previously lopped producing multiple stems or trunks.	
47	Lophostemon confertus	Brush Box	0.75	0.66	2.9	7.9	21	Mature		6	4	3	7	18.8		Fair	Fair/Poor	Medium	High	High	Tree previously lopped producing multiple stems or trunks.	
48	Lophostemon confertus	Brush Box	0.94	0.77	3.2	9.2	21	Mature		7	10	6	3	33.9		Fair	Fair/Poor	Medium	High	High	Tree previously lopped producing multiple stems or trunks. Basal wound with no decay observed.	
49	Lophostemon confertus	Brush Box	1.05	0.91	3.4	10.9	18	Mature		7	6	4	4	41.8		Fair	Fair/Poor	Medium	High	High	Tree previously lopped producing multiple stems or trunks.	
50	Lophostemon confertus	Brush Box	0.84	0.75	3.1	9.0	17	Mature		8	8	4	3			Fair	Fair/Poor	Medium	High	High	Tree previously lopped producing multiple stems or trunks.	






Tree Data Schedule P11



No	Genus-Species	Common name	DAB metres (radius)	DBH metres (radius)	SRZ (radius)	TPZ (radius)	Height Metres	Age		Canopy Spread (Metres) (radius)				SRZ incursion	TPZ incursion	Health	Condition	Useful Life Expectancy	Landscape significance	Retention value	Comments	Photo
			Above buttress	Breast Ht	Metres	Metres		Metres	Young	Semi-mature	Over-mature	North	South	East	West	%	%	Good Fair Fair/Poor Poor Failed	Good Fair Fair/Poor Poor Failed	High Medium Low		
51	Lophostemon confertus	Brush Box	0.86	0.75	3.1	9.0	17		Mature	6	7	4	3			Fair	Fair/Poor	Medium	High	High	Tree previously lopped producing multiple stems or trunks.	
52	Lophostemon confertus	Brush Box	0.35	0.27	2.1	3.2	10		Young	3	3	3	3			Fair	Fair	Long	Medium	Medium		
53	Lophostemon confertus	Brush Box	0.78	0.67	3.0	8.0	13		Mature	5	4	5	7			Fair/Poor	Fair/Poor	Medium	High	High	Tree previously lopped producing multiple stems or trunks.	
54	Cinnamomum camphora	Camphor Laurel	0.65	0.53	2.8	6.4	13		Mature	5	4	6	8			Poor	Poor	Short	Low	Low	Tree in severe decline, poor form sucker growth.	
55	Lophostemon confertus	Brush Box	1.09	0.95	3.4	11.4	18		Mature	8	6	7	10			Fair	Fair/Poor	Medium	High	High	Tree previously lopped producing multiple stems or trunks.	






Tree Data Schedule P12



No	Genus-Species	Common name	DAB	DBH	SRZ	TPZ	Height	Age		Canopy Spread (Metres)				SRZ	TPZ	Health	Condition	Useful Life	Landscape	Retention	Comments	Photo
			metres (radius)	metres (radius)	(radius)	(radius)		metres	metres	metres	metres	metres	metres	metres	metres	metres	metres	metres	metres	metres		
			Above buttress	Breast Ht	Metres	Metres	Metres	Young mature	Semi mature	North	South	East	West	%	%	Good Fair Fair/Poor Poor Failed	Good Fair Fair/Poor Poor Failed	High Medium Low	High Medium Low	High Medium Low		
56	Cinnamomum camphora	Camphor Laurel	0.55	0.45	2.6	5.4	15	Mature		2	2	4	2			Poor	Poor	Short	Low	Low	Tree in severe decline, poor form, sucker growth.	
57	Cinnamomum camphora	Camphor Laurel	0.92	0.8	3.2	9.6	19	Mature		5	2	5	12			Fair	Fair/Poor	Medium	High	High	Tree previously lopped producing multiple stems or trunks.	
58	Cinnamomum camphora	Camphor Laurel	0.95	0.81	3.2	9.7	20	Mature		4	4	6	12			Fair	Fair/Poor	Medium	High	High	Tree previously lopped producing multiple stems or trunks. Tree is showing signs of decline with dieback, decay and evidence of branch failure to 100mm.	
59	Cinnamomum camphora	Camphor Laurel	1.3	1.05	3.7	12.6	20	Mature		5	5	5	12			Fair	Fair/Poor	Medium	High	High	Tree previously lopped producing multiple stems or trunks. A minor amount of dieback and epicormic growth observed.	
60	Cinnamomum camphora	Camphor Laurel	1.22	1.09	3.6	13.1	20	Mature		7	3	5	14			Fair	Fair/Poor	Medium	High	High	Tree previously lopped producing multiple stems or trunks. A minor amount of dieback and epicormic growth observed. Evidence of previous branch failure up to 100mm.	

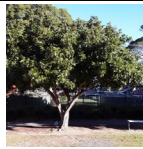




Tree Data Schedule P13



No	Genus-Species	Common name	DAB	DBH	SRZ	TPZ	Height	Age		Canopy Spread (Metres)				SRZ	TPZ	Health	Condition	Useful Life	Landscape	Retention	Comments	Photo
			metres (radius)	metres (radius)	(radius)	(radius)		metres	metres	metres	metres	metres	metres	metres	metres	metres	metres	%	%	Good Fair Fair/Poor Poor Failed		
61	Cinnamomum camphora	Camphor Laurel	1.2	1.02	3.6	12.2	21	Mature		4	4	5	15			Fair	Fair/Poor	Medium	High	High	Tree previously lopped producing multiple stems or trunks. A minor amount of dieback and epicmic growth observed.	
62	Jacaranda mimosifolia	Jacaranda	0.29	0.24	2.0	2.9	5	Semi mature		5	3	4	2			Fair	Fair/Poor	Medium	Low	Low		
63	Cupaniopsis anacardioides	Tuckaroo	0.55	0.47	2.6	5.6	6	Mature		6	4	6	6			Fair	Fair	Medium	Medium	Medium		
64	Cupaniopsis anacardioides	Tuckaroo	0.48	0.4	2.4	4.8	10	Mature		5	3	5	6			Fair	Fair	Medium	Medium	Medium		
65	Cupaniopsis anacardioides	Tuckaroo	0.5		2.5	0.0	8	Mature		6	3	5	6			Fair	Fair	Medium	Medium	Medium		






Tree Data Schedule P14

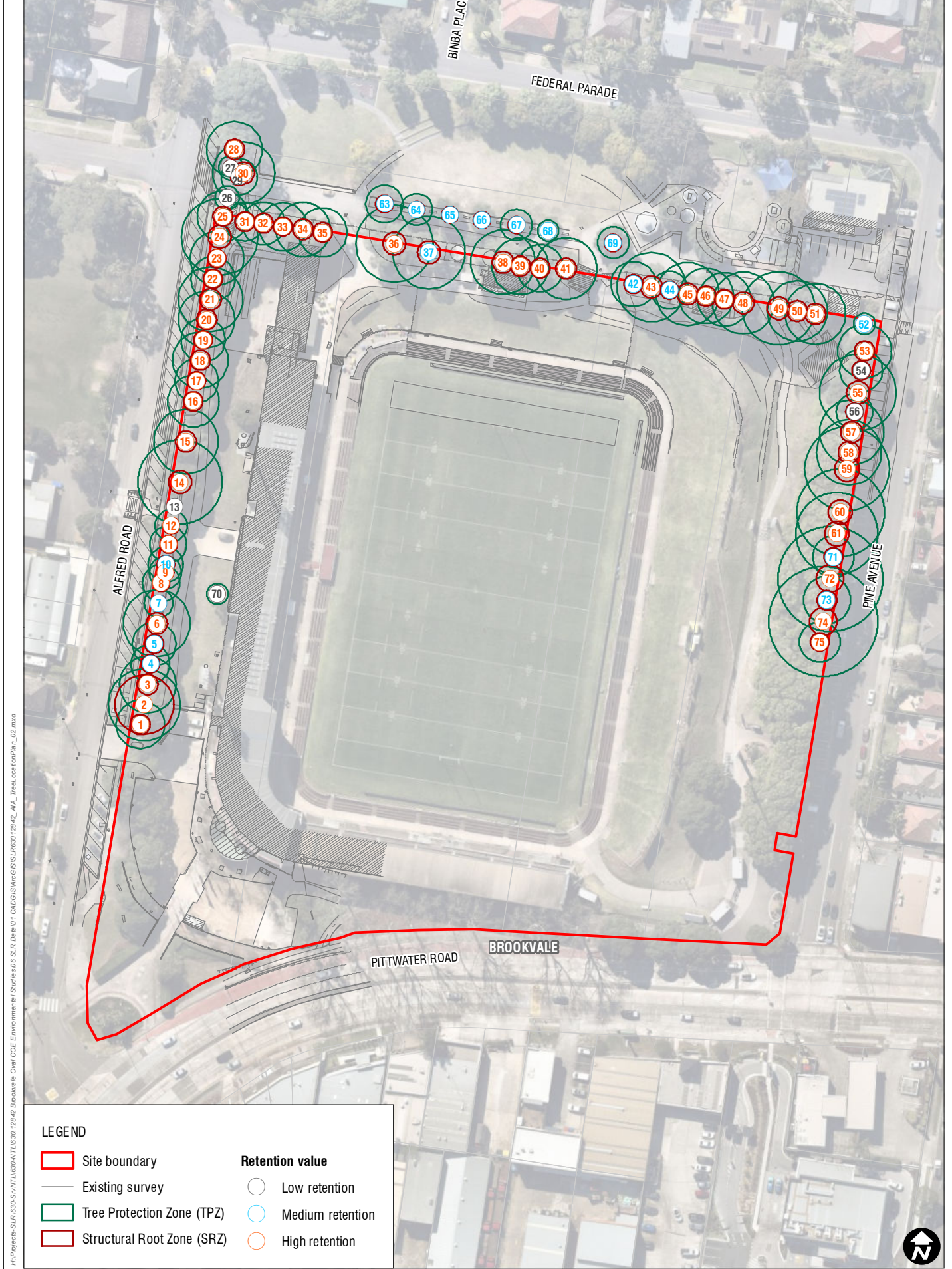


No	Genus-Species	Common name	DAB metres (radius)	DBH metres (radius)	SRZ (radius)	TPZ (radius)	Height Metres	Age		Canopy Spread (Metres) (radius)				SRZ incursion	TPZ incursion	Health	Condition	Useful Life Expectancy	Landscape significance	Retention value	Comments	Photo
			Above buttress	Breast Ht	Metres	Metres		Metres	Young mature	Semi Mature	North	South	East	West	%	%	Good Fair Fair/Poor Poor Failed	Good Fair Fair/Poor Poor Failed	High Medium Low	High Medium Low		
66	Cupaniopsis anacardiodes	Tuckaroo	0.51		2.5	0.0	6		Mature	5	4	3	4			Fair	Fair	Medium	Medium	Medium		
67	Cupaniopsis anacardiodes	Tuckaroo	0.49	0.39	2.5	4.7	6		Mature	6	3	3	5			Fair	Fair	Medium	Medium	Medium		
68	Cupaniopsis anacardiodes	Tuckaroo	0.35	0.26	2.1	3.1	6		Mature	4	2	4	3			Fair	Fair	Medium	Medium	Medium		
69	Waterhousia floribunda	Large Leafed Lily Pilly	0.49	0.39	2.5	4.7	10		Mature	6	3	6	6		13.9	Fair	Fair	Medium	Medium	Medium	Previous branch failure observed	
70	Corvmbia maculata	Spotted Gum	0.35	0.26	2.1	3.1	14		Semi mature	2	2	2	2		2.4	Fair	Fair/Poor	Medium	Medium	Low		

Tree Data Schedule P15










No	Genus-Species	Common name	DAB	DBH	SRZ	TPZ	Height	Age	Canopy Spread (Metres)				SRZ	TPZ	Health	Condition	Useful Life Expectancy	Landscape significance	Retention value	Comments	Photo		
			metres (radius)	metres (radius)	(radius)	(radius)			(radius)	(radius)	%	%	North	South								East	West
			Above buttress	Breast Ht	Metres	Metres	Metres	Young mature	Semi mature	Over-mature					Good Fair Fair/Poor Poor Failed	Good Fair Fair/Poor Poor Failed	High Medium Low	High Medium Low	High Medium Low				
71	Lophostemon confertus	Brush Box	0.62	0.52	2.7	6.2	9	Mature			2	2	5	8			Fair/Poor	Poor	Medium	Medium	Medium	Basal wound with no decay observed, trees habit is altered from lack of light from neighboring trees.	
72	Cinnamomum camphora	Camphor Laurel	1.61	1.3	4.0	15.6	20	Mature			8	4.5	6	16		1	Fair	Fair/Poor	Medium	Medium	High	Tree previously lopped producing multiple stems or trunks. A minor amount of dieback and epicormic growth observed.	
73	Cinnamomum camphora	Camphor Laurel	0.71	0.59	2.9	7.1	18	Mature			3	3	4	6			Fair/Poor	Poor	Medium	Low	Low	Large wound and decay observed mid-trunk. tree has a poor form, epicormic shoots and die-back	
74	Cinnamomum camphora	Camphor Laurel	1.67	1.36	4.1	16.3	20	Mature			5	7	5	15	25.3	43.6	Fair	Fair/Poor	Medium	Medium	High	Tree previously lopped producing multiple stems or trunks. A minor amount of dieback and epicormic growth observed.	
75	Cinnamomum camphora	Camphor Laurel	0.62	0.5	2.7	6.0	18	Mature			1	4	5	6		14.3	Fair/Poor	Fair/Poor	Medium	Medium	High	Trees habit is modified by light restrictions from nearby trees. A minor amount of dieback and epicormic growth observed.	



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LEGEND

- | | | | |
|---|----------------------------|---|------------------|
|  | Site boundary |  | Retention value |
|  | Existing survey |  | Low retention |
|  | Tree Protection Zone (TPZ) |  | Medium retention |
|  | Structural Root Zone (SRZ) | | High retention |

Scale: 1:1,500
GDA 1994 MGA Zone 56



11-Oct-2019
630.12842

Source: Nearmap (September 2019)

Sheet Size : A4



PH: 02 4037 3200

Tree Location Plan

APPENDIX 2

H:\Projects\SLR630-SHW\TL630\NTL630_12842 Brookvale Oval COE Environmental Studies\06 SLR Data\01 CADGIS\ArcGIS\SLR63012842_AIA_Tree Impact Plan_04.mxd



LEGEND

Site boundary	Existing sewer line	Retention value	Tree Protection Zone (TPZ)	TPZ incursion
Existing stormwater line	Proposed sewer line	Low retention	Structural Root Zone (SRZ)	SRZ incursion
Proposed stormwater line	Building envelope	Medium retention		
		High retention		



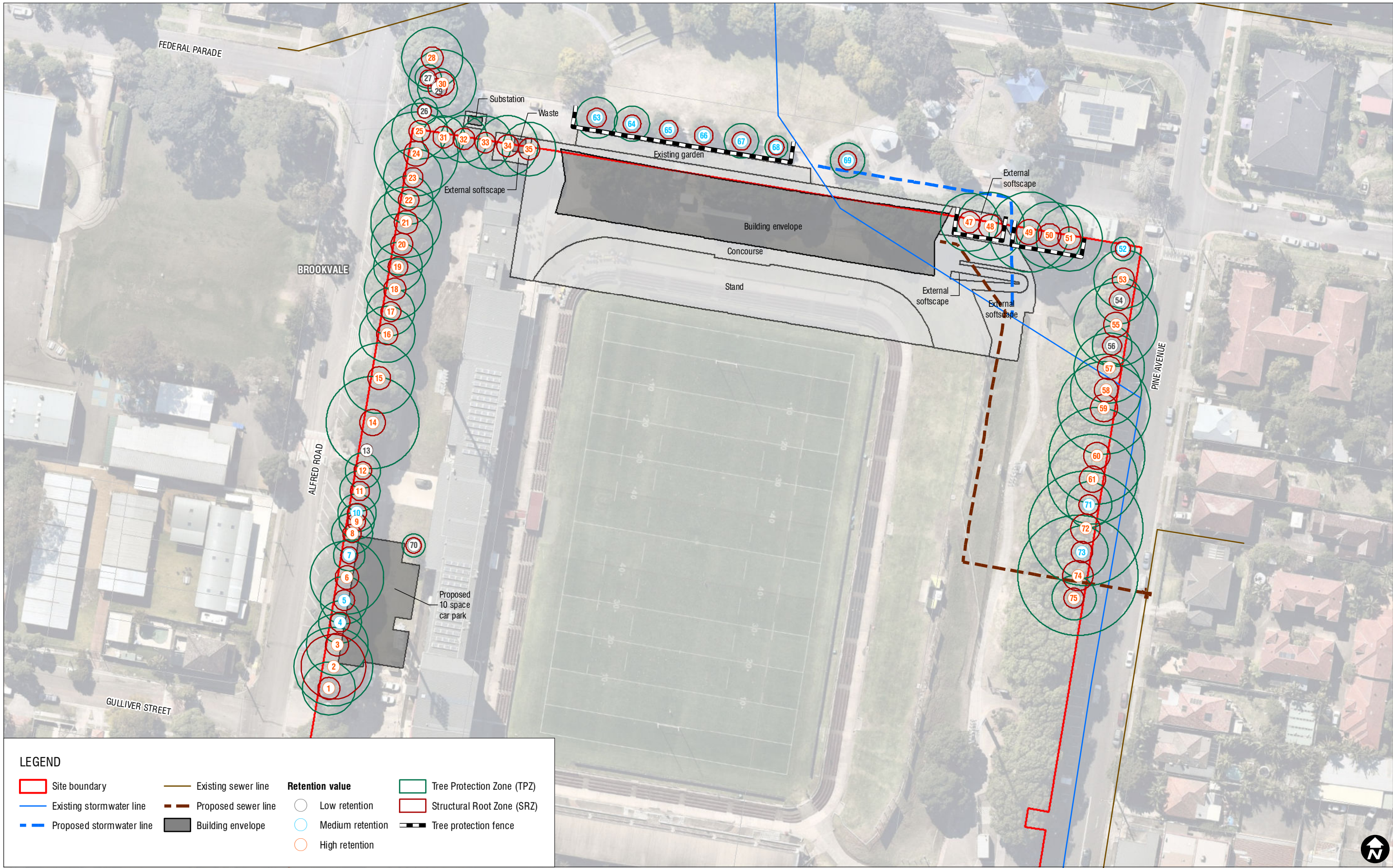
Scale: 1:1,154
GDA 1994 MGA Zone 56

21-Oct-2019
630.12842

Source: Nearamap (September 2019)

Note:
 - Building envelope design based on HASSELL drawing GA Plan - Concourse Level 00 Rev J.
 - Potential increased incursion to trees 34 and 35 due to concrete paving.
 - Trees 47 to 49 impacted by retaining wall and paving.

H:\Projects-SLR\630-SHW\TL630-MTL630-12842 Brookvale Over COE Environmental Studies\06 SLR Data\01 CADG\Src\GIS\SLR\630\12842_AIA_TreeProtectionPlan_01.mxd



LEGEND

- Site boundary
 - Existing stormwater line
 - Proposed stormwater line
 - Existing sewer line
 - Proposed sewer line
 - Building envelope
 - Tree Protection Zone (TPZ)
 - Structural Root Zone (SRZ)
 - Tree protection fence
- Retention value**
- Low retention
 - Medium retention
 - High retention



Scale: 1:1,000
GDA 1994 MGA Zone 56

11-Oct-2019
630.12842

Source: Neemap (September 2019)