ABNOBA ARBOR
Arboricultural Services

ARBORICULTURAL IMPACT ASSESSMENT| 433 PITTWATER RD. NORTH MANLY

Prepared For Warringah Golf Club

14.06.23

Prepared By Liam Strachan

ABNOBA ARBOR
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1 EXECUTIVE SUMMARY

On the 4th July 2023 Graeme McMullan (representing the Warringah Golf Club commissioned Abnoba Arbor to prepare an Arboricultural Impact Assessment to be linked to a joint development application (Northern beaches Council & WGC) for an upgrade of the Tennis/Recreation Centre & surrounds. The development proposes a new clubhouse plus other major works.

The property lies within the Northern Beaches Council LGA (Warringah).

The proposed development includes the demolition of existing structures and the installation of a new double storey building at the northern end of the subject site as well as extensive realignment of the existing stormwater and wetland area.

The recommendations and comments in this report are based on the following:

- Conduct a basic ground based visual tree assessment
- Provide information regarding tree species, dimensions, Landscape amenity value, health and vigour assessment, structural condition including potential mitigation options, priority rating for all recommended works.
- Ascertain Tree Protection Zones and Structural Root Zones.
- Determine the impact of the development on all of the trees.
- The amenity of adjoining neighbours and members community is to be considered.
- That report contains all relevant information as outlined in Warringah DCP 2011.

A total of 114 trees were assessed in total. 51 trees have been recommended for removal.

Table 1

Retention Value	To Retain	Tree Numbers	To Remove	Tree Numbers
Very High	0		0	
High	47	T42, T43, T48, T49, T54, T55, T56, T57, T58, T59, T72, T73, T74, T75, T76, T77, T78, T79, T80, T81, T82, T83, T84, T85, T86, T87, T88, T89, T90, T91, T92, T93, T94, T95, T96, T97, T98, T99, T100, T101, T102, T103, T104, T105, T109, T110, T113	24	T2, T3, T4, T7, T8, T9, T10, T11, T12, T13, T18, T19, T20, T23, T24, T25, T26, T28, T29, T31, T32, T33, T63, T65
Medium	13	T47, T51, T52, T53, T60, T61, T70, T71, T106, T107, T108, T111, T112	9	T1, T14, T17, T22, T27, T39, T44, T62, T68
Low	1	T46	6	T5, T15, T16, T21, T30, T64
Exempt	2	T45, T50	12	T6, T34, T35, T36, T37, T38, T40, T41, T66, T67, T69, T114
Total	63		51	

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3 INTRODUCTION

On the 4th July 2023 Graeme McMullan (representing the Warringah Golf Club commissioned Abnoba Arbor to prepare an Arboricultural Impact Assessment to be linked to a joint development application (Northern beaches Council & WGC) for an upgrade of the Tennis/Recreation Centre & surrounds. The development proposes a new clubhouse plus other major works.

The property lies within the Northern Beaches Council LGA (Warringah).

The proposed development includes the demolition of existing structures and the installation of a new double storey building at the northern end of the subject site as well as extensive realignment of the existing stormwater and wetland area.

Site inspection was conducted by Liam Strachan AQF Level 5 Arborist on the 7th July 2023.

3.1 SCOPE

The purpose of this report is to provide information on any trees that may be affected by the proposed demolition and development at 433 Pittwater Rd. North Manly.

The recommendations and comments in this report are based on the following:

- Conduct a basic ground based visual tree assessment
- Provide information regarding tree species, dimensions, Landscape amenity value, health and vigour assessment, structural condition including potential mitigation options, priority rating for all recommended works.
- Ascertain Tree Protection Zones and Structural Root Zones.
- Determine the impact of the development on all of the trees.
- The amenity of adjoining neighbours and members community is to be considered.
- That report contains all relevant information as outlined in Warringah DCP 2011.

In preparing this report, the author has considered the objectives of:

- The State environmental Planning Policy 'Biodiversity and Conservation' 2021
- The State environmental Planning Policy 'Vegetation in Non-Rural Areas' 2017,
- Warringah Local Environment Plan 2011
- Warringah Development Control Plan 2011
- AS 4373 'Pruning of Amenity Trees' 2007.

Australian Standard AS4970-2009 Protection of Trees on Development Sites has been used as a benchmark in the preparation of this report.

The report will also assess the on-going viability of the tree and if deemed appropriate, provide recommendations for pruning or the removal of the subject trees. The following report will focus on the trees sustainability within the landscape and will provide recommendations on the most appropriate course of action. The determination will be reached through the assessment of the tree's health, vigour, and structural condition at the time of inspection. The assessment did not include any internal diagnostics such as picus, resistograph, woody tissue examination, nor has any soil testing been conducted.

4 METHOD

4.1 METHODOLOGY SUMMARY

Table 2

Characteristic	Method
Photos	Digital camera
Tree measurements • **Height** • **DBH(Diameter at breast height)** • **SRZ (Structural root zone)** • **TPZ (Tree protection zone)**	• Clinometer, Tape measure • Diameter tape • SRZ = $(DAB \times 50)^{0.42} \times 0.64$ • DBH x 12 (AS4970-2009)
Documents Reviewed	• Warringah DCP 2011 • Warringah LEP 2011
Drawings Reviewed	• Group Architects DWG No. GA2020-023-D01 • Group Architects DWG No. GA2020-023-100 • Group Architects DWG No. GA2020-023-101 • Group Architects DWG No. GA2020-023-101a • Group Architects DWG No. GA2020-023-101b • Group Architects DWG No. GA2020-023-101c • Group Architects DWG No. GA2020-023-102 • Group Architects DWG No. GA2020-023-103 • Group Architects DWG No. GA2020-023-104 • Group Architects DWG No. GA2020-023-200 • Group Architects DWG No. GA2020-023-201 • Group Architects DWG No. GA2020-023-202 • Group Architects DWG No. GA2020-023-300 • C.M.S Surveyors Pty Ltd. DWG 19741 detail Sheet 1 of 7 • C.M.S Surveyors Pty Ltd. DWG 19741 detail Sheet 2 of 7 • C.M.S Surveyors Pty Ltd. DWG 19741 detail Sheet 3 of 7 • C.M.S Surveyors Pty Ltd. DWG 19741 detail Sheet 4 of 7 • C.M.S Surveyors Pty Ltd. DWG 19741 detail Sheet 5 of 7 • C.M.S Surveyors Pty Ltd. DWG 19741 detail Sheet 6 of 7 • C.M.S Surveyors Pty Ltd. DWG 19741 detail Sheet 7 of 7
Tree retention assessment	ULE (Useful life expectancy) STARS METHOD (IACA, 2010)
Tree health assessment	Visual Tree Assessment, (VTA) as per (Mattheck, et al., 2015) Inspection limited to ground based visual examination of the tree.

4.2 LIMITATIONS

Care has been taken to obtain all information from reliable sources. All data has been verified as far as possible. However, Liam Strachan - Consulting Arborist can neither guarantee nor be responsible for the accuracy of information provided by others. Unless stated otherwise:

- Information contained in this report covers only the trees examined and reflects the health and structure of the tree at the time of inspection. The documented, observations, results, recommendations and conclusions given may vary after the site visit due to environmental conditions. Liability will not be accepted for damage to person or property as a result of natural processes, unforeseeable actions or occurrences.
- Observations recorded for trees located within adjacent properties have been made without entering that property. Deciduous trees inspected during winter and all trees obscured by other vegetation are not able to be properly assessed. As a result, measurements for these trees are estimated. Similarly, these trees were not subject to a complete visual inspection and defects or abnormalities may be present but not recorded.
- The inspection was limited to visual examination from the base of the subject tree without dissection, excavation, probing or coring (unless specifically noted otherwise).
- There is no warranty or guarantee, expressed or implied, that problems or deficiencies of the subject tree may not arise in the future.

4.3 SITE INSPECTION

A visual inspection of the tree/s was performed from ground level, data collected includes:

- Genus, Species, Common Name;
- Height, Width, DBH (Diameter at Breast Height), DRB (Diameter above Root Buttress);
- Age, Health & Vigour;
- Significance, Amenity and Ecological Value;
- Form and Structural Condition;
- Visible Defects or Evidence of Wounding.

4.4 MEASUREMENTS

- Tree locations are supplied by client on the survey plan or triangulated using a measuring tape.
- Diameter at breast height (DBH) and Diameter above Root Buttress (DRB) are measured using a diameter tape.
- Height is measured using a clinometer.
- Canopy width is measuerd using a laser measure or tape measure.
- Structural Root Zone (SRZ) and Tree Protection Zone (TPZ) radii are calculated (in accordance with *AS 4970-2009*).
- TPZ or SRZ incursions are measured from the nearest face of the trunk to the face of the structure.

Tree schedule data is recorded in Appendix1.

4.5 REFERENCE DOCUMENTS

This report was written in coordination with:

- Australian Standard AS4970-2009 Protection of Trees on Development Sites
- Warringah DCP 2011
- Warringah LEP 2011
- Narla Environmental 'Flora & Fauna Constraints Assessment Report', dated February 2021,

4.6 DETERMINING A TREES SIGNIFICANCE

Tree health assessments were carried out using VTA as per Mattheck and significance and retention determinations were carried out using the STAR's method which combines ULE (useful life expectancy of subject tree) and significance rating based on characteristics such as health, form, vigour, cultural, heritage and amenity value. The 2 results are placed within a matrix which determines the retention value.

1. Is the tree a locally native remnant; an endangered species; a part of an endangered ecological community; or does the tree provide critical habitat for an endangered species?
2. Is the tree of botanical interest; Is it included in a significant tree register or listed as a heritage item under the Federal State or Local Regulations?
3. Is the tree visually prominent in the locality?
4. Is the tree well structured?
5. Is the tree in good health and/or does it display signs of good vigour?
6. Is the tree typically formed for the species?
7. Is the tree currently located in a position that will accommodate future growth?

Please see Appendix 2: STARS.

4.7 PLANNING GUIDELINES AND SPECIFIC LEGISLATION

Tree management measures are in place for Norther Beaches Council under the provisions of the trees and vegetation preservation for properties covered under Warringah DCP 2011.

- According to the NSW Planning Portal, the site is listed as RE1 Public Recreation.
- The site does not contain, nor does it form part of a heritage item.
- The site is not listed on the Warringah terrestrial biodiversity map.
- The site is not located on the NSW State Biodiversity Values map.

4.8 TREE MANAGEMENT CONTROLS

Northern Beaches Council definition of a prescribed tree is a palm or woody perennial plant with a single or multi stem greater than five (5) metres in height.

Part E1 of Warringah DCP States that:

A person shall not ringbark, cut down, top, lop, remove, poison, injure, or wilfully destroy tree or bushland vegetation that requires a Vegetation Clearing Permit under the provisions of Part 3 of the Vegetation SEPP. This includes damage to a tree or bushland vegetation by:

- Damaging or tearing live branches and roots;

- Damaging the bark, including attachment of objects using invasive fastenings, the fastening of materials around the trunk of trees which may result in a detrimental impact on tree health;
- Tree topping, where large branches and/or the trunk of the tree is removed from the top of the trees canopy;
- Tree lopping, where branches are removed to reduce the height and spread of the tree.
- Damaging the root zone of a tree by way of compaction, including storage and stockpiling materials;
- Changing of ground levels within the root zone of a tree by way of excavation, trenching, filling or stockpiling;
- Underscrubbing of bushland vegetation;
- Burning of vegetation (not part of a Hazard Reduction Certificate); or
- Any other act or activity that causes the destruction of, the severing of trunks or stems of, or any other substantial damage to, some or all of the native vegetation in an area.

A Vegetation Clearing Permit is required for:

a) Removal or cutting down of any tree over five (5) metres in height;
b) Pruning of more than ten percent (10%) of a tree canopy.
c) The removal or cutting down of vegetation in “Bushland”.

4.8.1 EXEMPTIONS

You can remove trees without a permit in the following circumstances. The tree is:

- Under 5 metres in height
- On the Exempt Tree Species List
- In an area in which the Council has authorised their removal as part of a hazard reduction program, where that removal is necessary in order to manage risk
- Required to be removed under other legislation (including the NSW Rural Fires Act 1997 and the Environmental Planning and Assessment Act 1979)
- Can be removed under the 10/50 Legislation. Some clearing of vegetation is allowed if your property is mapped in the 10/50 entitlement area. Development Application Approval conditions in some circumstances prevent the use of the RFS 10/50 entitlement area from being used.
- Removed by Rural Fire Services because they pose or will pose a significant threat to access along required fire trails or to human life, buildings or other property during a bush fire
- Located within two metres of an existing approved building (not including decks, pergolas, sheds, patios or the like, even if they are attached to a building). The measurement is made from the building to the base of the tree trunk.
- Is considered a high risk/imminent danger certified by a Level 5 qualified arborist. These trees can be removed without Council consent by the owner of the tree subject to the owner obtaining written confirmation from the arborist that clearly states:
    a) The arborist qualifications: AQF Level 5 Arborist or equivalent
    b) That the tree(s) is declared an imminent danger and high risk to life and property
    c) That immediate removal of the tree(s) is recommended
    d) A copy of the report must be sent to Council for record keeping purpose
- Any tree listed as a priority weed under the Bio Security Act 2015 and identified in the Greater Sydney Regional Weed Management Plan.
- Dead, and not required as the habitat of native animals - photographic evidence recommended

- Has fallen or partially fallen as a result of a storm and still present a danger (photos required)
- Part of the pruning or removal of hedges (unless hedge is conditioned to be retained in a development consent). "Hedge" means groups of two or more trees that:
    (a) are planted (whether in the ground or otherwise) so as to form a hedge, and
    (b) rise to a height of at least 2.5 metres (above existing ground level).

You can prune trees or clear vegetation in the following circumstances:

- Reasonable pruning of up to 10% of a tree's canopy within 12 calendar months. Pruning must be in accordance with Australian Standards AS 4373 – 2007
- The removal of deadwood from a tree
- Removal of any species of parasite mistletoe or parasitic plant from any part of a tree
- It meets the criteria of other legislation eg under 10/50 Legislation some clearing of vegetation is allowed if your property is mapped in the 10/50 entitlement area.

4.8.2 EXEMPT SPECIES

Table 3

Acacia baileyana (Cootamundra Wattle)	*Acacia salicina* (Golden wreath wattle)	Ficus species except *F. macrophylla, F. rubiginosa, F. coronata*	*Alnus jorullensis* (Evergreen alder)
Araucaria bidwillii (Bunya Pine)	*Brachychiton acerfolius* (Illawarra Flame Tree)	*Cassia spp* (Cassia)	*Castanospermum australe* (Black bean/Moreton Bay Chestnut)
Celtis australis (S-Hackberry)	*Cinnamomum camphora* (Camphor Laurel)	*Citharexylum spinosum* (Fiddlewood)	*Cotoneaster species* (Red Cotoneaster)
Cupaniopsis anacardioides (Tuckeroo)	*Cupressus species* (Conifer)	*Eriobotrya japonica* (Loquat)	*Citrus Spp.* (Citrus)
Malus spp. (Apple)	*Erythrina spp.* (Coral Tree)	*Eucalyptus nicholii* (Narrow-Leaved Peppermint)	*Eucalyptus scoparia* (Willow/Wallangarra White Gum)
Fraxinus grifithii (Evergreen Ash)	*Gleditsia triacanthos* (Honey Locust)	*Grevillia robusta* (Silky Oak)	*Harpophyllum caffrum* (Kaffir Plum)
Jacaranda mimosifolia (Jacaranda)	*Lagerstroemia indica* (Crepe Myrtle)	*Lagunaria patersonia* (Norfolk Island Hibiscus)	*Ligustrum lucidum* (Broad-leafed Privet)
Liquidamber styraciflua (Liquidamber/Sweet Gum)	*Nerium oleander* (oleander)	*Olea spp.* (Olive)	All Palms except *Livistona australis*
Pinus sp (Pine species)	*Pittosporum undulatum* (up to 8m) (Sweet Pittosporum)	*Populus sp.* (Poplar species)	*pyracantha angustifolia* (Orange fire Thorn)
Rhaphiolepsis indica (Indian Hawthorn)	*Robinia pseudoacacia* (False acacia)	*Salix spp.* (Willow)	*Sapium sebiferum* (Chinese Tallow Tree)
Schefflera actinophylla (Qld Umbrella Tree)	*Spathodea campanulata* (African Tulip Tree)	*Syagrus romanzoffiana* (Cocos Palm)	*Ulmus parvifolia* (Chinese Elm)

4.9 SIGNIFICANCE IN THE ENVIRONMENT.

Trees are subject to the following legislation:

- Biodiversity Conservation Act NSW (BIO Act 2016): Provides provisions for conserving biodiversity.
- The State environmental Planning Policy 'Biodiversity and Conservation' 2021
- Threatened Species Conservation Act NSW (1995 TCS Act): Provides provisions for conserving threatened species, populations and ecological communities of animals and plants as well as managing key threatening processes.
- 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.
- NSW Bushfire Brigade 10/50 Legislation is not enforced for this site.

4.10 VTA

The VTA system is based on the theory of tree biology, physiology and tree architecture and structure. This method is used by Arborists to identify visible signs on trees that indicate good health or potential problems. Symptoms of decay, growth patterns and defects are identified and assessed as to their potential to cause whole tree, part tree or branch failure, this system is based around methods discussed by Claus Mattheck in `The Body Language of Trees' (1994). For the purpose of this report, parts of the VTA system will be used along with other industry standard literature and other relevant studies that provide an insight into potential hazards in trees. This assessment is a snapshot of what could be reasonably seen or determined from a basic visual inspection. The VTA system is generally used as a means to identify hazardous trees, it is important to realize that for a tree to be hazardous there must be a target.

4.11 AUSTRALIAN STANDARD AS4970-2009

- The Australian Standard AS4970–2009 Protection of trees on development sites has been used as a benchmark in the preparation of this report and the terminology and impact assessment methodology have been adopted from this document. This AIA complies with 2.3.5 Arboricultural Impact Assessment of AS4970-2009.

- Recommendations have been based on tree Retention Value, Vigour, Condition and ULE. Trees with a high Retention Value should be given greater priority for retention than trees with Medium Retention Value. Trees with Long (40 years +) ULE should be given greater priority for retention than trees with Short (5-15 years) ULE

- **ULE –** Useful Life Expectancy. The length of time from the date of inspection that the Arborist estimates the tree will live and provide a useful positive contribution to the landscape amenity of the site. ULE ratings are Long (retainable for 40 years or more), Medium (retainable for 16-39 years), Short (retainable for 5-15 years) and Removal (tree requiring immediate removal due to imminent risk or absolute unsuitability).

- **VIGOUR –** Good (G), Fair (F) or Poor (P). The general appearance of the canopy/foliage of the tree at the time of inspection. Vigour can vary with the season and rainfall frequency. A tree can have Good vigour but be hazardous due to Poor condition. A tree in Good vigour has the ability to sustain its life processes. Vigour is synonymous with health.

- **CONDITION –** Good (G), Fair (F) or Poor (P). The general form and structure of the trunk/s and branching. Trunk lean, trunk/branch structural defects, canopy skewness or other hazard features are considered.

- Tree Protection Zones (TPZ) and Structural Root Zones (SRZ) are as per Section 3 of AS4970-2009 and are defined in the rear of this report. It should be noted that the TPZs and SRZs indicated on the site drawings are notional areas only and do not reflect actual root locations.

- **SRZ RADIUS –** Structural Root Zone. The area around a tree required for tree stability. Earthworks should be prohibited within the SRZ. The area is calculated from the formula and graph at Figure 1 ofAS4970-2009. The SRZ graph has been adapted from the work of Claus Mattheck (1994). DBH + 10% has been used for the calculation of SRZ. Where DBH is measured at grade or at a height other than 1.4m above grade, 10% has not been added.

- **TPZ RADIUS –** Tree Protection Zone. Radial offset (m) of twelve times (12x) trunk DBH measured from centre of trunk (for trees less than 0.3 metre DBH minimum TPZ is 2.0 metres). To satisfactorily retain the tree, construction activity (both soil cut and fill) must be restricted within this offset. TPZ offsets are rounded to the nearest 0.1 metre. Existing constraints to root spread can vary. Generally, an area equivalent to the TPZ should be available to the tree post development. Encroachment occupying up to 10% of the TPZ area is acceptable without detailed rootzone assessment. Encroachments greater than 10% require specific arboricultural assessment.

- “Construction” for the purpose of this AIA means excavation (greater than 100mm), compacted fill or machine trenching. “Excavation” includes cut batters, boxing–out for the various pavement types, trenching for utilities and footings for retaining walls.

- Trees within proposed construction footprints are recommended for removal (Rm).

- 3.4.6 Where construction is proposed within Structural Root Zone (SRZ) offsets, those trees have been similarly recommended for removal (Rm). Fully elevated, pier and beam type construction or hand dug services trenches (or horizontal boring) is recommended and an accepted form of construction methodology for this type of structure.

- Trees with greater than 25% of the Tree Protection Zone (TPZ) impacted by construction are generally recommended for removal (Rm). There are however different types of construction incursions proposed (e.g. fill, cut, services, pavement type, retaining walls) with varying tree impacts likely. Existing constraints to root development also vary the notional TPZ. Compacted fill can be equally as damaging to tree longevity: root development is restricted within heavily compacted soils.

- Trees to be retained with construction impacting less than 25% of the TPZ area were rated as. Specific construction monitoring will be required for these trees (refer to Recommendations).

- TPZ encroachments of >10% are defined (3.3.3 of AS4970) as 'major'. This does not mean that the tree will be fatally injured, but that 'the project arborist must demonstrate that the tree(s) would remain viable'.

- Where construction is proposed beyond the TPZ, those trees are rated as Retain (R) with no specific tree protection design or tree protection monitoring required.

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5 FINDINGS

5.1 SITE CONTROL MAPS

According to the NSW Planning Portal, the site is listed as R3 Medium Density Residential. Please see Figure 1

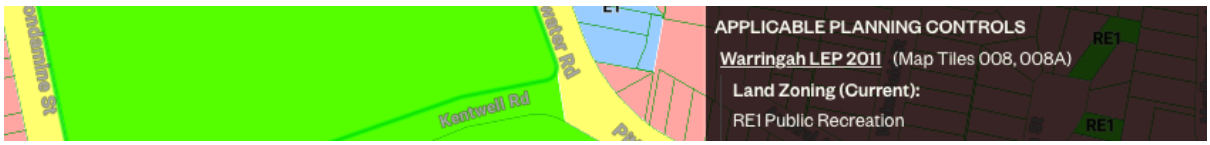


Figure 1

The following relevant Government environmental and heritage mapping overlays have been reviewed (SEED – NSW Government 2020).

- According to the NSW Planning Portal, the site is listed as RE1 Public Recreation.
- The site does not contain, nor does it form part of a heritage item.
- The site is not listed on the Warringah terrestrial biodiversity map. Please see Figure 2.

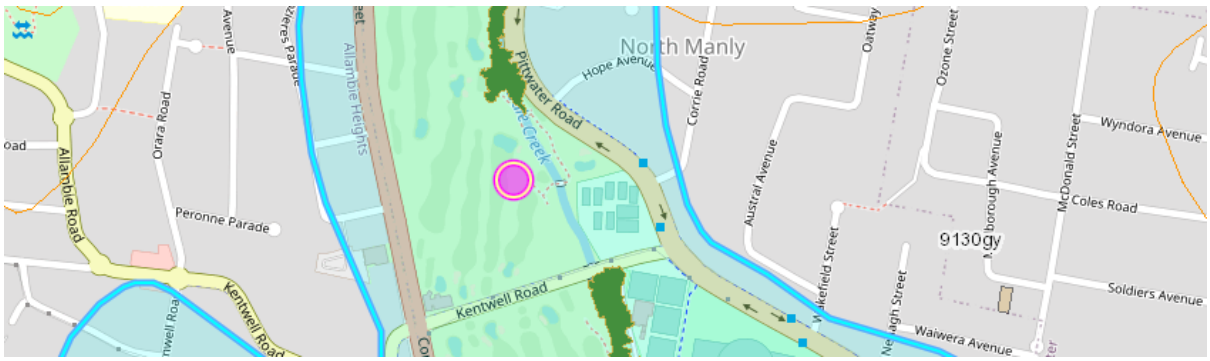
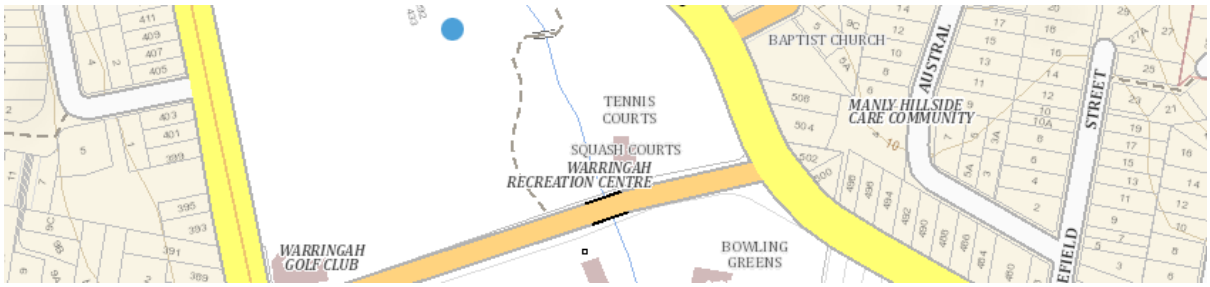


Figure 2

The site is not located on the NSW State Terrestrial Biodiversity Values map. Please see Figure 3.



5.2 THE SITE

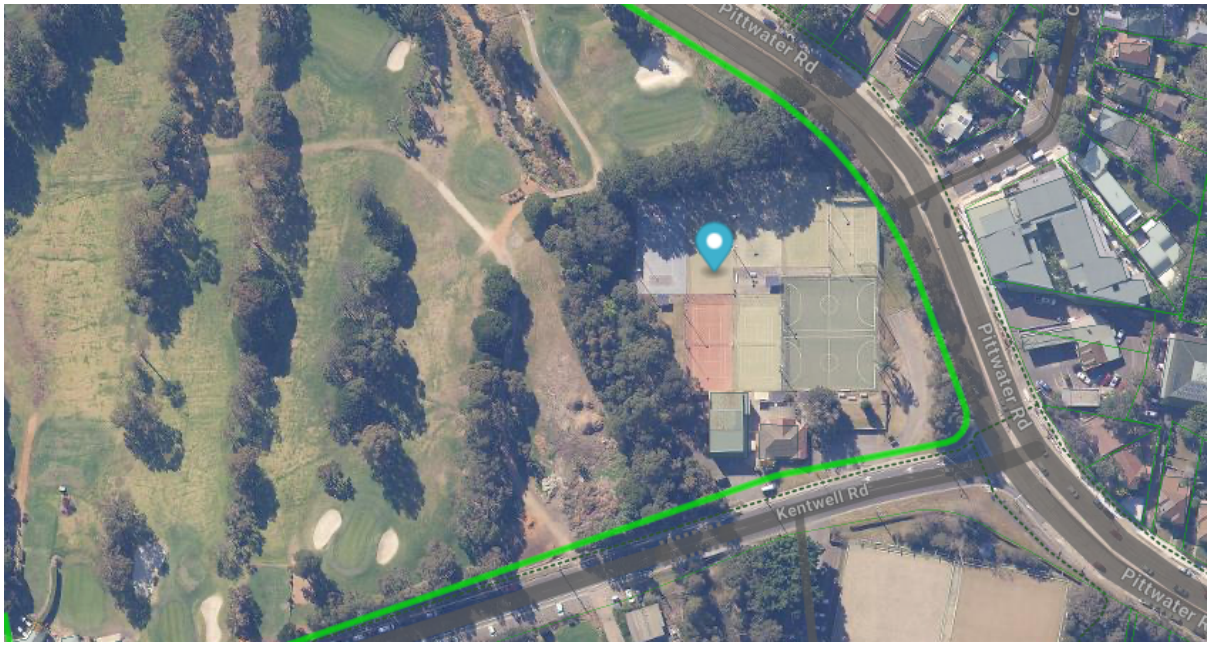


Figure 3

By Site Survey the subject site is best described as being within lands bordered by Kentwell Road, Pittwater Road & the Warringah Golf Club. Trees discussed are located within the subject site, adjacent to the subject site & within the Pittwater Road reserve. Documents provided describe the subject site as the Warringah Recreation Centre.

The site currently contains two stand alone buildings, a series of tennis courts and Astro turf soccer courts with a bitumen carpark at the south eastern corner of the site. Due to the nature of the site, past development means that the project area is flat. A sandstone retaining wall separates the site from the road on the western boundary.

Site soils are likely to deviate from their natural state due to past urban development, however, site soils are classified as 9130wa (Warriewood) swamp soil characterised as:

Landscape – level to gently undulating swales, depressions and infilled lagoons on Quaternary sands. Local relief <10 m, slopes <3%. Watertable at <2 m. Mostly cleared of native vegetation.

Soils – deep (>150 cm), well sorted, sandy Humus Podzols (Uc2.32) and dark, mottled Siliceous Sands (Uc1.21), overlying buried Acid Peats (O) in depressions; deep (>200 cm) Podzols (Uc2.12, Uc2.32) and pale Siliceous Sands (Uc1.2) on sandy rises.

Limitations – localised flooding and run-on, high watertables, highly permeable soil.

Vegetation is characterised as extensively cleared, sclerophyll scrub and woodland. Remaining native tree species include broad- leaved paperbark *Melaleuca quinquenervia*, coastal banksia *Banksia integrifolia*, swamp oak *Casuarina glauca* and swamp mahogany *Eucalyptus robusta*. Remaining scrub and understorey species include coastal teatree *Leptospermum laevigatum,* spike rushes *Eleocharis spp*., and tall swamp sedge *Gahnia sieberiana.*

Areas to the north and south of the subject site contain areas of the Threatened Ecological Community, Swamp oak Floodplain of the NSW North Coast, Sydney Basin & South east Corner Bioregion, which runs along the banks of Brookvale Creek.

The Narla Environmental 'Flora & Fauna Constraints Assessment Report', dated February 2021, commissioned by the Northern Beaches Council states that "The vegetation within the Subject Site (adjacent Brookvale Creek) conforms to the BC Act (NSW) listed EEC Swamp oak Floodplain of the NSW North Coast, Sydney Basin & South east Corner Bioregions". The Narla document also acknowledges other Acts that may apply to portions of the total Subject Site. Tree species discussed within this document are confirmed to be members of the naturally occurring (original) communities.

5.3 SWAMP OAK FLOODPLAIN OF THE NSW NORTH COAST, SYDNEY BASIN & SOUTH EAST CORNER BIOREGION

The Coastal Swamp Oak Forest ecological community is characterised by the dominance of *Casuarina glauca* in the canopy, with an understorey of rushes, sedges, forbs and grasses. Coastal Swamp Oak Forest is typically found on loose or alluvial soil on coastal flats, floodplains, drainage lines, lake margins, wetlands and estuarine fringes where soils are at least occasionally saturated, water-logged or inundated. Sometimes the ecological community can intergrade with mangroves or saltmarsh communities (on the seaward side), or with *Melaleuca* species and eucalypts (more landward).

Remnant patches of Coastal Swamp Oak Forest that retain mature trees and/or with diverse and good native understorey, particularly those that are closely connected with another area of native vegetation have very high conservation value. Like other coastal ecosystems, the ecological community provides an important protective role, by buffering the land from the impacts of seawater incursions and storms.

This community is found on the coastal floodplains of NSW. It has a dense to sparse tree layer in which *Casuarina glauca* (swamp oak) is the dominant species northwards from Bermagui.

Other trees including *Acmena smithii* (lilly pilly), *Glochidion* spp. (cheese trees) and *Melaleuca* spp. (paperbarks) may be present as subordinate species, and are found most frequently in stands of the community northwards from Gosford. Tree diversity decreases with latitude, and *Melaleuca ericifolia* is the only abundant tree in this community south of Bermagui.

The understorey is characterised by frequent occurrences of vines, *Parsonsia straminea, Geitonoplesium cymosum* and *Stephania japonica* var. *discolor*, a sparse cover of shrubs, and a continuous groundcover of forbs, sedges, grasses and leaf litter.

The composition of the ground stratum varies depending on levels of salinity in the groundwater. Under less saline conditions prominent ground layer plants include forbs such *Centella asiatica, Commelina cyanea, Persicaria decipiens*and *Viola banksii*; graminoids such as *Carex appressa, Gahnia clarkei, Lomandra longifolia, Oplismenus imbecillis*; and the fern *Hypolepis muelleri*.

On the fringes of coastal estuaries, where soils are more saline, the ground layer may include the threatened grass species, *Alexfloydia repens*, as well as *Baumea juncea, Juncus kraussii, Phragmites australis, Selliera radicans* and other saltmarsh species.

5.4 SUMMARY OF PROPOSED DEVELOPMENT

The proposed development includes the demolition of existing structures and the installation of a new double storey building at the northern end of the subject site as well as extensive realignment of the existing stormwater and wetland area.

5.5 SUMMARY OF SITE INSPECTION DATA

Generally, the sites vegetation was observed to have a mixture of exotic and endemic tree canopy. The existing surveyed trees are shown in Appendix 1.

Other vegetation on site does not meet the dimensions for Northern Beaches Council to consider them as trees, trees as defined on Northern Beaches Council website as being over 5 metres in height.

5.6 CURRENT TREE POPULATION

A total of 114 trees were assessed in total. Table 4 summarises the origins of the surveyed tree species:

Table 4

Species Origin	Number of Trees
Endemic	89
Native	13
Exotic	10
Noxious Weed	2
Total	114

Table 5 documents the species on site, the amount of each species and the origin of said species.

Table 5

Tree Species	Species Origin	Tree Numbers	Total
Casuarina glauca (Swamp-Oak)	Endemic	T1, T2, T3, T4, T5, T6, T7, T8, T9, T10, T11, T12, T13, T14, T15, T16, T17, T18, T19, T20, T21, T22, T23, T24, T25, T26, T27, T28, T29, T30, T31, T32, T33, T54, T55, T56, T57, T58, T59, T72, T73, T74, T75, T76, T77, T78, T79, T80, T81, T82, T83, T84, T85, T86, T87, T88, T89, T90, T91, T92, T93, T94, T95, T96, T97, T98, T99, T100, T101, T112	**70**
Harpophyllum caffrum (Kaffir Plum)	Exotic	T34, T36, T37, T41	**4**
Cupressus species (Conifer)	Exotic	T35, T40, T66, T67	**4**
Cinnamomum camphora (Camphor Laurel)	Noxious Weed	T38	**1**
Glochidion ferdinandi (Cheese Tree)	Endemic	T39, T106, T107, T108, T111	**5**
Eucalyptus robusta (Swamp Mahogany)	Endemic	T42, T43, T44, T47, T48, T49	**6**

Tree Species	Species Origin	Tree Numbers	Total
Syagrus romanzoffiana (Cocos Palm)	Exotic	T45, T114	**2**
Angophora costata (Sydney Red Gum)	Native	T46, T52, T53	**3**
Pittosporum undulatum (Sweet Pittosporum)	Native	T50	**1**
Melaleuca linarifolia (Snow in Summer)	Native	T51	**1**
Callistemon viminalis (Weeping Bottlebrush)	Native	T60, T61, T70, T71	**4**
Magnolia grandiflora (White magnolia)	Exotic	T62	**1**
Melaleuca quinquenervia (Broad-Leafed Paperbark)	Endemic	T63, T102, T103, T104, T105, T109, T110, T113	**8**
Syzygium paniculatum (Magenta Lilly Pilly)	Native	T64, T65	**2**
Archontophoenix spp. (Alex/Bagalow Palm)	Native	T68	**1**
Ficus benjimina (Weeping Fig)	Native	T69	**1**

5.7 U.L.E

Useful Life Expectancy (Barrell, 2009). The length of time from the date of inspection that the Arborist estimates the tree will live and provide a useful positive contribution to the landscape amenity of the site. ULE ratings are Long (retainable for 40 years or more), Medium (retainable for 16-39 years), Short (retainable for 5-15 years) and Removal (tree requiring immediate removal due to imminent risk or absolute unsuitability).

Table 6

U.L.E	Number of Trees	Tree Numbers
40 Plus	64	T2, T3, T9, T10, T13, T18, T20, T25, T28, T32, T33, T35, T37, T38, T42, T45, T48, T49, T52, T58, T59, T60, T62, T63, T65, T68, T72, T73, T74, T75, T76, T77, T78, T79, T80, T81, T82, T83, T84, T85, T86, T87, T88, T89, T90, T91, T92, T93, T94, T95, T96, T97, T98, T99, T100, T101, T103, T104, T105, T109, T110, T111, T113, T114
15-40yrs	40	T1, T4, T7, T8, T11, T14, T17, T19, T22, T23, T24, T26, T27, T29, T31, T34, T36, T39, T40, T41, T43, T44, T47, T50, T51, T53, T54, T55, T56, T57, T61, T66, T67, T70, T71, T102, T106, T107, T108, T112
5-15yrs	7	T5, T12, T15, T21, T30, T64, T69
1-5yrs	2	T16, T46
Remove Hazardous	0	
Dead	1	T6
Total		**114**

5.8 LANDSCAPE SIGNIFICANCE

Landscape significance was deemed using IACA Significance of a Tree, Assessment Rating System (STARS). Results are published in the table below.

Table 7

Landscape Significance	Number of Trees	Tree Numbers
High	72	T2, T3, T4, T5, T7, T8, T9, T10, T11, T12, T13, T18, T19, T20, T23, T24, T25, T26, T28, T29, T31, T32, T33, T42, T43, T48, T49, T54, T55, T56, T57, T58, T59, T63, T65, T72, T73, T74, T75, T76, T77, T78, T79, T80, T81, T82, T83, T84, T85, T86, T87, T88, T89, T90, T91, T92, T93, T94, T95, T96, T97, T98, T99, T100, T101, T102, T103, T104, T105, T109, T110, T113
Medium	20	T14, T17, T22, T27, T39, T44, T47, T51, T52, T53, T60, T61, T64, T68, T70, T71, T106, T107, T108, T111
Low	8	T1, T15, T16, T21, T30, T46, T62, T112
Exempt	12	T6, T34, T35, T36, T37, T40, T41, T50, T66, T67, T69, T114
Environmental Weed	2	T38, T45
Total		**114**

IACA 2010, *IACA Significance of a Tree, Assessment Rating System (STARS)*, Institute of Australian Consulting Arborculturists, Australia, www.iaca.org.au Appendix 2.

5.9 RETENTION VALUES

Retention values were recorded using IACA Significance of a Tree, Assessment Rating System (STARS). Results are published in the table below.

Table 8

Retention Value	Number of Trees	Tree Numbers
Very High	0	
High	71	T2, T3, T4, T7, T8, T9, T10, T11, T12, T13, T18, T19, T20, T23, T24, T25, T26, T28, T29, T31, T32, T33, T42, T43, T48, T49, T54, T55, T56, T57, T58, T59, T63, T65, T72, T73, T74, T75, T76, T77, T78, T79, T80, T81, T82, T83, T84, T85, T86, T87, T88, T89, T90, T91, T92, T93, T94, T95, T96, T97, T98, T99, T100, T101, T102, T103, T104, T105, T109, T110, T113
Medium	22	T1, T14, T17, T22, T27, T39, T44, T47, T51, T52, T53, T60, T61, T62, T68, T70, T71, T106, T107, T108, T111, T112
Low	7	T5, T15, T16, T21, T30, T46, T64
Exempt	14	T6, T34, T35, T36, T37, T38, T40, T41, T45, T50, T66, T67, T69, T114
Total		**114**

IACA 2010, *IACA Significance of a Tree, Assessment Rating System (STARS)*, Institute of Australian Consulting Arborculturists, Australia, www.iaca.org.au Appendix 2.

6 PROPOSED DEVELOPMENT IMPACT

Tree Protection Zones (TPZ's) and Structural Root Zones (SRZ's) are defined as per Section 3 of Australian Standard AS4970-2009 Protection of Trees on Development Sites. It should be noted that TPZ's and SRZ's are notional areas only and do not reflect actual root locations. All TPZ's and SRZ's are marked on plans located at the rear of this document. At this time no exploratory root investigation has been undertaken, it may be recommended based on the findings within this report.

6.1 TREES UNNAFFECTED BY PROPOSED DEVELOPMENT

Table 9

Tree ID	Tree Species	TPZ Radius (M)	Retention Value (STARS)	Observations and Defects	Notes	Generic Tree Protection Measures
T43	Eucalyptus robusta (Swamp Mahogany)	11	High	Deadwood Moderate (30-100mm) , Dieback (isolated) , Previous Failures (isolated)		TPZ Fencing
T44	Eucalyptus robusta (Swamp Mahogany)	2.2	Medium	Deadwood Minor (0-30mm)		TPZ Fencing
T45	Syagrus romanzoffiana (Cocos Palm)	2.6	Exempt			TPZ Fencing
T46	Angophora costata (Sydney Red Gum)	2.6	Low	Deadwood Moderate (30-100mm) , Dieback (major)		TPZ Fencing
T47	Eucalyptus robusta (Swamp Mahogany)	2.0	Medium	Suppressed		TPZ Fencing
T49	Eucalyptus robusta (Swamp Mahogany)	3.7	High	Deadwood Moderate (30-100mm) , Dieback (isolated) , Epicormic Shoots (minor) , Included Bark (branches)		TPZ Fencing
T50	Pittosporum undulatum (Sweet Pittosporum)	2.2	Exempt	Co-Dominant Stems		TPZ Fencing
T51	Melaleuca linarifolia (Snow in Summer)	2.6	Medium	Co-Dominant Stems (included bark)		TPZ Fencing
T52	Angophora costata (Sydney Red Gum)	4.3	Medium	Co-Dominant Stems , Deadwood Minor (0-30mm)		TPZ Fencing
T53	Angophora costata (Sydney Red Gum)	2.3	Medium	Deadwood Minor (0-30mm)		TPZ Fencing

Tree ID	Tree Species	TPZ Radius (M)	Retention Value (STARS)	Observations and Defects	Notes	Generic Tree Protection Measures
T54	Casuarina glauca (Swamp-Oak)	2.8	High	Deadwood Minor (0-30mm) , Included Bark (branches) , Weak Branch Attachments (isolated)		TPZ Fencing
T55	Casuarina glauca (Swamp-Oak)	2.0	High	Co-Dominant Stems (included bark) , Suppressed		TPZ Fencing
T56	Casuarina glauca (Swamp-Oak)	5.5	High	Co-Dominant Stems (included bark) , Deadwood Minor (0-30mm)		TPZ Fencing
T57	Casuarina glauca (Swamp-Oak)	3.1	High	Co-Dominant Stems , Deadwood Minor (0-30mm)		TPZ Fencing
T58	Casuarina glauca (Swamp-Oak)	3.8	High	Deadwood Minor (0-30mm)		TPZ Fencing
T59	Casuarina glauca (Swamp-Oak)	3.7	High	Co-Dominant Stems , Deadwood Minor (0-30mm) , Suppressed		TPZ Fencing
T70	Callistemon viminalis (Weeping Bottlebrush)	4.3	Medium	Co-Dominant Stems (included bark) , Included Bark (natural for species)		TPZ Fencing
T71	Callistemon viminalis (Weeping Bottlebrush)	5.3	Medium	Poor Pruning (powerlines)		TPZ Fencing
T72	Casuarina glauca (Swamp-Oak)	4.1	High		Stand of trees with integrated root system, roots noted growing through existing bitumen	TPZ Fencing
T73	Casuarina glauca (Swamp-Oak)	3.4	High		Stand of trees with integrated root system, roots noted growing through existing bitumen	TPZ Fencing
T74	Casuarina glauca (Swamp-Oak)	2.4	High		Stand of trees with integrated root system, roots noted growing through existing bitumen	TPZ Fencing
T75	Casuarina glauca (Swamp-Oak)	3.0	High		Stand of trees with integrated root system, roots noted growing through existing bitumen	TPZ Fencing
T76	Casuarina glauca (Swamp-Oak)	3.0	High		Stand of trees with integrated root system, roots noted growing through existing bitumen	TPZ Fencing

Tree ID	Tree Species	TPZ Radius (M)	Retention Value (STARS)	Observations and Defects	Notes	Generic Tree Protection Measures
T77	Casuarina glauca (Swamp-Oak)	4.3	High		Stand of trees with integrated root system, roots noted growing through existing bitumen	TPZ Fencing
T78	Casuarina glauca (Swamp-Oak)	2.4	High		Stand of trees with integrated root system, roots noted growing through existing bitumen	TPZ Fencing
T79	Casuarina glauca (Swamp-Oak)	3.8	High		Stand of trees with integrated root system, roots noted growing through existing bitumen	TPZ Fencing
T80	Casuarina glauca (Swamp-Oak)	3.6	High		Stand of trees with integrated root system, roots noted growing through existing bitumen	TPZ Fencing
T81	Casuarina glauca (Swamp-Oak)	3.0	High		Stand of trees with integrated root system, roots noted growing through existing bitumen	TPZ Fencing
T82	Casuarina glauca (Swamp-Oak)	3.0	High		Stand of trees with integrated root system, roots noted growing through existing bitumen	TPZ Fencing
T83	Casuarina glauca (Swamp-Oak)	3.0	High		Stand of trees with integrated root system, roots noted growing through existing bitumen	TPZ Fencing
T84	Casuarina glauca (Swamp-Oak)	3.0	High		Stand of trees with integrated root system, roots noted growing through existing bitumen	TPZ Fencing
T85	Casuarina glauca (Swamp-Oak)	3.0	High		Stand of trees with integrated root system, roots noted growing through existing bitumen	TPZ Fencing
T86	Casuarina glauca (Swamp-Oak)	3.0	High		Stand of trees with integrated root system, roots noted growing through existing bitumen	TPZ Fencing
T87	Casuarina glauca (Swamp-Oak)	5.6	High		Stand of trees with integrated root system, roots noted growing through existing bitumen	TPZ Fencing

Tree ID	Tree Species	TPZ Radius (M)	Retention Value (STARS)	Observations and Defects	Notes	Generic Tree Protection Measures
T88	Casuarina glauca (Swamp-Oak)	4.1	High		Stand of trees with integrated root system, roots noted growing through existing bitumen	TPZ Fencing
T89	Casuarina glauca (Swamp-Oak)	3.0	High		Stand of trees with integrated root system, roots noted growing through existing bitumen	TPZ Fencing
T90	Casuarina glauca (Swamp-Oak)	3.0	High		Stand of trees with integrated root system, roots noted growing through existing bitumen	TPZ Fencing
T91	Casuarina glauca (Swamp-Oak)	3.4	High		Stand of trees with integrated root system, roots noted growing through existing bitumen	TPZ Fencing
T92	Casuarina glauca (Swamp-Oak)	4.3	High		Stand of trees with integrated root system, roots noted growing through existing bitumen	TPZ Fencing
T93	Casuarina glauca (Swamp-Oak)	3.0	High		Stand of trees with integrated root system, roots noted growing through existing bitumen	TPZ Fencing
T94	Casuarina glauca (Swamp-Oak)	3.0	High		Stand of trees with integrated root system, roots noted growing through existing bitumen	TPZ Fencing
T95	Casuarina glauca (Swamp-Oak)	3.8	High		Stand of trees with integrated root system, roots noted growing through existing bitumen	TPZ Fencing
T96	Casuarina glauca (Swamp-Oak)	4.9	High		Stand of trees with integrated root system, roots noted growing through existing bitumen	TPZ Fencing
T98	Casuarina glauca (Swamp-Oak)	3.0	High		Stand of trees with integrated root system, roots noted growing through existing bitumen	TPZ Fencing
T99	Casuarina glauca (Swamp-Oak)	3.5	High		Stand of trees with integrated root system, roots noted growing through existing bitumen	TPZ Fencing

Tree ID	Tree Species	TPZ Radius (M)	Retention Value (STARS)	Observations and Defects	Notes	Generic Tree Protection Measures
T100	Casuarina glauca (Swamp-Oak)	3.6	High		Stand of trees with integrated root system, roots noted growing through existing bitumen	TPZ Fencing
T106	Glochidion ferdinandi (Cheese Tree)	4.1	Medium	Co-Dominant Stems	Root spread likely constrained due to sandstone retaining wall	TPZ Fencing
T107	Glochidion ferdinandi (Cheese Tree)	5.5	Medium	Co-Dominant Stems (included bark)	Root spread likely constrained due to sandstone retaining wall	TPZ Fencing
T108	Glochidion ferdinandi (Cheese Tree)	4.1	Medium	Co-Dominant Stems (included bark) , Deadwood Minor (0-30mm)	Root spread likely constrained due to sandstone retaining wall	TPZ Fencing
T110	Melaleuca quinquenervia (Broad-Leafed Paperbark)	8.0	High	Co-Dominant Stems (included bark) , Crossing Rubbing Branches , Deadwood Minor (0-30mm) , Included Bark (natural for species)	Root spread likely constrained due to sandstone retaining wall	TPZ Fencing
T111	Glochidion ferdinandi (Cheese Tree)	4.8	Medium	Co-Dominant Stems		TPZ Fencing
T112	Casuarina glauca (Swamp-Oak)	2.0	Medium	Co-Dominant Stems (included bark)		TPZ Fencing

6.2 TREES WITH MINOR INCURSIONS

When the extent of TPZ incursion is deemed minor as per AS4970 Protection of Trees on Development Sites i.e., less than 10%, excavation may be undertaken using traditional methods. Excavation for Benching and Shoring must be considered.

Table 10

Tree ID	Tree Species	TPZ Radius (M)	Retention Value (STARS)	Observations and Defects	Notes	TPZ Enc. %	Encroachment Type	Generic Tree Protection Measures
T48	Eucalyptus robusta	4.3	High	Co-Dominant Stems , Deadwood Minor (0-30mm) , Dieback (isolated) , Over Extended Limbs (isolated)		1.25%	TPZ extends on to the subject site, encroachment marginal	TPZ Fencing

Tree ID	Tree Species	TPZ Radius (M)	Retention Value (STARS)	Observations and Defects	Notes	TPZ Enc. %	Encroachment Type	Generic Tree Protection Measures
	(Swamp Mahogany)							
T60	Callistemon viminalis (Weeping Bottlebrush)	4.8	Medium	Co-Dominant Stems (included bark) , Included Bark (natural for species)		8.47%	TPZ extend onto subject site, minor encroachment	TPZ Fencing
T61	Callistemon viminalis (Weeping Bottlebrush)	4.6	Medium	Co-Dominant Stems (included bark) , Dieback (minor) , Included Bark (natural for species)		6.52%	TPZ extend onto subject site, minor encroachment	TPZ Fencing
T97	Casuarina glauca (Swamp-Oak)	5.5	High		Stand of trees with integrated root system, roots noted growing through existing bitumen	3.45%	New carpark	TPZ Fencing
T101	Casuarina glauca (Swamp-Oak)	7.2	High		Stand of trees with integrated root system, roots noted growing through existing bitumen	5.88%	New carpark	TPZ Fencing
T103	Melaleuca quinquenervia (Broad-Leafed Paperbark)	10.6	High	Co-Dominant Stems (included bark) , Crossing Rubbing Branches , Deadwood Minor (0-30mm) , Dieback (isolated) , Included Bark (natural for species) , Wounds (minor)		7.88%	New carpark	TPZ Fencing
T104	Melaleuca quinquenervia (Broad-Leafed Paperbark)	10.7	High	Co-Dominant Stems (included bark) , Crossing Rubbing Branches , Deadwood Minor (0-30mm) , Dieback (isolated) , Included Bark (natural for species) , Root Scalping , Wounds (minor)		6.95%	New carpark	TPZ Fencing

6.3 TREES WITH MAJOR INCURSIONS

Table 11

Tree ID	Tree Species	TPZ Radius (M)	Retention Value (STARS)	Observations and Defects	Notes	TPZ Encroachment %	Encroachment Type	Retain/ Remove	Generic Tree Protection Measures	Specific Tree Protection Measures
T102	Melaleuca quinquenervia (Broad-Leafed Paperbark)	11.9	High	Cavity (minor) , Co-Dominant Stems (included bark) , Deadwood Minor (0-30mm) , Decay , Dieback (isolated) , Included Bark (natural for species)	Tree species renowned for having expansive root system, root concentration maybe higher in the carpark due to the curbstone on the Pittwater Rd. side of the tree	12.72%	New carpark	Retain	TPZ Fencing	Employ tree sensitive construction for the carpark i.e. build at grade with no excavation (see section 7.2.2), or project arborist supervision to ensure all roots are cut cleanly and employ remediation plan for remainder of TPZ to encourage replacement root growth. Section 7.4. Any excavation should be limited to the car park area only, natural ground should be retained at the eastern side of the car park between the proposed parking area and Pittwater Rd.
T105	Melaleuca quinquenervia (Broad-Leafed Paperbark)	12.0	High	Co-Dominant Stems (included bark) , Crossing Rubbing Branches , Deadwood Minor (0-30mm) , Dieback (isolated) , Included Bark (natural for species) , Over Extended Limbs (isolated) , Root Scalping , Weak Branch Attachments (isolated) , Wounds (minor)		10.57%	New carpark	Retain	TPZ Fencing	Employ tree sensitive construction for the carpark i.e. build at grade with no excavation (see section 7.2.2), or project arborist supervision to ensure all roots are cut cleanly and employ remediation plan for remainder of TPZ to encourage replacement root growth. Section 7.4. Any excavation should be limited to the car park area only, natural ground should be retained at the eastern side of the car park between the proposed parking area and Pittwater Rd.
T109	Melaleuca quinquenervia (Broad-Leafed Paperbark)	14.8	High	Co-Dominant Stems (included bark) , Deadwood Moderate (30-100mm) , Dieback (isolated) , Included Bark (natural for species)	Root spread likely constrained due to sandstone retaining wall	21.15%	New carpark and access road	Retain	TPZ Fencing	Tree is located on Pittwater Rd. which is separated from the subject site via a sandstone retaining wall. No foreseen impact.
T113	Melaleuca quinquenervia (Broad-Leafed Paperbark)	10.7	High	Co-Dominant Stems (included bark) , Deadwood Moderate (30-100mm) , Dieback (isolated) , Included Bark	Root spread likely constrained due to sandstone retaining wall	20.93%	Realligned stormwater and wetland area	Retain	TPZ Fencing	Tree is located on Pittwater Rd. which is separated from the subject site via a sandstone retaining wall. No foreseen impact.

Tree ID	Tree Species	TPZ Radius (M)	Retention Value (STARS)	Observations and Defects	Notes	TPZ Encroachment %	Encroachment Type	Retain/ Remove	Generic Tree Protection Measures	Specific Tree Protection Measures
				(natural for species) , Over Extended Limbs (isolated)						

6.4 TREES TO BE REMOVED

Table 12

Tree ID	Tree Species	Retention Value (STARS)	Observations and Defects	Notes	Encroachment Type
T1	Casuarina glauca (Swamp-Oak)	Medium	Cavity (minor) , Co-Dominant Stems , Deadwood Moderate (30-100mm) , Decay , Weak Branch Attachments (isolated) , Wounds (moderate)		Realigned stormwater and wetland area
T2	Casuarina glauca (Swamp-Oak)	High	Co-Dominant Stems , Deadwood Moderate (30-100mm) , Included Bark (natural for species) , Included Union (insignificant)		Realigned stormwater and wetland area
T3	Casuarina glauca (Swamp-Oak)	High	Co-Dominant Stems , Co-Dominant Stems (included bark) , Crossing Rubbing Branches , Deadwood Moderate (30-100mm)		Realigned stormwater and wetland area
T4	Casuarina glauca (Swamp-Oak)	High	Co-Dominant Stems , Crossing Rubbing Branches , Deadwood Moderate (30-100mm) , Dieback (isolated)		Realigned stormwater and wetland area
T5	Casuarina glauca (Swamp-Oak)	Low	Co-Dominant Stems (included bark) , Crown Density (40-60%) , Deadwood Moderate (30-100mm) , Dieback (moderate) , Included Bark (branches) , Included Union (poor) , Weak Branch Attachments (isolated)		Realigned stormwater and wetland area
T6	Casuarina glauca (Swamp-Oak)	Exempt	Dead tree		Realigned stormwater and wetland area

Tree ID	Tree Species	Retention Value (STARS)	Observations and Defects	Notes	Encroachment Type
T7	Casuarina glauca (Swamp-Oak)	High	Crown Density (60-80%) , Deadwood Moderate (30-100mm)		Realigned stormwater and wetland area
T8	Casuarina glauca (Swamp-Oak)	High	Co-Dominant Stems , Crown Density (60-80%) , Deadwood Moderate (30-100mm) , Dieback (isolated)		Realigned stormwater and wetland area
T9	Casuarina glauca (Swamp-Oak)	High	Co-Dominant Stems (included bark) , Crossing Rubbing Branches , Deadwood Moderate (30-100mm) , Dieback (isolated) , Included Bark (branches) , Over Extended Limbs (isolated) , Previous Failures (isolated)		Realigned stormwater and wetland area
T10	Casuarina glauca (Swamp-Oak)	High	Co-Dominant Stems (included bark) , Deadwood Moderate (30-100mm) , Included Bark (branches) , Included Union (insignificant) , Over Extended Limbs (isolated) , Phototropism (moderate) , Wounds (minor)		Bulk Earthworks for new clubhouse
T11	Casuarina glauca (Swamp-Oak)	High	Crown Density (60-80%) , Deadwood Moderate (30-100mm)		Bulk Earthworks for new clubhouse
T12	Casuarina glauca (Swamp-Oak)	High	Co-Dominant Stems (included bark) , Crown Density (60-80%) , Deadwood Minor (0-30mm) , Suppressed		Bulk Earthworks for new clubhouse
T13	Casuarina glauca (Swamp-Oak)	High	Co-Dominant Stems (included bark) , Crown Density (60-80%) , Deadwood Moderate (30-100mm) , Dieback (isolated) , Included Union (moderate) , Mechanical Damage , Over Extended Limbs (isolated)		Bulk Earthworks for new clubhouse
T14	Casuarina glauca (Swamp-Oak)	Medium	Crown Density (40-60%) , Deadwood Moderate (30-100mm) , Dieback (isolated) , Suppressed		Bulk Earthworks for new clubhouse
T15	Casuarina glauca (Swamp-Oak)	Low	Co-Dominant Stems (included bark) , Crown Density (60-80%) , Dieback (moderate) , Included Union (moderate) , Suppressed		Bulk Earthworks for new clubhouse
T16	Casuarina glauca (Swamp-Oak)	Low	Co-Dominant Stems (included bark) , Crown Density (40-60%) , Deadwood Major (>100mm) ,		Bulk Earthworks for new clubhouse

Tree ID	Tree Species	Retention Value (STARS)	Observations and Defects	Notes	Encroachment Type
			Dieback (major) , Included Union (poor) , Suppressed , Weak Branch Attachments (systemic)		
T17	Casuarina glauca (Swamp-Oak)	Medium	Deadwood Moderate (30-100mm) , Suppressed		Bulk Earthworks for new clubhouse
T18	Casuarina glauca (Swamp-Oak)	High	Co-Dominant Stems (included bark) , Crossing Rubbing Branches , Deadwood Moderate (30-100mm) , Dieback (isolated)		Bulk Earthworks for new clubhouse
T19	Casuarina glauca (Swamp-Oak)	High	Co-Dominant Stems (included bark) , Crown Density (60-80%) , Deadwood Moderate (30-100mm) , Suppressed		Bulk Earthworks for new clubhouse
T20	Casuarina glauca (Swamp-Oak)	High	Co-Dominant Stems (included bark) , Deadwood Moderate (30-100mm) , Dieback (isolated) , Included Union (insignificant)		Bulk Earthworks for new clubhouse
T21	Casuarina glauca (Swamp-Oak)	Low	Co-Dominant Stems (included bark) , Crown Density (40-60%) , Deadwood Moderate (30-100mm) , Dieback (moderate) , Included Union (moderate) , Suppressed , Wounds (moderate)		Bulk Earthworks for new clubhouse
T22	Casuarina glauca (Swamp-Oak)	Medium	Co-Dominant Stems , Deadwood Moderate (30-100mm) , Suppressed		Bulk Earthworks for new clubhouse
T23	Casuarina glauca (Swamp-Oak)	High	Co-Dominant Stems (included bark) , Crown Density (40-60%) , Deadwood Moderate (30-100mm) , Dieback (isolated) , Included Union (insignificant) , Suppressed , Weak Branch Attachments (isolated)		Bulk Earthworks for new clubhouse
T24	Casuarina glauca (Swamp-Oak)	High	Co-Dominant Stems (included bark) , Deadwood Moderate (30-100mm) , Dieback (isolated) , Suppressed		Bulk Earthworks for new clubhouse
T25	Casuarina glauca (Swamp-Oak)	High	Co-Dominant Stems (included bark) , Deadwood Moderate (30-100mm) , Dieback (isolated) , Included Union (insignificant) , Mechanical Damage , Over Extended Limbs (isolated) , Wounds (minor)		Bulk Earthworks for new clubhouse

Tree ID	Tree Species	Retention Value (STARS)	Observations and Defects	Notes	Encroachment Type
T26	Casuarina glauca (Swamp-Oak)	High	Co-Dominant Stems (included bark) , Deadwood Moderate (30-100mm) , Dieback (isolated) , Suppressed , Weak Branch Attachments (isolated) , Wounds (minor)		Bulk Earthworks for new clubhouse
T27	Casuarina glauca (Swamp-Oak)	Medium	Co-Dominant Stems (included bark) , Crown Density (60-80%) , Deadwood Moderate (30-100mm) , Included Union (moderate) , Suppressed		Bulk Earthworks for new clubhouse
T28	Casuarina glauca (Swamp-Oak)	High	Co-Dominant Stems (included bark) , Crossing Rubbing Branches , Deadwood Moderate (30-100mm) , Dieback (isolated) , Included Union (insignificant) , Over Extended Limbs (isolated)		Bulk Earthworks for new clubhouse
T29	Casuarina glauca (Swamp-Oak)	High	Co-Dominant Stems (included bark) , Crossing Rubbing Branches , Deadwood Moderate (30-100mm) , Dieback (isolated) , Suppressed		Bulk Earthworks for new clubhouse
T30	Casuarina glauca (Swamp-Oak)	Low	Co-Dominant Stems (included bark) , Crown Density (60-80%) , Deadwood Minor (0-30mm) , Epicormic Shoots (moderate) , Suppressed		Bulk Earthworks for new clubhouse
T31	Casuarina glauca (Swamp-Oak)	High	Co-Dominant Stems (included bark) , Crossing Rubbing Branches , Deadwood Moderate (30-100mm) , Dieback (isolated) , Included Union (insignificant) , Over Extended Limbs (isolated) , Suppressed		Bulk Earthworks for new clubhouse
T32	Casuarina glauca (Swamp-Oak)	High	Co-Dominant Stems , Crossing Rubbing Branches , Deadwood Moderate (30-100mm) , Dieback (isolated) , Included Bark (branches) , Included Union (insignificant) , Over Extended Limbs (isolated) , Weak Branch Attachments (isolated) , Wounds (minor)		Bulk Earthworks for new clubhouse
T33	Casuarina glauca (Swamp-Oak)	High	Co-Dominant Stems , Crossing Rubbing Branches , Deadwood Minor (0-30mm) , Dieback (isolated)		Bulk Earthworks for new clubhouse
T34	Harpophyllum caffrum (Kaffir Plum)	Exempt	Co-Dominant Stems (included bark)		Bulk Earthworks for new clubhouse

Tree ID	Tree Species	Retention Value (STARS)	Observations and Defects	Notes	Encroachment Type
T35	Cupressus species (Conifer)	Exempt	Co-Dominant Stems (included bark) , Crossing Rubbing Branches , Deadwood Minor (0-30mm)		Exempt species, tree is earmarked for removal on demolition plan, presumably for upgrades to the stormwater and wetland area
T36	Harpophyllum caffrum (Kaffir Plum)	Exempt	Co-Dominant Stems		Exempt species, tree is earmarked for removal on demolition plan, presumably for upgrades to the stormwater and wetland area
T37	Harpophyllum caffrum (Kaffir Plum)	Exempt	Co-Dominant Stems (included bark) , Deadwood Minor (0-30mm) , Epicormic Shoots (minor) , Included Bark (branches) , Over Extended Limbs (isolated) , Previous Failures (isolated) , Weak Branch Attachments (isolated) , Wounds (minor)		Exempt species, tree is earmarked for removal on demolition plan, presumably for upgrades to the stormwater and wetland area
T38	Cinnamomum camphora (Camphor Laurel)	Exempt	Co-Dominant Stems (included bark) , Crossing Rubbing Branches , Epicormic Shoots (moderate)		tree is earmarked for removal on demolition plan, presumably for upgrades to the stormwater and wetland area
T39	Glochidion ferdinandi (Cheese Tree)	Medium	Deadwood Minor (0-30mm) , Included Bark (branches)		Exempt species, tree is earmarked for removal on demolition plan, presumably for upgrades to the stormwater and wetland area
T40	Cupressus species (Conifer)	Exempt	Co-Dominant Stems		Exempt species, tree is earmarked for removal on demolition plan, presumably for upgrades to the stormwater and wetland area
T41	Harpophyllum caffrum (Kaffir Plum)	Exempt	Co-Dominant Stems (included bark)		Exempt species, tree is earmarked for removal on demolition plan, presumably for upgrades to the stormwater and wetland area
T42	Eucalyptus robusta (Swamp Mahogany)	High	Deadwood Moderate (30-100mm) , Dieback (isolated) , Epicormic Shoots (minor)		TPZ Fencing
T62	Magnolia grandiflora (White magnolia)	Medium	Co-Dominant Stems		New tennis courts
T63	Melaleuca quinquenervia (Broad-Leafed Paperbark)	High	Co-Dominant Stems , Deadwood Moderate (30-100mm) , Dieback (isolated)		New tennis courts
T64	Syzygium paniculatum (Magenta Lilly Pilly)	Low	Co-Dominant Stems (included bark) , Suppressed		New tennis courts
T65	Syzygium paniculatum (Magenta Lilly Pilly)	High	Co-Dominant Stems , Deadwood Minor (0-30mm) , Dieback (isolated)		New tennis courts

Tree ID	Tree Species	Retention Value (STARS)	Observations and Defects	Notes	Encroachment Type
T66	Cupressus species (Conifer)	Exempt	Co-Dominant Stems (included bark)		New tennis courts
T67	Cupressus species (Conifer)	Exempt	Co-Dominant Stems		New tennis courts
T68	Archontophoenix spp. (Alex/Bagalow Palm)	Medium		Group of 4 clumping palms	New tennis courts
T69	Ficus benjimina (Weeping Fig)	Exempt	Co-Dominant Stems (included bark)		New tennis courts
T114	Syagrus romanzoffiana (Cocos Palm)	Exempt			New Tennis courts

7 TREE SENSITIVE DESIGN

Tree sensitive design is site responsive design - designing in harmony with the existing conditions of the site, including the trees. Considerations include the condition, location, size /age and relative construction tolerances of the subject trees. How the project will be constructed, site access and equipment manoeuvring should also be considered during design, to ensure the design can be delivered without existing trees being compromised.

Tree sensitive design may be employed to gain further acceptable encroachments to the TPZ. Structures that require little or no excavation are considered tree sensitive design. Consideration should be given to tree sensitive measures such as pier and beam, suspended slabs, cantilevered building sections, screw piles and contiguous piling.

In order for trees to remain viable buildings could be raised on piers above ground level. When soil or any type of fill is placed over the existing root system, it causes a reduction in the oxygen supply to the tree roots and slows down the rate of gas exchange between the roots and the air in the soil pore space. Both oxygen and water are essential to the growth, development and nutrient uptake by the roots. Many of the soil organisms also utilize the water and oxygen in their normal growth processes. Lack of oxygen in the soil may result in accumulation of noxious gases and chemicals detrimental to good growth. When this occurs, the feeder roots fail to develop, the root system and the above-ground portion of the tree begin to decline. Many factors (including tree species, depth and type of fill, drainage, soil structure below the fill and the general vigour of the existing tree) have a determining influence upon the time it takes for the above-ground symptoms to appear. Thus, it might take anywhere from several months to as much as 3 to 5 years before tree death would occur.

7.1 FOOTINGS

Consideration should be given to tree sensitive measures such as pier and beam, suspended slabs, cantilevered building sections, screw piles and contiguous piling.

Tree sensitive design may be employed to gain further acceptable encroachments to the TPZ. Structures that require little or no excavation are considered tree sensitive design.

Isolated pier locations should be assessed for roots prior to piling. When placing piers in the TPZ, the first 800mm should be undertaken by hand digging only. Care should be taken not to damage roots 50mm and over. Pier holes should be flexible in design and be placed in such a manner that significant roots are bridged rather than severed.

Loss of permeable surfaces will be taken into consideration.

7.2 LANDSCAPING WITHIN THE TPZ

7.2.1 FENCES AND WALLS

If a new fence is to be installed within the TPZ of trees to be retained must be constructed with suspended sections 100mm clear above or beside any structural woody root or further as required, or any new wall to be built only to the depth of that existing. Structural woody roots to be further protected by utilising the construction techniques of pier or bridge footings, or screw piles between or over them with a minimum clearance above or beside of 100mm, or further as required to allow for future and ongoing growth.

When placing piers in the TPZ, the first 800mm should be undertaken by hand digging only. Care should be taken not to damage roots 50mm and over. Pier holes should be flexible in design and be placed in such a manner that significant roots are bridged rather than severed. Root investigation should be conducted using non-destructive techniques.

Techniques include:

- Hand excavation
- Vacuum excavation
- High pressure water jet excavation
- Air Spade

All excavation should be undertaken or supervised by an AQF Level 5 Arborist.

7.2.2 HARDSTAND SURFACES

A hardstand surface may be constructed at ground level without any excavation, by first killing with herbicide the plants to be removed from the pathway area, and then removing that plant material by cutting the trunks of woody shrubs to ground level and by raking all other plant material to expose the top soil surface without organic matter. This will remove the need for physically disturbing the soil and the roots of the tree.

If a hardstand surface is to be constructed near a protected tree, careful excavation is to be undertaken manually by using non-motorized hand tools to determine the location of first order and lower order structural roots with a diameter of 20mm or greater, without damaging them Where a driveway or footpath is to pass by the tree a suspended slab is to be constructed or approved similar, to protect the roots that may be encountered at, near, or above ground, and may be constructed on structural soil. Where such a driveway or footpath is to be constructed the edge of the structure closest to the tree is to terminate no closer than 0.5m from the outside edge of the trunk, or further depending on the species and its likely further growth to allow for future development and expansion of the trunk, buttresses, and first order and lower order roots as may be advised by a Consultant Arboriculturist.

7.2.3 LEVEL CHANGES

Soil level changes are outlined as non-permissible in AS4970–2009. The soils on the site are classified as shallow which will make lowering the soil levels within the TPZ virtually impossible. Upon the site inspection I noted many large roots protruding from the soil.

Making the soil levels higher is an easier task if done correctly and can have little impact on tree vitality. Raising the grade or soil level over existing roots can have an even greater effect on the future growth and survival of existing trees. When soil or any type of fill is placed over the existing root system, it causes a reduction in the oxygen supply to the tree roots and slows down the rate of gas exchange between the roots and the air in the soil pore space.

Both oxygen and water are essential to the growth, development and nutrient uptake by the roots. Many of the soil organisms also utilize the water and oxygen in their normal growth processes. Lack of oxygen in the soil may result in accumulation of noxious gases and chemicals detrimental to good growth. When this occurs, the feeder roots fail to develop, the root system and the above-ground portion of the tree begin to decline. Many factors (including tree species, depth and type of fill, drainage, soil structure below the fill and the general vigour of the existing tree) have a determining influence upon the time it takes for the above-ground

symptoms to appear. Thus, it might take anywhere from several months to as much as 3 to 5 years before tree death would occur.

In order for the root conditions to remain favourable all vegetation should be removed, including sod and underbrush beneath the branch spread of the tree. Organic matter, as it decomposes beneath a soil fill, can create noxious gases detrimental to the tree roots. The top 3 to 6 inches of the soil surface should be cultivated or broken up carefully so as to disturb the least possible number of roots. This treatment allows better contact with the fill soil and prevents a sharp line of demarcation between the existing soil surface and the fill and where internal soil drainage is good. The fill should consist of large aggregate or sandy soil so that aeriation and drainage is achieved and then the organic layer on top.

Such amendments may even improve the root conditions as breaking up the topsoil would alleviate the surface compaction and improve oxygen flow and water infiltration. Adding more porous topsoil would also aid in preventing future compaction and would also protect the exposed roots from damage.

If the fill is no more than 600mm, and internal soil drainage is good. Starting at the outer extremities of the branches, apply from 75 to 150mm of coarse gravel or crushed stone. The depth towards the trunk of the tree should be increased gradually until it is 200 to 300mm or deeper within 2 feet of the trunk. The gravel can reach the surface of the fill in the area extending 600mm around the trunk of the tree (see Figure 3). The gravel can be covered with a thin layer of straw, woven plastic or other porous material to keep soil from filtering into the coarse gravel and sealing the air spaces. Some good topsoil should be spread over the area to the desired depth.

7.3 SERVICES

All underground services should be placed outside the TPZs of the retained trees. When routing services outside the TPZ becomes unavoidable, trenching must be undertaken using tree sensitive excavation.

Techniques include:

- Hand excavation
- Vacuum excavation
- High pressure water jet excavation
- Air Spade
- Horizontal Directional Drilling (Entry and exit pits must be located outside of the TPZ)

All excavation should be undertaken or supervised by an AQF Level 5 Arborist.

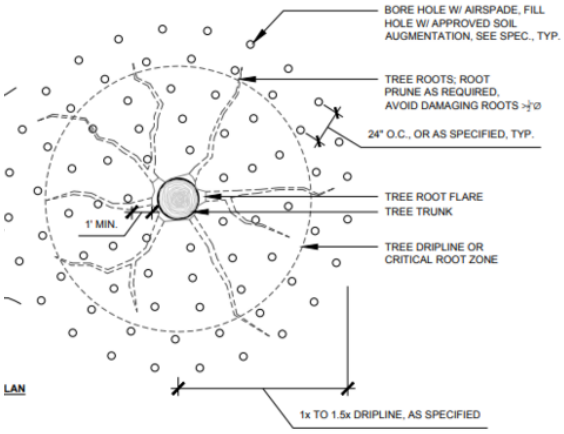
7.4 SOIL REMEDIATION FOLLOWING ROOT PRUNING

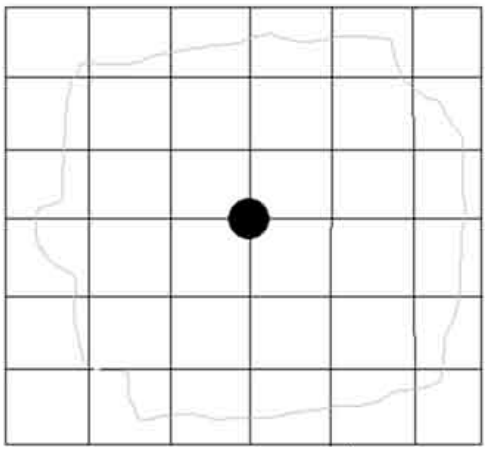
“When intentionally cutting roots, it is important to make clean cuts, perpendicular to the line of the root. Clean cuts offer a smaller surface for drying and compartmentalize better. Roots that are torn by large grading equipment can develop cracks that run laterally along the root, increasing the extent of damage. When grading near trees, always prune the roots in advance.” (Urban 2008)

It is also recommended that a remediation plan is put in place to compensate for the root loss, in the form of vertical mulching and soil inoculation to stimulate new root growth.

Vertical mulching, a method that is known to invigorate root growth and improve tree vigour. Using air excavation tools, 150-230 mm deep holes with a 150mm diameter, should be created and then filled with composted mulch. Mulch details to be outlined in 6.4 Recommended Materials. The effects of vertical

mulching are greatly enhanced when combined with surface mulching. (Urban, 2008). The holes should be spaced approximately 750mm apart in a grid formation and should be done to a radius of one to one and a half times the dripline. Please refer to Figure 11. Air spade works should be carried out when soil is of adequate field capacity and not in too dry or saturated conditions. Vertical mulching should be undertaken using an organic soil blend of 80% double washed sand 20% natural washed soil, mixed with worm casting. Worm castings make soil more absorbent; they can remove toxins from soil and introduce beneficial microbes and bacteria into the soil including phosphorous and nitrogen. They can also increase CEC.





Following the root pruning, the soil should also be inoculated with products such as Nutri-life TrichoShield. Tricoshield is a talc-based formulation containing the beneficial fungal species *Trichoderma harzianum*, *Trichoderma lignorum* and *Gliocladium virens*, and the plant growth promoting, bio-balancing bacteria Bacillus subtilis. Trichoderma is also a root growth promoter.

Trichoderma spp. are proposed as major plant growth-promoting fungi that widely exist in the natural environment. These strains have the abilities of rapid growth and reproduction and efficient transformation of soil nutrients. Moreover, they can change the plant rhizosphere soil environment and promote plant growth. (Halifu, Deng, Song, & Song, 2019)

8 CONCLUSIONS AND RECOMMENDATIONS

Table 13 summarises the number of trees to be removed and their assigned retention values.

Table 13

Retention Value	Total
Very High	0
High	25
Medium	8
Low	6
Exempt	12
Total	**51**

Given the environmental mapping and the Narla document dated February 2021, the following table details the trees being removed and their origin. A total of 36 trees endemic to the EEC Swamp oak Floodplain of the NSW North Coast, Sydney Basin & South east Corner Bioregions have been recommended for removal due to development impacts.

Table 14

Species Origin	**Number of Trees**	**Tree Numbers**
Endemic	36	T1, T2, T3, T4, T5, T6, T7, T8, T9, T10, T11, T12, T13, T14, T15, T16, T17, T18, T19, T20, T21, T22, T23, T24, T25, T26, T27, T28, T29, T30, T31, T32, T33, T39, T42, T63
Native	4	T64, T65, T68, T69
Exotic	10	T34, T35, T36, T37, T40, T41, T62, T66, T67, T114
Noxious Weed	1	T38
Total		**51**

The following trees suffer development impacts that are not able to be mitigated and will require to be removed and replaced.

Table 15

Tree ID	Tree Species	Retention Value (STARS)
T1	Casuarina glauca (Swamp-Oak)	Medium
T2	Casuarina glauca (Swamp-Oak)	High
T3	Casuarina glauca (Swamp-Oak)	High
T4	Casuarina glauca (Swamp-Oak)	High
T5	Casuarina glauca (Swamp-Oak)	Low

Tree ID	Tree Species	Retention Value (STARS)
T6	Casuarina glauca (Swamp-Oak)	Exempt
T7	Casuarina glauca (Swamp-Oak)	High
T8	Casuarina glauca (Swamp-Oak)	High
T9	Casuarina glauca (Swamp-Oak)	High
T10	Casuarina glauca (Swamp-Oak)	High
T11	Casuarina glauca (Swamp-Oak)	High
T12	Casuarina glauca (Swamp-Oak)	High
T13	Casuarina glauca (Swamp-Oak)	High
T14	Casuarina glauca (Swamp-Oak)	Medium
T15	Casuarina glauca (Swamp-Oak)	Low
T16	Casuarina glauca (Swamp-Oak)	Low
T17	Casuarina glauca (Swamp-Oak)	Medium
T18	Casuarina glauca (Swamp-Oak)	High
T19	Casuarina glauca (Swamp-Oak)	High
T20	Casuarina glauca (Swamp-Oak)	High
T21	Casuarina glauca (Swamp-Oak)	Low
T22	Casuarina glauca (Swamp-Oak)	Medium
T23	Casuarina glauca (Swamp-Oak)	High
T24	Casuarina glauca (Swamp-Oak)	High
T25	Casuarina glauca (Swamp-Oak)	High
T26	Casuarina glauca (Swamp-Oak)	High
T27	Casuarina glauca (Swamp-Oak)	Medium
T28	Casuarina glauca (Swamp-Oak)	High
T29	Casuarina glauca (Swamp-Oak)	High
T30	Casuarina glauca (Swamp-Oak)	Low

Tree ID	Tree Species	Retention Value (STARS)
T31	Casuarina glauca (Swamp-Oak)	High
T32	Casuarina glauca (Swamp-Oak)	High
T33	Casuarina glauca (Swamp-Oak)	High
T34	Harpophyllum caffrum (Kaffir Plum)	Exempt
T35	Cupressus species (Conifer)	Exempt
T36	Harpophyllum caffrum (Kaffir Plum)	Exempt
T37	Harpophyllum caffrum (Kaffir Plum)	Exempt
T38	Cinnamomum camphora (Camphor Laurel)	Exempt
T39	Glochidion ferdinandi (Cheese Tree)	Medium
T40	Cupressus species (Conifer)	Exempt
T41	Harpophyllum caffrum (Kaffir Plum)	Exempt
T42	Eucalyptus robusta (Swamp Mahogany)	High
T62	Magnolia grandiflora (White magnolia)	Medium
T63	Melaleuca quinquenervia (Broad-Leafed Paperbark)	High
T64	Syzygium paniculatum (Magenta Lilly Pilly)	Low
T65	Syzygium paniculatum (Magenta Lilly Pilly)	High
T66	Cupressus species (Conifer)	Exempt
T67	Cupressus species (Conifer)	Exempt
T68	Archontophoenix spp. (Alex/Bagalow Palm)	Medium
T69	Ficus benjimina (Weeping Fig)	Exempt
T114	Syagrus romanzoffiana (Cocos Palm)	Exempt

The following trees may be retained and subject to the following tree protection measures;

Table 16

Tree ID	Tree Species	TPZ Radius (M)	SRZ Radius (M)	Retention Value (STARS)	Generic Tree Protection Measures	Specific Tree Protection Measures
T43	Eucalyptus robusta (Swamp Mahogany)	4.4	2.3	High	TPZ Fencing	
T44	Eucalyptus robusta (Swamp Mahogany)	2.2	1.8	Medium	TPZ Fencing	
T45	Syagrus romanzoffiana (Cocos Palm)	2.6	1.9	Exempt	TPZ Fencing	
T46	Angophora costata (Sydney Red Gum)	2.6	2.0	Low	TPZ Fencing	
T47	Eucalyptus robusta (Swamp Mahogany)	2.0	1.8	Medium	TPZ Fencing	
T48	Eucalyptus robusta (Swamp Mahogany)	4.3	2.3	High	TPZ Fencing	
T49	Eucalyptus robusta (Swamp Mahogany)	3.7	2.2	High	TPZ Fencing	
T50	Pittosporum undulatum (Sweet Pittosporum)	2.2	1.6	Exempt	TPZ Fencing	
T51	Melaleuca linarifolia (Snow in Summer)	2.6	1.9	Medium	TPZ Fencing	
T52	Angophora costata (Sydney Red Gum)	4.3	2.3	Medium	TPZ Fencing	
T53	Angophora costata (Sydney Red Gum)	2.3	1.8	Medium	TPZ Fencing	
T54	Casuarina glauca (Swamp-Oak)	2.8	1.9	High	TPZ Fencing	
T55	Casuarina glauca (Swamp-Oak)	2.0	1.8	High	TPZ Fencing	

Tree ID	Tree Species	TPZ Radius (M)	SRZ Radius (M)	Retention Value (STARS)	Generic Tree Protection Measures	Specific Tree Protection Measures
T56	Casuarina glauca (Swamp-Oak)	5.5	2.1	High	TPZ Fencing	
T57	Casuarina glauca (Swamp-Oak)	3.1	2.1	High	TPZ Fencing	
T58	Casuarina glauca (Swamp-Oak)	3.8	2.3	High	TPZ Fencing	
T59	Casuarina glauca (Swamp-Oak)	3.7	2.2	High	TPZ Fencing	
T60	Callistemon viminalis (Weeping Bottlebrush)	4.8	2.3	Medium	TPZ Fencing	
T61	Callistemon viminalis (Weeping Bottlebrush)	4.6	2.2	Medium	TPZ Fencing	
T70	Callistemon viminalis (Weeping Bottlebrush)	4.3	2.3	Medium	TPZ Fencing	
T71	Callistemon viminalis (Weeping Bottlebrush)	5.3	2.4	Medium	TPZ Fencing	
T72	Casuarina glauca (Swamp-Oak)	4.1	2.3	High	TPZ Fencing	
T73	Casuarina glauca (Swamp-Oak)	3.4	2.2	High	TPZ Fencing	
T74	Casuarina glauca (Swamp-Oak)	2.4	2.3	High	TPZ Fencing	
T75	Casuarina glauca (Swamp-Oak)	3.0	2.0	High	TPZ Fencing	
T76	Casuarina glauca (Swamp-Oak)	3.0	2.0	High	TPZ Fencing	
T77	Casuarina glauca (Swamp-Oak)	4.3	2.3	High	TPZ Fencing	
T78	Casuarina glauca (Swamp-Oak)	2.4	1.9	High	TPZ Fencing	
T79	Casuarina glauca (Swamp-Oak)	3.8	2.3	High	TPZ Fencing	

Tree ID	Tree Species	TPZ Radius (M)	SRZ Radius (M)	Retention Value (STARS)	Generic Tree Protection Measures	Specific Tree Protection Measures
T80	Casuarina glauca (Swamp-Oak)	3.6	2.1	High	TPZ Fencing	
T81	Casuarina glauca (Swamp-Oak)	3.0	2.0	High	TPZ Fencing	
T82	Casuarina glauca (Swamp-Oak)	3.0	2.0	High	TPZ Fencing	
T83	Casuarina glauca (Swamp-Oak)	3.0	2.0	High	TPZ Fencing	
T84	Casuarina glauca (Swamp-Oak)	3.0	2.0	High	TPZ Fencing	
T85	Casuarina glauca (Swamp-Oak)	3.0	2.0	High	TPZ Fencing	
T86	Casuarina glauca (Swamp-Oak)	3.0	2.0	High	TPZ Fencing	
T87	Casuarina glauca (Swamp-Oak)	5.6	2.4	High	TPZ Fencing	
T88	Casuarina glauca (Swamp-Oak)	4.1	2.3	High	TPZ Fencing	
T89	Casuarina glauca (Swamp-Oak)	3.0	2.0	High	TPZ Fencing	
T90	Casuarina glauca (Swamp-Oak)	3.0	2.0	High	TPZ Fencing	
T91	Casuarina glauca (Swamp-Oak)	3.4	2.1	High	TPZ Fencing	
T92	Casuarina glauca (Swamp-Oak)	4.3	2.2	High	TPZ Fencing	
T93	Casuarina glauca (Swamp-Oak)	3.0	2.0	High	TPZ Fencing	
T94	Casuarina glauca (Swamp-Oak)	3.0	2.0	High	TPZ Fencing	
T95	Casuarina glauca (Swamp-Oak)	3.8	2.3	High	TPZ Fencing	
T96	Casuarina glauca (Swamp-Oak)	4.9	2.4	High	TPZ Fencing	

Tree ID	Tree Species	TPZ Radius (M)	SRZ Radius (M)	Retention Value (STARS)	Generic Tree Protection Measures	Specific Tree Protection Measures
T97	Casuarina glauca (Swamp-Oak)	5.5	2.5	High	TPZ Fencing	
T98	Casuarina glauca (Swamp-Oak)	3.0	2.0	High	TPZ Fencing	
T99	Casuarina glauca (Swamp-Oak)	3.5	2.1	High	TPZ Fencing	
T100	Casuarina glauca (Swamp-Oak)	3.6	2.1	High	TPZ Fencing	
T101	Casuarina glauca (Swamp-Oak)	7.2	2.8	High	TPZ Fencing	
T102	Melaleuca quinquenervia (Broad-Leafed Paperbark)	11.9	3.5	High	TPZ Fencing	Employ tree sensitive construction for the carpark i.e. build at grade with no excavation (see section 7.2.2), or project arborist supervision to ensure all roots are cut cleanly and employ remediation plan for remainder of TPZ to encourage replacement root growth. Section 7.4. Any excavation should be limited to the car park area only, natural ground should be retained at the eastern side of the car park between the proposed parking area and Pittwater Rd.
T103	Melaleuca quinquenervia (Broad-Leafed Paperbark)	10.6	3.3	High	TPZ Fencing	
T104	Melaleuca quinquenervia (Broad-Leafed Paperbark)	10.7	3.3	High	TPZ Fencing	
T105	Melaleuca quinquenervia (Broad-Leafed Paperbark)	12.0	3.3	High	TPZ Fencing	Employ tree sensitive construction for the carpark i.e. build at grade with no excavation (see section 7.2.2), or project arborist supervision to ensure all roots are cut cleanly and employ remediation plan for remainder of TPZ to encourage replacement root growth. Section 7.4. Any excavation should be limited to the car park area only, natural ground should be retained at the eastern side of the car park between the proposed parking area and Pittwater Rd.
T106	Glochidion ferdinandi (Cheese Tree)	4.1	2.3	Medium	TPZ Fencing	
T107	Glochidion ferdinandi (Cheese Tree)	5.5	2.6	Medium	TPZ Fencing	
T108	Glochidion ferdinandi (Cheese Tree)	4.1	2.4	Medium	TPZ Fencing	
T109	Melaleuca quinquenervia (Broad-Leafed Paperbark)	14.8	3.8	High	TPZ Fencing	Tree is located on Pittwater Rd. which is separated from the subject site via a sandstone retaining wall. No foreseen impact.

Tree ID	Tree Species	TPZ Radius (M)	SRZ Radius (M)	Retention Value (STARS)	Generic Tree Protection Measures	Specific Tree Protection Measures
T110	Melaleuca quinquenervia (Broad-Leafed Paperbark)	8.0	3.0	High	TPZ Fencing	
T111	Glochidion ferdinandi (Cheese Tree)	4.8	2.6	Medium	TPZ Fencing	
T112	Casuarina glauca (Swamp-Oak)	2.0	1.6	Medium	TPZ Fencing	
T113	Melaleuca quinquenervia (Broad-Leafed Paperbark)	10.7	3.7	High	TPZ Fencing	Tree is located on Pittwater Rd. which is separated from the subject site via a sandstone retaining wall. No foreseen impact.

Two trees (T105 and T109) suffer major encroachments of more than 10% but less than 15%. Recommendations have been made pertaining to the trees longevity. It is recommended that tree sensitive design is employed in regard to installation of the new car park (see section 7.2.2). Failing that a project arborist should be employed to supervise the excavation and undertake correct root pruning and soil remediation should be undertaken to encourage new root growth (see section 7.4). Any excavation should be limited to the car park area only, natural ground should be retained at the eastern side of the car park between the proposed parking area and Pittwater Rd.

It is important to stress as this stage that the tree protection requirements and project consulting arborist instructions are to be strictly adhered to at all times, due to the fine tolerances and potential catastrophic impacts if not adhered to by the project consulting arborists instructions.

Failure to comply will result in not obtaining final sign off/practical completion, and upon a discovery of failure to comply, it is recommended the certifier be immediately notified.

It is therefore the responsibility of the builder/foreman to ensure no breaches into the TPZ exclusion zones occur by anyone on site / any contractor / sub-contractor.

9 TREE PROTECTION MEASURES

9.1 FENCING

It will not be practical or possible to erect a TPZ fence encompassing the entire TPZ as access will be required to perform the works, however, an exclusion zone should be erected around the tree to limit activities that take place within the TPZ. *AS4970-2009 Protection of Trees on Development sites* states that the following activities are prohibited within the TPZs;

- Storage.
- Preparation of chemicals, including preparation of cement products.
- Refueling.
- Dumping of waste.
- Washing down and cleaning of equipment.

AS 4687 specifies applicable fencing requirements, 1.8M Mesh fence. Shade cloth or similar should be attached to reduce the transport of dust, other particulate matter and liquids into the protected area.

Fencing must

- be 1.8m high fully supported chainmesh protective fencing. The fencing shall be secure and fastened to prevent movement. The fencing shall have a lockable opening for access. Roots greater than 40mm in diameter shall not be pruned, damaged or destroyed during the installation or maintenance of the fencing. The fencing shall not be moved, altered or removed without the approval of the Project Arborist;
- have a minimum of two signs that include the words “Tree Protection Zone – Keep Out”. Each sign shall be a minimum size of 600mm x 500mm and the name and contact details of the Project Arborist. Signs shall be attached facing outwards in prominent positions at 10 metre intervals or closer where the fence changes direction. The signs shall be visible within the site;
- be kept free of weeds and, except where the existing surface is grass, grass. Weeds shall be removed by hand; and
- unless the existing surface is grass, have mulch installed and maintained to a depth of 75mm.

Fencing should be installed before any machinery or materials are brought onto the site and before the commencement of works including demolition. Once erected, protective fencing must not be removed or altered without approval by the project arborist. Fencing must be clearly signed and adhere to the standard as outlined in *AS4970-2009 Protection of Trees on Development Sites*.

9.2 TRUNK PROTECTION

Trunk protection as outlined in *Australian Standard AS4970-2009 Protection of Trees on Development Sites* should be installed. This should be installed by or signed off by an AQF Level 5 arborist.

Trunk protection is achieved when the vertical trunk of exposed trees is protected by the placement of 1.8m lengths of 50 x 100mm hardwood timbers, spaced vertically, at 150mm centres and secured by 2mm wire at 300mm wide spacing over suitable protective padding material e.g. Jute Matting. The trunk protection shall be maintained intact until the completion of all work on site. Additionally, smaller fences can be erected around the trunks to avoid damage.

Trunk protection should be installed before any machinery or materials are brought onto the site and before the commencement of works including demolition. Once erected, trunk protection should be certified by the project arborist and adhere to the standard as outlined in *AS4970-2009 Protection of Trees on Development Sites*.

9.3 GROUND PROTECTION

It is also recommended that the trees are mulched within the TPZ’s. Section 4.6 of Australian Standard AS4970-2009 Protection of Trees on Development Sites states that the area within the TPZ should be mulched. The mulch must be maintained to a depth of 50–100 mm using material that complies with AS 4454. Mulch should be applied at no greater depth than 50-75 mm. Mulch should be spread beyond the dripline (Shigo, 1991). The mulch should be no closer than 200mm away from the base of the trunk as this can cause collar rot and increase the incidence of disease.

This will also allow for a favourable root environment for the trees possibly improving tree health throughout the development period. Benefits of mulching include:

- Conservation of soil moisture.
- Soil erosion and runoff are reduced, slowing water movement and keeping water in contact with soil.
- Soil fertility is increased by nutrients from mulch.
- Soil microorganism activity is enhanced.
- Protects surface soil from compactive forces, such as vehicles, people and rain impact.

The mulch should be suitably coarse and broken down to ensure a Carbon: Nitrogen ratio of no more than 25:1 or less and should be no less than 75mm and no more than 100mm in depth. It is important to choose the correct mulch for improving soil fertility. The mulches must have high C:N ratios. Mulches with low C:N ratios may develop nitrogen deficiency (Carlson, 2001) Mulching should be arranged by a project arborist.

Soil moisture levels should be regularly monitored by the project arborist. “Benefits of mulch to the soil environment and ultimately plant health and growth are accrued both immediately after application as the mulch protects the soil surface, and over time as the organic mulch decomposes. Immediate benefits include conserving soil moisture, reducing salt build up in the surface soil, reducing soil erosion and water runoff, protection from compactive forces, insulating the soil from temperature extremes, reducing reflection and reradiation of heat, and suppressing weed growth. Benefits that accrue over time from the use of organic mulches involve improvements to soil structure, permeability, aeration, fertility, and biological activity. Improved aeration, temperature, and moisture conditions near the surface encourage rooting and other biological activities that enhance soil structure. Just the absence of cultivation and the low amount of compaction will allow soil structure to improve through wetting and drying cycles and biological activity. Improved soil structure increases the infiltration rate and allows more uniform water distribution and less soil erosion, all of which favour plant growth.” (Harris, Clark & Matheny, 2004)

If access for machinery is required within the TPZ ground protection measures will be required. The purpose of ground protection is to prevent root damage and soil compaction within the TPZ.

Although heavy machinery is not permitted within the TPZ, access is permitted when additional ground protection measures are employed in accordance with *AS4970-2009 Protection of Trees on Development sites* specifically section 4.5.3 Ground Protection . A permeable geotextile membrane should be laid over the required area beneath a layer of coarse mulch and then covered with rumble boards. The boards should be placed on their flat edge, side by side with a 30-50mm gap to form a rumble strip. The boards are to be held together with a metal bracing straps.

9.4 TREE SENSITIVE METHODOLOGY

9.4.1 PRUNING RETAINED TREES

Trees that require pruning in order to facilitate the new build should be directed by an AQF Level 5 project arborist and undertaken by a minimum AQF Level 3 arborist adhering to *AS4373-2007* and NSW Workcover Code of Practice *Amenity Tree Industry 1998* and Safe Work *Guide to Managing Risks of Tree Trimming and Removal Work 2016*.

9.4.2 EXCAVATION WITHIN THE TPZ

When the extent of TPZ incursion is deemed minor as per AS4970 Protection of Trees on Development Sites i.e., less than 10%, excavation may be undertaken using traditional methods. Excavation for Benching and Shoring must be considered.

When the encroachment is deemed to be major i.e., greater than 10% of the TPZ of trees to be retained; exploratory root investigation using non-destructive root sensitive techniques should be undertaken at the perimeter of the required penetration point nearest the tree, bearing in mind compensation for benching and battering.

Techniques include:

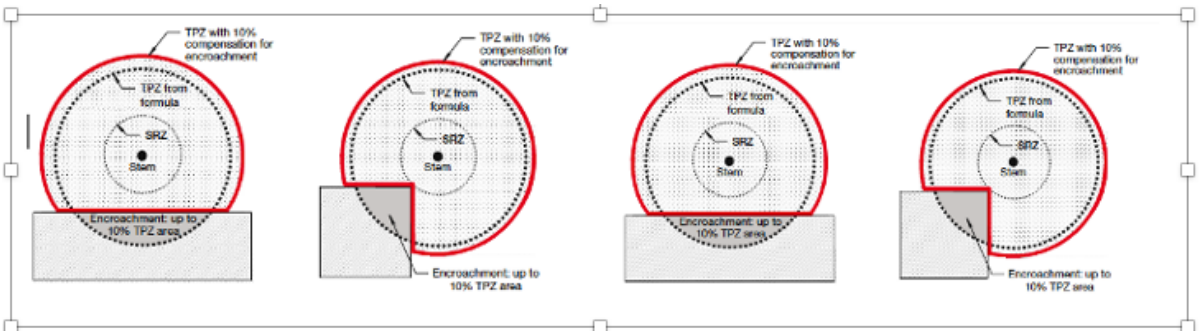
- Hand excavation
- Vacuum excavation
- High pressure water jet excavation
- Air Spade

The exploratory root investigation should be undertaken at the outer limits of the of the penetration point to a maximum of 700mm or when compacted sub-soil or rock bed is encountered. Roots greater than 50mm in diameter should be retained and advice from a project arborist sought.

Any roots less than 50mm in diameter that will require pruning should be undertaken by a suitably qualified arborist using sharp tools to ensure clean cuts. “When intentionally cutting roots, it is important to make clean cuts, perpendicular to the line of the root. Clean cuts offer a smaller surface for drying and compartmentalize better. Roots that are torn by large grading equipment can develop cracks that run laterally along the root, increasing the extent of damage. When grading near trees, always prune the roots in advance.” (Urban 2008)

9.4.3 TPZ COMPENSATION

TPZ area lost to incursions should be compensated for elsewhere on the site and contiguous to the TPZ.



9.4.4 INSTALLATION OF SERVICES WITHIN TPZ

All underground services should be placed outside the TPZs of the retained trees. When routing services outside the TPZ becomes unavoidable, trenching must be undertaken using tree sensitive excavation.

Techniques include:

- Hand excavation
- Vacuum excavation
- High pressure water jet excavation
- Air Spade
- Horizontal Directional Drilling (Entry and exit pits must be located outside of the TPZ)

All excavation should be undertaken or supervised by an AQF Level 5 Arborist.

9.4.5 PIER PLACEMENT WITHIN TPZ

When placing piers in the TPZ, the first 800mm should be undertaken by hand digging only. Care should be taken not to damage roots 50mm and over. Pier holes should be flexible in design and be placed in such a manner that significant roots are bridged rather than severed.

9.4.6 DEMOLITION OF HARDSTAND AREAS WITHIN TPZ

Demolition of hardstand areas within the TPZ's of trees may be undertaken using machinery but must be done so with care. Demolition should commence at the outer most point of the hard stand area nearest the tree working backwards away from the tree, with the machinery remaining on hard stand surfaces.

Where hard stand surfaces aren't available for machinery ground protection will be required.

This should be done under the supervision of a project arborist.

Once the hardstand surface has been demolished, ground protection as per AS4970 should be installed to limit the incidence of compaction and soil contamination.

9.4.7 LANDSCAPING WITHIN THE TPZ

Any landscaping works that require excavation within the TPZ should be done so using the methods outlined in 7.1.4.

Any pier holes for retaining walls should be done so by hand prior to piling.

Any excavation within the SRZ of trees should be done so under the direct supervision of a project arborist.

9.4.8 FILL WITHIN THE TPZ

Fill placed in the TPZ of trees to be retained shall be well-drained material equivalent or finer in texture than the existing site topsoil material and should comply with AS4419:2003 (Soils for Landscaping and Garden Use).

In order for the root conditions to remain favourable all vegetation should be removed, including sod and underbrush beneath the branch spread of the tree. Organic matter, as it decomposes beneath a soil fill, can create noxious gases detrimental to the tree roots. The top 75 to 150 mm of the soil surface should be cultivated or broken up carefully using non-motorized hand tools only, so as to disturb the least possible number of roots. This treatment allows better contact with the fill soil and prevents a sharp line of demarcation between the existing soil surface and the fill and where internal soil drainage is good. The fill should consist of large aggregate or sandy soil so that aeriation and drainage is achieved and then the organic layer on top.

9.5 HOLD POINTS, INSPECTION AND CERTIFICATION

To ensure all plans are implemented hold points have been specified in a schedule of works (below). Once each stage is reached the work will be inspected and certified by the project arborist and the next stage may commence.

9.5.1 SCHEDULE OF WORKS AND RESPONSIBILITIES

Table 5

Hold Point	Task	Responsibility	Certification	Timing of Inspection
1	Review construction plan and update TPP	Principle Contractor	Project Arborist	Prior to CC being granted
2	Install TPZ Fencing, trunk and branch protection.	Principle Contractor	Project Arborist	Prior to site establishment.
3	Supervise earthworks within TPZ of T102 and T105	Principle Contractor	Project Arborist	When required
4	Monthly inspection of site	Principle Contractor	Project Arborist	Monthly as required
5	Final inspection of Trees by Project Arborist	Principle Contractor	Project Arborist	Prior to issue of occupancy certificate.

10 WORKS CITED

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11 GLOSSARY OF TERMS

Borers: 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 14meters in height of assessed tree.

Dead wooding: The removal dead branches from a tree.

Dieback: Tree deterioration where the branches and leaves die.

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.

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.

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

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

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.

12 APPENDIX 1: TREE SCHEDULE

12.1 SCHEDULE 1: ATTRIBUTES

Table 17

Tree ID	Tree Species	Height (M)	Spread (M) N, E, S, W	DBH (M)	DRB (M)	TPZ Radius (M)	TPZ Area (M2)	SRZ Radius (M)	SRZ Area (M2)	Age Class	Structure	Health	E.L.E	Landscape Significance (STARS)	Retention Value (STARS)	Observations and Defects	Notes	Species Origin
T1	Casuarina glauca (Swamp-Oak)	12	5,2,3,2	0.26	0.31	3.1	30.6	2.0	12.9	Juvenile	Fair	Fair	15-40yrs	Low	Medium	Cavity (minor) , Co-Dominant Stems , Deadwood Moderate (30-100mm) , Decay , Weak Branch Attachments (isolated) , Wounds (moderate)		Endemic
T2	Casuarina glauca (Swamp-Oak)	15	5,5,5,5	0.44	0.56	5.3	87.6	2.6	21.1	Mature	Good	Good	40 plus	High	High	Co-Dominant Stems , Deadwood Moderate (30-100mm) , Included Bark (natural for species) , Included Union (insignificant)		Endemic
T3	Casuarina glauca (Swamp-Oak)	15	5,5,2,2	0.6	0.74	7.2	162.9	2.9	26.7	Mature	Good	Good	40 plus	High	High	Co-Dominant Stems , Co-Dominant Stems (included bark) , Crossing Rubbing Branches , Deadwood Moderate (30-100mm)		Endemic
T4	Casuarina glauca (Swamp-Oak)	15	3,3,3,3	0.54	0.69	6.5	131.9	2.8	25.2	Mature	Good	Fair	15-40yrs	High	High	Co-Dominant Stems , Crossing Rubbing Branches , Deadwood Moderate (30-100mm) , Dieback (isolated)		Endemic
T5	Casuarina glauca (Swamp-Oak)	15	4,4,4,4	0.47	0.53	5.6	99.9	2.5	20.2	Mature	Fair	Poor	5-15yrs	High	Low	Co-Dominant Stems (included bark) , Crown Density (40-60%) , Deadwood Moderate (30-100mm) , Dieback (moderate) , Included Bark (branches) , Included		Endemic

Tree ID	Tree Species	Height (M)	Spread (M) N, E, S, W	DBH (M)	DRB (M)	TPZ Radius (M)	TPZ Area (M2)	SRZ Radius (M)	SRZ Area (M2)	Age Class	Structure	Health	E.L.E	Landscape Significance (STARS)	Retention Value (STARS)	Observations and Defects	Notes	Species Origin
																Union (poor) , Weak Branch Attachments (isolated)		
T6	Casuarina glauca (Swamp-Oak)	11	2,2,2,2	0.2	0.27	2.4	18.1	1.9	11.5	Dead	Very Poor	Dead	Dead	Exempt	Exempt			Endemic
T7	Casuarina glauca (Swamp-Oak)	15	6,5,4,6	0.42	0.53	5.0	79.8	2.5	20.2	Mature	Good	Fair	15-40yrs	High	High	Crown Density (60-80%) , Deadwood Moderate (30-100mm)		Endemic
T8	Casuarina glauca (Swamp-Oak)	16	4,6,4,5	0.44	0.53	5.3	87.6	2.5	20.2	Mature	Good	Fair	15-40yrs	High	High	Co-Dominant Stems , Crown Density (60-80%) , Deadwood Moderate (30-100mm) , Dieback (isolated)		Endemic
T9	Casuarina glauca (Swamp-Oak)	17	8,8,8,7	0.65	0.77	7.8	191.1	3.0	27.6	Mature	Good	Good	40 plus	High	High	Co-Dominant Stems (included bark) , Crossing Rubbing Branches , Deadwood Moderate (30-100mm) , Dieback (isolated) , Included Bark (branches) , Over Extended Limbs (isolated) , Previous Failures (isolated)		Endemic
T10	Casuarina glauca (Swamp-Oak)	18	9,6,7,8	0.78	0.91	9.4	275.2	3.2	31.8	Mature	Fair	Good	40 plus	High	High	Co-Dominant Stems (included bark) , Deadwood Moderate (30-100mm) , Included Bark (branches) , Included Union (insignificant) , Over Extended Limbs (isolated) , Phototropism (moderate) , Wounds (minor)		Endemic
T11	Casuarina glauca (Swamp-Oak)	19	4,4,4,4	0.34	0.4	4.1	52.3	2.3	15.9	Early Mature	Good	Fair	15-40yrs	High	High	Crown Density (60-80%) , Deadwood Moderate (30-100mm)		Endemic
T12	Casuarina glauca (Swamp-Oak)	14	2,2,2,2	0.19	0.23	2.3	16.3	1.8	10.0	Semi Mature	Fair	Fair	5-15yrs	High	High	Co-Dominant Stems (included bark) , Crown Density (60-80%) ,		Endemic

Tree ID	Tree Species	Height (M)	Spread (M) N, E, S, W	DBH (M)	DRB (M)	TPZ Radius (M)	TPZ Area (M2)	SRZ Radius (M)	SRZ Area (M2)	Age Class	Structure	Health	E.L.E	Landscape Significance (STARS)	Retention Value (STARS)	Observations and Defects	Notes	Species Origin
																Deadwood Minor (0-30mm) , Suppressed		
T13	Casuarina glauca (Swamp-Oak)	17	8,6,7,6	0.42	0.55	5.0	79.8	2.6	20.8	Mature	Fair	Good	40 plus	High	High	Co-Dominant Stems (included bark) , Crown Density (60-80%) , Deadwood Moderate (30-100mm) , Dieback (isolated) , Included Union (moderate) , Mechanical Damage , Over Extended Limbs (isolated)		Endemic
T14	Casuarina glauca (Swamp-Oak)	14	3,3,3,3	0.31	0.38	3.7	43.5	2.2	15.3	Semi Mature	Good	Fair	15-40yrs	Medium	Medium	Crown Density (40-60%) , Deadwood Moderate (30-100mm) , Dieback (isolated) , Suppressed		Endemic
T15	Casuarina glauca (Swamp-Oak)	13	2,2,2,2	0.18	0.22	2.2	14.7	1.8	9.6	Juvenile	Fair	Fair	5-15yrs	Low	Low	Co-Dominant Stems (included bark) , Crown Density (60-80%) , Dieback (moderate) , Included Union (moderate) , Suppressed		Endemic
T16	Casuarina glauca (Swamp-Oak)	13	6,3,2,3	0.22	0.3	2.6	21.9	2.0	12.5	Semi Mature	Poor	Poor	1-5yrs	Low	Low	Co-Dominant Stems (included bark) , Crown Density (40-60%) , Deadwood Major (>100mm) , Dieback (major) , Included Union (poor) , Suppressed , Weak Branch Attachments (systemic)		Endemic
T17	Casuarina glauca (Swamp-Oak)	14	2,2,2,2	0.23	0.29	2.8	23.9	2.0	12.2	Semi Mature	Fair	Fair	15-40yrs	Medium	Medium	Deadwood Moderate (30-100mm) , Suppressed		Endemic
T18	Casuarina glauca (Swamp-Oak)	18	7,6,5,6	0.44	0.56	5.3	87.6	2.6	21.1	Mature	Good	Good	40 plus	High	High	Co-Dominant Stems (included bark) , Crossing Rubbing Branches , Deadwood Moderate (30-100mm) , Dieback (isolated)		Endemic

Tree ID	Tree Species	Height (M)	Spread (M) N, E, S, W	DBH (M)	DRB (M)	TPZ Radius (M)	TPZ Area (M2)	SRZ Radius (M)	SRZ Area (M2)	Age Class	Structure	Health	E.L.E	Landscape Significance (STARS)	Retention Value (STARS)	Observations and Defects	Notes	Species Origin
T19	Casuarina glauca (Swamp-Oak)	17	4,2,2,4	0.4	0.55	4.8	72.4	2.6	20.8	Semi Mature	Fair	Fair	15-40yrs	High	High	Co-Dominant Stems (included bark) , Crown Density (60-80%) , Deadwood Moderate (30-100mm) , Suppressed		Endemic
T20	Casuarina glauca (Swamp-Oak)	17	6,4,6,5	0.52	0.66	6.2	122.3	2.8	24.3	Mature	Good	Good	40 plus	High	High	Co-Dominant Stems (included bark) , Deadwood Moderate (30-100mm) , Dieback (isolated) , Included Union (insignificant)		Endemic
T21	Casuarina glauca (Swamp-Oak)	13	2,2,2,2	0.24	0.29	2.9	26.1	2.0	12.2	Semi Mature	Poor	Poor	5-15yrs	Low	Low	Co-Dominant Stems (included bark) , Crown Density (40-60%) , Deadwood Moderate (30-100mm) , Dieback (moderate) , Included Union (moderate) , Suppressed , Wounds (moderate)		Endemic
T22	Casuarina glauca (Swamp-Oak)	14	3,2,2,3	0.24	0.29	2.9	26.1	2.0	12.2	Semi Mature	Fair	Fair	15-40yrs	Medium	Medium	Co-Dominant Stems , Deadwood Moderate (30-100mm) , Suppressed		Endemic
T23	Casuarina glauca (Swamp-Oak)	19	6,5,6,7	0.44	0.46	5.3	87.6	2.4	17.9	Early Mature	Good	Good	15-40yrs	High	High	Co-Dominant Stems (included bark) , Crown Density (40-60%) , Deadwood Moderate (30-100mm) , Dieback (isolated) , Included Union (insignificant) , Suppressed , Weak Branch Attachments (isolated)		Endemic
T24	Casuarina glauca (Swamp-Oak)	16	5,5,4,4	0.32	0.41	3.8	46.3	2.3	16.3	Semi Mature	Fair	Fair	15-40yrs	High	High	Co-Dominant Stems (included bark) , Deadwood Moderate (30-100mm) , Dieback (isolated) , Suppressed		Endemic

Tree ID	Tree Species	Height (M)	Spread (M) N, E, S, W	DBH (M)	DRB (M)	TPZ Radius (M)	TPZ Area (M2)	SRZ Radius (M)	SRZ Area (M2)	Age Class	Structure	Health	E.L.E	Landscape Significance (STARS)	Retention Value (STARS)	Observations and Defects	Notes	Species Origin
T25	Casuarina glauca (Swamp-Oak)	19	4,5,4,6	0.41	0.53	4.9	76.0	2.5	20.2	Mature	Good	Good	40 plus	High	High	Co-Dominant Stems (included bark) , Deadwood Moderate (30-100mm) , Dieback (isolated) , Included Union (insignificant) , Mechanical Damage , Over Extended Limbs (isolated) , Wounds (minor)		Endemic
T26	Casuarina glauca (Swamp-Oak)	18	4,5,6,5	0.39	0.52	4.7	68.8	2.5	19.9	Early Mature	Fair	Good	15-40yrs	High	High	Co-Dominant Stems (included bark) , Deadwood Moderate (30-100mm) , Dieback (isolated) , Suppressed , Weak Branch Attachments (isolated) , Wounds (minor)		Endemic
T27	Casuarina glauca (Swamp-Oak)	16	3,3,3,3	0.32	0.4	3.8	46.3	2.3	15.9	Semi Mature	Fair	Fair	15-40yrs	Medium	Medium	Co-Dominant Stems (included bark) , Crown Density (60-80%) , Deadwood Moderate (30-100mm) , Included Union (moderate) , Suppressed		Endemic
T28	Casuarina glauca (Swamp-Oak)	19	8,4,4,8	0.57	0.77	6.8	147.0	3.0	27.6	Mature	Fair	Good	40 plus	High	High	Co-Dominant Stems (included bark) , Crossing Rubbing Branches , Deadwood Moderate (30-100mm) , Dieback (isolated) , Included Union (insignificant) , Over Extended Limbs (isolated)		Endemic
T29	Casuarina glauca (Swamp-Oak)	19	5,5,5,5	0.46	0.66	5.5	95.7	2.8	24.3	Early Mature	Fair	Good	15-40yrs	High	High	Co-Dominant Stems (included bark) , Crossing Rubbing Branches , Deadwood Moderate (30-100mm) , Dieback (isolated) , Suppressed		Endemic
T30	Casuarina glauca (Swamp-Oak)	7	2,3,4,2	0.15	0.19	1.8	10.2	1.6	8.5	Juvenile	Fair	Fair	5-15yrs	Low	Low	Co-Dominant Stems (included bark) , Crown		Endemic

Tree ID	Tree Species	Height (M)	Spread (M) N, E, S, W	DBH (M)	DRB (M)	TPZ Radius (M)	TPZ Area (M2)	SRZ Radius (M)	SRZ Area (M2)	Age Class	Structure	Health	E.L.E	Landscape Significance (STARS)	Retention Value (STARS)	Observations and Defects	Notes	Species Origin
																Density (60-80%) , Deadwood Minor (0-30mm) , Epicormic Shoots (moderate) , Suppressed		
T31	Casuarina glauca (Swamp-Oak)	16	4,2,5,3,	0.3	0.38	3.6	40.7	2.2	15.3	Early Mature	Good	Fair	15-40yrs	High	High	Co-Dominant Stems (included bark) , Crossing Rubbing Branches , Deadwood Moderate (30-100mm) , Dieback (isolated) , Included Union (insignificant) , Over Extended Limbs (isolated) , Suppressed		Endemic
T32	Casuarina glauca (Swamp-Oak)	18	5,4,5,4	0.41	0.46	4.9	76.0	2.4	17.9	Mature	Good	Good	40 plus	High	High	Co-Dominant Stems , Crossing Rubbing Branches , Deadwood Moderate (30-100mm) , Dieback (isolated) , Included Bark (branches) , Included Union (insignificant) , Over Extended Limbs (isolated) , Weak Branch Attachments (isolated) , Wounds (minor)		Endemic
T33	Casuarina glauca (Swamp-Oak)	19	4,5,5,4	0.42	0.5	5.0	79.8	2.5	19.2	Mature	Good	Good	40 plus	High	High	Co-Dominant Stems , Crossing Rubbing Branches , Deadwood Minor (0-30mm) , Dieback (isolated)		Endemic
T34	Harpophyllum caffrum (Kaffir Plum)	9	5,5,5,5	0.25	0.32	3.0	28.3	2.1	13.2	Semi Mature	Fair	Fair	15-40yrs	Exempt	Exempt	Co-Dominant Stems (included bark)		Exotic
T35	Cupressus species (Conifer)	14	5,4,2,5	0.4	0.56	4.8	72.4	2.6	21.1	Mature	Good	Good	40 plus	Exempt	Exempt	Co-Dominant Stems (included bark) , Crossing Rubbing Branches , Deadwood Minor (0-30mm)		Exotic

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T36	Harpophyllum caffrum (Kaffir Plum)	14	5,5,5,5	0.4	0.66	4.8	72.4	2.8	24.3	Mature	Good	Good	15-40yrs	Exempt	Exempt	Co-Dominant Stems		Exotic
T37	Harpophyllum caffrum (Kaffir Plum)	16	9,9,9,9	1.21	1.11	14.5	662.3	3.5	37.6	Mature	Fair	Good	40 plus	Exempt	Exempt	Co-Dominant Stems (included bark) , Deadwood Minor (0-30mm) , Epicormic Shoots (minor) , Included Bark (branches) , Over Extended Limbs (isolated) , Previous Failures (isolated) , Weak Branch Attachments (isolated) , Wounds (minor)		Exotic
T38	Cinnamomum camphora (Camphor Laurel)	9	4,4,4,4	0.34	0.66	4.1	52.3	2.8	24.3	Juvenile	Fair	Good	40 plus	Environmental Weed	Exempt	Co-Dominant Stems (included bark) , Crossing Rubbing Branches , Epicormic Shoots (moderate)		Noxious Weed
T39	Glochidion ferdinandi (Cheese Tree)	12	4,4,4,5	0.28	0.31	3.4	35.5	2.0	12.9	Semi Mature	Fair	Good	15-40yrs	Medium	Medium	Deadwood Minor (0-30mm) , Included Bark (branches)		Endemic
T40	Cupressus species (Conifer)	11	2,2,2,2	0.13	0.15	1.6	7.6	1.5	7.0	Juvenile	Good	Fair	15-40yrs	Exempt	Exempt	Co-Dominant Stems		Exotic
T41	Harpophyllum caffrum (Kaffir Plum)	8	6,5,6,6	0.56	0.77	6.7	141.9	3.0	27.6	Early Mature	Fair	Good	15-40yrs	Exempt	Exempt	Co-Dominant Stems (included bark)		Exotic
T42	Eucalyptus robusta (Swamp Mahogany)	16	6,5,6,4	0.36	0.42	4.3	58.6	2.3	16.6	Semi Mature	Good	Fair	40 plus	High	High	Deadwood Moderate (30-100mm) , Dieback (isolated) , Epicormic Shoots (minor)		Endemic
T43	Eucalyptus robusta (Swamp Mahogany)	12	6,6,6,6	0.37	0.42	4.4	61.9	2.3	16.6	Semi Mature	Good	Fair	15-40yrs	High	High	Deadwood Moderate (30-100mm) , Dieback (isolated) , Previous Failures (isolated)		Endemic
T44	Eucalyptus robusta	14	2,2,2,2	0.18	0.23	2.2	14.7	1.8	10.0	Juvenile	Good	Fair	15-40yrs	Medium	Medium	Deadwood Minor (0-30mm)		Endemic

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	(Swamp Mahogany)																	
T45	Syagrus romanzoffiana (Cocos Palm)	9	2,2,2,2	0.22	0.28	2.6	21.9	1.9	11.8	Semi Mature	Good	Good	40 plus	Environmental Weed	Exempt			Noxious Weed
T46	Angophora costata (Sydney Red Gum)	11	3,2,4 e	0.22	0.29	2.6	21.9	2.0	12.2	Juvenile	Good	Very Poor	1-5yrs	Low	Low	Deadwood Moderate (30-100mm) , Dieback (major)		Native
T47	Eucalyptus robusta (Swamp Mahogany)	8	5,3,2,5	0.17	0.22	2.0	13.1	1.8	9.6	Juvenile	Fair	Fair	15-40yrs	Medium	Medium	Suppressed		Endemic
T48	Eucalyptus robusta (Swamp Mahogany)	14	4,5,6,4	0.36	0.42	4.3	58.6	2.3	16.6	Semi Mature	Good	Good	40 plus	High	High	Co-Dominant Stems , Deadwood Minor (0-30mm) , Dieback (isolated) , Over Extended Limbs (isolated)		Endemic
T49	Eucalyptus robusta (Swamp Mahogany)	14	5,6,5,5	0.31	0.39	3.7	43.5	2.2	15.6	Semi Mature	Good	Good	40 plus	High	High	Deadwood Moderate (30-100mm) , Dieback (isolated) , Epicormic Shoots (minor) , Included Bark (branches)		Endemic
T50	Pittosporum undulatum (Sweet Pittosporum)	6	3,3,3,3	0.18	0.19	2.2	14.7	1.6	8.5	Juvenile	Fair	Good	15-40yrs	Exempt	Exempt	Co-Dominant Stems		Native
T51	Melaleuca linarifolia (Snow in Summer)	6	3,2,4,3	0.22	0.28	2.6	21.9	1.9	11.8	Semi Mature	Good	Good	15-40yrs	Medium	Medium	Co-Dominant Stems (included bark)		Native
T52	Angophora costata (Sydney Red Gum)	12	4,4,3,4	0.36	0.44	4.3	58.6	2.3	17.3	Semi Mature	Good	Good	40 plus	Medium	Medium	Co-Dominant Stems , Deadwood Minor (0-30mm)		Native
T53	Angophora costata	10	3,2,2,4	0.19	0.22	2.3	16.3	1.8	9.6	Semi Mature	Good	Fair	15-40yrs	Medium	Medium	Deadwood Minor (0-30mm)		Native

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	(Sydney Red Gum)																	
T54	Casuarina glauca (Swamp-Oak)	12	2,2,3,2	0.23	0.26	2.8	23.9	1.9	11.1	Semi Mature	Fair	Good	15-40yrs	High	High	Deadwood Minor (0-30mm) , Included Bark (branches) , Weak Branch Attachments (isolated)		Endemic
T55	Casuarina glauca (Swamp-Oak)	12	2,2,2,2	0.17	0.22	2.0	13.1	1.8	9.6	Juvenile	Fair	Good	15-40yrs	High	High	Co-Dominant Stems (included bark) , Suppressed		Endemic
T56	Casuarina glauca (Swamp-Oak)	14	3,3,3,4	0.46	0.35	5.5	95.7	2.1	14.2	Semi Mature	Good	Good	15-40yrs	High	High	Co-Dominant Stems (included bark) , Deadwood Minor (0-30mm)		Endemic
T57	Casuarina glauca (Swamp-Oak)	13	3,3,3,3	0.26	0.33	3.1	30.6	2.1	13.6	Semi Mature	Good	Good	15-40yrs	High	High	Co-Dominant Stems , Deadwood Minor (0-30mm)		Endemic
T58	Casuarina glauca (Swamp-Oak)	14	4,4,4,4	0.32	0.4	3.8	46.3	2.3	15.9	Semi Mature	Good	Good	40 plus	High	High	Deadwood Minor (0-30mm)		Endemic
T59	Casuarina glauca (Swamp-Oak)	15	4,4,3,2	0.31	0.36	3.7	43.5	2.2	14.6	Semi Mature	Fair	Good	40 plus	High	High	Co-Dominant Stems , Deadwood Minor (0-30mm) , Suppressed		Endemic
T60	Callistemon viminalis (Weeping Bottlebrush)	6	4,5,6,4	0.4	0.41	4.8	72.4	2.3	16.3	Mature	Good	Good	40 plus	Medium	Medium	Co-Dominant Stems (included bark) , Included Bark (natural for species)		Native
T61	Callistemon viminalis (Weeping Bottlebrush)	6	4,3,5,4	0.38	0.39	4.6	65.3	2.2	15.6	Mature	Good	Good	15-40yrs	Medium	Medium	Co-Dominant Stems (included bark) , Dieback (minor) , Included Bark (natural for species)		Native
T62	Magnolia grandiflora (White magnolia)	7	3,3,3,3	0.27	0.3	3.2	33.0	2.0	12.5	Semi Mature	Good	Good	40 plus	Low	Medium	Co-Dominant Stems		Exotic
T63	Melaleuca quinquenervia (Broad-Leafed Paperbark)	15	5,6,7,5	0.8	1.11	9.6	289.5	3.5	37.6	Mature	Fair	Good	40 plus	High	High	Co-Dominant Stems , Deadwood Moderate (30-100mm) , Dieback (isolated)		Endemic

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T64	Syzygium paniculatum (Magenta Lilly Pilly)	9	1,2,3,1	0.33	0.4	4.0	49.3	2.3	15.9	Semi Mature	Fair	Poor	5-15yrs	Medium	Low	Co-Dominant Stems (included bark) , Suppressed		Native
T65	Syzygium paniculatum (Magenta Lilly Pilly)	15	6,4,6,3	0.55	0.6	6.6	136.8	2.7	22.4	Mature	Fair	Good	40 plus	High	High	Co-Dominant Stems , Deadwood Minor (0-30mm) , Dieback (isolated)		Native
T66	Cupressus species (Conifer)	9	2,3,2,3	0.22	0.31	2.6	21.9	2.0	12.9	Early Mature	Good	Good	15-40yrs	Exempt	Exempt	Co-Dominant Stems (included bark)		Exotic
T67	Cupressus species (Conifer)	10	3,3,3,2	0.29	0.33	3.5	38.0	2.1	13.6	Early Mature	Good	Good	15-40yrs	Exempt	Exempt	Co-Dominant Stems		Exotic
T68	Archontophoenix spp. (Alex/Bagalow Palm)	8	2,2,2,2	0.18	0.44	2.2	14.7	2.3	17.3	Semi Mature	Fair	Good	40 plus	Medium	Medium		Group of 4 clumping palms	Native
T69	Ficus benjimina (Weeping Fig)	6	4,4,4,4	0.29	0.3	3.5	38.0	2.0	12.5	Juvenile	Good	Poor	5-15yrs	Exempt	Exempt	Co-Dominant Stems (included bark)		Native
T70	Callistemon viminalis (Weeping Bottlebrush)	6	4,4,4,4	0.36	0.44	4.3	58.6	2.3	17.3	Early Mature	Good	Good	15-40yrs	Medium	Medium	Co-Dominant Stems (included bark) , Included Bark (natural for species)		Native
T71	Callistemon viminalis (Weeping Bottlebrush)	6	5,4,3,5	0.44	0.47	5.3	87.6	2.4	18.2	Early Mature	Fair	Good	15-40yrs	Medium	Medium	Poor Pruning (powerlines)		Native
T72	Casuarina glauca (Swamp-Oak)	13	3,3,3,3	0.34	0.4	4.1	52.3	2.3	15.9	Semi Mature	Good	Good	40 plus	High	High		Stand of trees with integrated root system, roots noted growing through existing bitumen	Endemic
T73	Casuarina glauca (Swamp-Oak)	13	3,3,3,3	0.28	0.39	3.4	35.5	2.2	15.6	Semi Mature	Good	Good	40 plus	High	High		Stand of trees with integrated root system, roots noted	Endemic

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																	growing through existing bitumen	
T74	Casuarina glauca (Swamp-Oak)	13	3,3,3,3	0.2	0.4	2.4	18.1	2.3	15.9	Semi Mature	Good	Good	40 plus	High	High		Stand of trees with integrated root system, roots noted growing through existing bitumen	Endemic
T75	Casuarina glauca (Swamp-Oak)	13	3,3,3,3	0.25	0.3	3.0	28.3	2.0	12.5	Semi Mature	Good	Good	40 plus	High	High		Stand of trees with integrated root system, roots noted growing through existing bitumen	Endemic
T76	Casuarina glauca (Swamp-Oak)	13	3,3,3,3	0.25	0.3	3.0	28.3	2.0	12.5	Semi Mature	Good	Good	40 plus	High	High		Stand of trees with integrated root system, roots noted growing through existing bitumen	Endemic
T77	Casuarina glauca (Swamp-Oak)	13	3,3,3,3	0.36	0.41	4.3	58.6	2.3	16.3	Semi Mature	Good	Good	40 plus	High	High		Stand of trees with integrated root system, roots noted growing through existing bitumen	Endemic
T78	Casuarina glauca (Swamp-Oak)	13	3,3,3,3	0.2	0.28	2.4	18.1	1.9	11.8	Semi Mature	Good	Good	40 plus	High	High		Stand of trees with integrated root system, roots noted growing through existing bitumen	Endemic
T79	Casuarina glauca (Swamp-Oak)	13	3,3,3,3	0.32	0.43	3.8	46.3	2.3	16.9	Semi Mature	Good	Good	40 plus	High	High		Stand of trees with integrated root system, roots noted growing through existing bitumen	Endemic
T80	Casuarina glauca (Swamp-Oak)	13	3,3,3,3	0.3	0.35	3.6	40.7	2.1	14.2	Semi Mature	Good	Good	40 plus	High	High		Stand of trees with integrated root system, roots noted growing through existing bitumen	Endemic

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T81	Casuarina glauca (Swamp-Oak)	13	3,3,3,3	0.25	0.3	3.0	28.3	2.0	12.5	Semi Mature	Good	Good	40 plus	High	High		Stand of trees with integrated root system, roots noted growing through existing bitumen	Endemic
T82	Casuarina glauca (Swamp-Oak)	13	3,3,3,3	0.25	0.3	3.0	28.3	2.0	12.5	Semi Mature	Good	Good	40 plus	High	High		Stand of trees with integrated root system, roots noted growing through existing bitumen	Endemic
T83	Casuarina glauca (Swamp-Oak)	13	3,3,3,3	0.25	0.3	3.0	28.3	2.0	12.5	Semi Mature	Good	Good	40 plus	High	High		Stand of trees with integrated root system, roots noted growing through existing bitumen	Endemic
T84	Casuarina glauca (Swamp-Oak)	13	3,3,3,3	0.25	0.3	3.0	28.3	2.0	12.5	Semi Mature	Good	Good	40 plus	High	High		Stand of trees with integrated root system, roots noted growing through existing bitumen	Endemic
T85	Casuarina glauca (Swamp-Oak)	13	3,3,3,3	0.25	0.3	3.0	28.3	2.0	12.5	Semi Mature	Good	Good	40 plus	High	High		Stand of trees with integrated root system, roots noted growing through existing bitumen	Endemic
T86	Casuarina glauca (Swamp-Oak)	13	3,3,3,3	0.25	0.3	3.0	28.3	2.0	12.5	Semi Mature	Good	Good	40 plus	High	High		Stand of trees with integrated root system, roots noted growing through existing bitumen	Endemic
T87	Casuarina glauca (Swamp-Oak)	13	3,3,3,3	0.47	0.45	5.6	99.9	2.4	17.6	Semi Mature	Good	Good	40 plus	High	High		Stand of trees with integrated root system, roots noted growing through existing bitumen	Endemic
T88	Casuarina glauca (Swamp-Oak)	13	3,3,3,3	0.34	0.4	4.1	52.3	2.3	15.9	Semi Mature	Good	Good	40 plus	High	High		Stand of trees with integrated root system, roots noted	Endemic

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																	growing through existing bitumen	
T89	Casuarina glauca (Swamp-Oak)	13	3,3,3,3	0.25	0.3	3.0	28.3	2.0	12.5	Semi Mature	Good	Good	40 plus	High	High		Stand of trees with integrated root system, roots noted growing through existing bitumen	Endemic
T90	Casuarina glauca (Swamp-Oak)	13	3,3,3,3	0.25	0.3	3.0	28.3	2.0	12.5	Semi Mature	Good	Good	40 plus	High	High		Stand of trees with integrated root system, roots noted growing through existing bitumen	Endemic
T91	Casuarina glauca (Swamp-Oak)	13	3,3,3,3	0.28	0.32	3.4	35.5	2.1	13.2	Semi Mature	Good	Good	40 plus	High	High		Stand of trees with integrated root system, roots noted growing through existing bitumen	Endemic
T92	Casuarina glauca (Swamp-Oak)	13	3,3,3,3	0.36	0.39	4.3	58.6	2.2	15.6	Semi Mature	Good	Good	40 plus	High	High		Stand of trees with integrated root system, roots noted growing through existing bitumen	Endemic
T93	Casuarina glauca (Swamp-Oak)	13	3,3,3,3	0.25	0.3	3.0	28.3	2.0	12.5	Semi Mature	Good	Good	40 plus	High	High		Stand of trees with integrated root system, roots noted growing through existing bitumen	Endemic
T94	Casuarina glauca (Swamp-Oak)	13	3,3,3,3	0.25	0.3	3.0	28.3	2.0	12.5	Semi Mature	Good	Good	40 plus	High	High		Stand of trees with integrated root system, roots noted growing through existing bitumen	Endemic
T95	Casuarina glauca (Swamp-Oak)	13	3,3,3,3	0.32	0.4	3.8	46.3	2.3	15.9	Semi Mature	Good	Good	40 plus	High	High		Stand of trees with integrated root system, roots noted growing through existing bitumen	Endemic

Tree ID	Tree Species	Height (M)	Spread (M) N, E, S, W	DBH (M)	DRB (M)	TPZ Radius (M)	TPZ Area (M2)	SRZ Radius (M)	SRZ Area (M2)	Age Class	Structure	Health	E.L.E	Landscape Significance (STARS)	Retention Value (STARS)	Observations and Defects	Notes	Species Origin
T96	Casuarina glauca (Swamp-Oak)	13	3,3,3,3	0.41	0.47	4.9	76.0	2.4	18.2	Semi Mature	Good	Good	40 plus	High	High		Stand of trees with integrated root system, roots noted growing through existing bitumen	Endemic
T97	Casuarina glauca (Swamp-Oak)	13	3,3,3,3	0.46	0.49	5.5	95.7	2.5	18.9	Semi Mature	Good	Good	40 plus	High	High		Stand of trees with integrated root system, roots noted growing through existing bitumen	Endemic
T98	Casuarina glauca (Swamp-Oak)	13	3,3,3,3	0.25	0.3	3.0	28.3	2.0	12.5	Semi Mature	Good	Good	40 plus	High	High		Stand of trees with integrated root system, roots noted growing through existing bitumen	Endemic
T99	Casuarina glauca (Swamp-Oak)	13	3,3,3,3	0.29	0.35	3.5	38.0	2.1	14.2	Semi Mature	Good	Good	40 plus	High	High		Stand of trees with integrated root system, roots noted growing through existing bitumen	Endemic
T100	Casuarina glauca (Swamp-Oak)	13	3,3,3,3	0.3	0.34	3.6	40.7	2.1	13.9	Semi Mature	Good	Good	40 plus	High	High		Stand of trees with integrated root system, roots noted growing through existing bitumen	Endemic
T101	Casuarina glauca (Swamp-Oak)	13	3,3,3,3	0.6	0.67	7.2	162.9	2.8	24.6	Semi Mature	Good	Good	40 plus	High	High		Stand of trees with integrated root system, roots noted growing through existing bitumen	Endemic
T102	Melaleuca quinquenervia (Broad-Leafed Paperbark)	18	7,8,7,8	0.99	1.12	11.9	443.4	3.5	37.8	Mature	Good	Good	15-40yrs	High	High	Cavity (minor) , Co-Dominant Stems (included bark) , Deadwood Minor (0-30mm) , Decay , Dieback (isolated) , Included Bark (natural for species)	Tree species renowned for having expansive root system, root concentration maybe higher in the carpark due to the curbstone	Endemic

Tree ID	Tree Species	Height (M)	Spread (M) N, E, S, W	DBH (M)	DRB (M)	TPZ Radius (M)	TPZ Area (M2)	SRZ Radius (M)	SRZ Area (M2)	Age Class	Structure	Health	E.L.E	Landscape Significance (STARS)	Retention Value (STARS)	Observations and Defects	Notes	Species Origin
																	on the Pittwater Rd. side of the tree	
T103	Melaleuca quinquenervia (Broad-Leafed Paperbark)	14	6,7,6,7	0.88	1	10.6	350.3	3.3	34.4	Mature	Good	Good	40 plus	High	High	Co-Dominant Stems (included bark) , Crossing Rubbing Branches , Deadwood Minor (0-30mm) , Dieback (isolated) , Included Bark (natural for species) , Wounds (minor)		Endemic
T104	Melaleuca quinquenervia (Broad-Leafed Paperbark)	15	7,7,8,7	0.89	0.98	10.7	358.3	3.3	33.8	Mature	Good	Good	40 plus	High	High	Co-Dominant Stems (included bark) , Crossing Rubbing Branches , Deadwood Minor (0-30mm) , Dieback (isolated) , Included Bark (natural for species) , Root Scalping , Wounds (minor)		Endemic
T105	Melaleuca quinquenervia (Broad-Leafed Paperbark)	15	8,6,6,8	1	0.99	12.0	452.4	3.3	34.1	Mature	Good	Good	40 plus	High	High	Co-Dominant Stems (included bark) , Crossing Rubbing Branches , Deadwood Minor (0-30mm) , Dieback (isolated) , Included Bark (natural for species) , Over Extended Limbs (isolated) , Root Scalping , Weak Branch Attachments (isolated) , Wounds (minor)		Endemic
T106	Glochidion ferdinandi (Cheese Tree)	6	5,5,5,5	0.34	0.43	4.1	52.3	2.3	16.9	Semi Mature	Good	Good	15-40yrs	Medium	Medium	Co-Dominant Stems	Root spread likely constrained due to sandstone retaining wall	Endemic
T107	Glochidion ferdinandi (Cheese Tree)	7	5,4,4,5	0.46	0.55	5.5	95.7	2.6	20.8	Semi Mature	Good	Good	15-40yrs	Medium	Medium	Co-Dominant Stems (included bark)	Root spread likely constrained due to sandstone retaining wall	Endemic

Tree ID	Tree Species	Height (M)	Spread (M) N, E, S, W	DBH (M)	DRB (M)	TPZ Radius (M)	TPZ Area (M2)	SRZ Radius (M)	SRZ Area (M2)	Age Class	Structure	Health	E.L.E	Landscape Significance (STARS)	Retention Value (STARS)	Observations and Defects	Notes	Species Origin
T108	Glochidion ferdinandi (Cheese Tree)	8	5,6,7,5	0.34	0.48	4.1	52.3	2.4	18.6	Semi Mature	Good	Good	15-40yrs	Medium	Medium	Co-Dominant Stems (included bark) , Deadwood Minor (0-30mm)	Root spread likely constrained due to sandstone retaining wall	Endemic
T109	Melaleuca quinquenervia (Broad-Leafed Paperbark)	18	8,2,3,8	1.23	1.4	14.8	684.4	3.8	45.6	Mature	Good	Good	40 plus	High	High	Co-Dominant Stems (included bark) , Deadwood Moderate (30-100mm) , Dieback (isolated) , Included Bark (natural for species)	Root spread likely constrained due to sandstone retaining wall	Endemic
T110	Melaleuca quinquenervia (Broad-Leafed Paperbark)	15	5,6,4,6	0.67	0.78	8.0	203.1	3.0	27.9	Mature	Good	Good	40 plus	High	High	Co-Dominant Stems (included bark) , Crossing Rubbing Branches , Deadwood Minor (0-30mm) , Included Bark (natural for species)	Root spread likely constrained due to sandstone retaining wall	Endemic
T111	Glochidion ferdinandi (Cheese Tree)	8	4,5,4,5	0.4	0.55	4.8	72.4	2.6	20.8	Semi Mature	Fair	Fair	40 plus	Medium	Medium	Co-Dominant Stems		Endemic
T112	Casuarina glauca (Swamp-Oak)	7	2,2,2,2	0.16	0.19	2.0	12.6	1.6	8.5	Juvenile	Fair	Good	15-40yrs	Low	Medium	Co-Dominant Stems (included bark)		Endemic
T113	Melaleuca quinquenervia (Broad-Leafed Paperbark)	18	6,7,5,6	0.89	1.33	10.7	358.3	3.7	43.7	Mature	Good	Good	40 plus	High	High	Co-Dominant Stems (included bark) , Deadwood Moderate (30-100mm) , Dieback (isolated) , Included Bark (natural for species) , Over Extended Limbs (isolated)	Root spread likely constrained due to sandstone retaining wall	Endemic
T114	Syagrus romanzoffiana (Cocos Palm)	12	4,4,4,4	0.28	0.33	3.4	35.5	2.1	13.6	Mature	Good	Good	40 plus	Exempt	Exempt			Exotic

12.2 SCHEDULE 2: DEVELOPMENT IMPACT

Table 18

Tree ID	Tree Species	Height (M)	TPZ Area (M2)	SRZ Radius (M)	SRZ Area (M2)	In Development Footprint	In SRZ	TPZ Encroachment (M2)	TPZ Encroachment %	In Footprint/ Major/ Minor/ Nil	Encroachment Type	Retain/ Remove	Generic Tree Protection Measures	Specific Tree Protection Measures
T1	Casuarina glauca (Swamp-Oak)	12	30.6	2.0	12.9	Yes		0.73	0.00%	In Footprint	Realligned stormwater and wetland area	Remove		
T2	Casuarina glauca (Swamp-Oak)	15	87.6	2.6	21.1	Yes		0	0.00%	In Footprint	Realligned stormwater and wetland area	Remove		
T3	Casuarina glauca (Swamp-Oak)	15	162.9	2.9	26.7	Yes		0	0.00%	In Footprint	Realligned stormwater and wetland area	Remove		
T4	Casuarina glauca (Swamp-Oak)	15	131.9	2.8	25.2	Yes		0	0.00%	In Footprint	Realligned stormwater and wetland area	Remove		
T5	Casuarina glauca (Swamp-Oak)	15	99.9	2.5	20.2	Yes		0	0.00%	In Footprint	Realligned stormwater and wetland area	Remove		
T6	Casuarina glauca (Swamp-Oak)	11	18.1	1.9	11.5	Yes		0	0.00%	In Footprint	Realligned stormwater and wetland area	Remove		
T7	Casuarina glauca (Swamp-Oak)	15	79.8	2.5	20.2	Yes		0	0.00%	In Footprint	Realligned stormwater and wetland area	Remove		
T8	Casuarina glauca (Swamp-Oak)	16	87.6	2.5	20.2	Yes		0	0.00%	In Footprint	Realligned stormwater and wetland area	Remove		
T9	Casuarina glauca (Swamp-Oak)	17	191.1	3.0	27.6	Yes		0	0.00%	In Footprint	Realligned stormwater and wetland area	Remove		
T10	Casuarina glauca (Swamp-Oak)	18	275.2	3.2	31.8	Yes		0	0.00%	In Footprint	Bulk Earthworks for new clubhouse	Remove		
T11	Casuarina glauca (Swamp-Oak)	19	52.3	2.3	15.9	Yes		0	0.00%	In Footprint	Bulk Earthworks for new clubhouse	Remove		
T12	Casuarina glauca (Swamp-Oak)	14	16.3	1.8	10.0	Yes		0	0.00%	In Footprint	Bulk Earthworks for new clubhouse	Remove		
T13	Casuarina glauca (Swamp-Oak)	17	79.8	2.6	20.8	Yes		6.13	0.00%	In Footprint	Bulk Earthworks for new clubhouse	Remove		
T14	Casuarina glauca (Swamp-Oak)	14	43.5	2.2	15.3	Yes		4.26	0.00%	In Footprint	Bulk Earthworks for new clubhouse	Remove		

Tree ID	Tree Species	Height (M)	TPZ Area (M2)	SRZ Radius (M)	SRZ Area (M2)	In Development Footprint	In SRZ	TPZ Encroachment (M2)	TPZ Encroachment %	In Footprint/ Major/ Minor/ Nil	Encroachment Type	Retain/ Remove	Generic Tree Protection Measures	Specific Tree Protection Measures
T15	Casuarina glauca (Swamp-Oak)	13	14.7	1.8	9.6	Yes			0.00%	In Footprint	Bulk Earthworks for new clubhouse	Remove		
T16	Casuarina glauca (Swamp-Oak)	13	21.9	2.0	12.5	Yes			0.00%	In Footprint	Bulk Earthworks for new clubhouse	Remove		
T17	Casuarina glauca (Swamp-Oak)	14	23.9	2.0	12.2	Yes			0.00%	In Footprint	Bulk Earthworks for new clubhouse	Remove		
T18	Casuarina glauca (Swamp-Oak)	18	87.6	2.6	21.1	Yes			0.00%	In Footprint	Bulk Earthworks for new clubhouse	Remove		
T19	Casuarina glauca (Swamp-Oak)	17	72.4	2.6	20.8	Yes			0.00%	In Footprint	Bulk Earthworks for new clubhouse	Remove		
T20	Casuarina glauca (Swamp-Oak)	17	122.3	2.8	24.3	Yes			0.00%	In Footprint	Bulk Earthworks for new clubhouse	Remove		
T21	Casuarina glauca (Swamp-Oak)	13	26.1	2.0	12.2	Yes			0.00%	In Footprint	Bulk Earthworks for new clubhouse	Remove		
T22	Casuarina glauca (Swamp-Oak)	14	26.1	2.0	12.2	Yes			0.00%	In Footprint	Bulk Earthworks for new clubhouse	Remove		
T23	Casuarina glauca (Swamp-Oak)	19	87.6	2.4	17.9	Yes		0	0.00%	In Footprint	Bulk Earthworks for new clubhouse	Remove		
T24	Casuarina glauca (Swamp-Oak)	16	46.3	2.3	16.3	Yes		0	0.00%	In Footprint	Bulk Earthworks for new clubhouse	Remove		
T25	Casuarina glauca (Swamp-Oak)	19	76.0	2.5	20.2	Yes		0	0.00%	In Footprint	Bulk Earthworks for new clubhouse	Remove		
T26	Casuarina glauca (Swamp-Oak)	18	68.8	2.5	19.9	Yes		0	0.00%	In Footprint	Bulk Earthworks for new clubhouse	Remove		
T27	Casuarina glauca (Swamp-Oak)	16	46.3	2.3	15.9	Yes		0	0.00%	In Footprint	Bulk Earthworks for new clubhouse	Remove		
T28	Casuarina glauca (Swamp-Oak)	19	147.0	3.0	27.6	Yes		0	0.00%	In Footprint	Bulk Earthworks for new clubhouse	Remove		
T29	Casuarina glauca (Swamp-Oak)	19	95.7	2.8	24.3	Yes		0	0.00%	In Footprint	Bulk Earthworks for new clubhouse	Remove		
T30	Casuarina glauca (Swamp-Oak)	7	10.2	1.6	8.5	Yes		0	0.00%	In Footprint	Bulk Earthworks for new clubhouse	Remove		

Tree ID	Tree Species	Height (M)	TPZ Area (M2)	SRZ Radius (M)	SRZ Area (M2)	In Development Footprint	In SRZ	TPZ Encroachment (M2)	TPZ Encroachment %	In Footprint/ Major/ Minor/ Nil	Encroachment Type	Retain/ Remove	Generic Tree Protection Measures	Specific Tree Protection Measures
T31	Casuarina glauca (Swamp-Oak)	16	40.7	2.2	15.3	Yes		0	0.00%	In Footprint	Bulk Earthworks for new clubhouse	Remove		
T32	Casuarina glauca (Swamp-Oak)	18	76.0	2.4	17.9	Yes		0	0.00%	In Footprint	Bulk Earthworks for new clubhouse	Remove		
T33	Casuarina glauca (Swamp-Oak)	19	79.8	2.5	19.2	Yes		0	0.00%	In Footprint	Bulk Earthworks for new clubhouse	Remove		
T34	Harpophyllum caffrum (Kaffir Plum)	9	28.3	2.1	13.2	Yes		0	0.00%	In Footprint	Bulk Earthworks for new clubhouse	Remove		
T35	Cupressus species (Conifer)	14	72.4	2.6	21.1	Yes		0	0.00%	In Footprint	Exempt species, tree is earmarked for removal on demolition plan, presumably for upgrades to the stormwater and wetland area	Remove		
T36	Harpophyllum caffrum (Kaffir Plum)	14	72.4	2.8	24.3	Yes		0	0.00%	In Footprint	Exempt species, tree is earmarked for removal on demolition plan, presumably for upgrades to the stormwater and wetland area	Remove		
T37	Harpophyllum caffrum (Kaffir Plum)	16	662.3	3.5	37.6	Yes		0	0.00%	In Footprint	Exempt species, tree is earmarked for removal on demolition plan, presumably for upgrades to the stormwater and wetland area	Remove		
T38	Cinnamomum camphora (Camphor Laurel)	9	52.3	2.8	24.3	Yes		0	0.00%	In Footprint	tree is earmarked for removal on demolition plan, presumably for upgrades to the stormwater and wetland area	Remove		
T39	Glochidion ferdinandi (Cheese Tree)	12	35.5	2.0	12.9	Yes		0	0.00%	In Footprint	Exempt species, tree is earmarked for removal on demolition plan, presumably for upgrades	Remove		

Tree ID	Tree Species	Height (M)	TPZ Area (M2)	SRZ Radius (M)	SRZ Area (M2)	In Development Footprint	In SRZ	TPZ Encroachment (M2)	TPZ Encroachment %	In Footprint/ Major/ Minor/ Nil	Encroachment Type	Retain/ Remove	Generic Tree Protection Measures	Specific Tree Protection Measures
											to the stormwater and wetland area			
T40	Cupressus species (Conifer)	11	7.6	1.5	7.0	Yes		0	0.00%	In Footprint	Exempt species, tree is earmarked for removal on demolition plan, presumably for upgrades to the stormwater and wetland area	Remove		
T41	Harpophyllum caffrum (Kaffir Plum)	8	141.9	3.0	27.6	Yes		0	0.00%	In Footprint	Exempt species, tree is earmarked for removal on demolition plan, presumably for upgrades to the stormwater and wetland area	Remove		
T42	Eucalyptus robusta (Swamp Mahogany)	16	58.6	2.3	16.6	Yes		0	0.00%	In Footprint	Endemic tree species earmarked for removal on demolition plan from carpark passes through SRZ	Remove		
T43	Eucalyptus robusta (Swamp Mahogany)	12	61.9	2.3	16.6	Yes		0	0.00%	In Footprint	Endemic tree species earmarked for removal on demolition plan	Retain	TPZ Fencing	
T44	Eucalyptus robusta (Swamp Mahogany)	14	14.7	1.8	10.0	Yes		0	0.00%	In Footprint	Endemic tree species earmarked for removal on demolition plan	Retain	TPZ Fencing	
T45	Syagrus romanzoffiana (Cocos Palm)	9	21.9	1.9	11.8	No		0	0.00%	Nil		Retain	TPZ Fencing	
T46	Angophora costata (Sydney Red Gum)	11	21.9	2.0	12.2	No		0	0.00%	Nil		Retain	TPZ Fencing	
T47	Eucalyptus robusta	8	13.1	1.8	9.6	No		0	0.00%	Nil		Retain	TPZ Fencing	

Tree ID	Tree Species	Height (M)	TPZ Area (M2)	SRZ Radius (M)	SRZ Area (M2)	In Development Footprint	In SRZ	TPZ Encroachment (M2)	TPZ Encroachment %	In Footprint/ Major/ Minor/ Nil	Encroachment Type	Retain/ Remove	Generic Tree Protection Measures	Specific Tree Protection Measures
	(Swamp Mahogany)													
T48	Eucalyptus robusta (Swamp Mahogany)	14	58.6	2.3	16.6	No		0	1.25%	Minor	TPZ extends on to the subject site, encroachemnt marginal	Retain	TPZ Fencing	
T49	Eucalyptus robusta (Swamp Mahogany)	14	43.5	2.2	15.6	No		0	0.00%	Nil		Retain	TPZ Fencing	
T50	Pittosporum undulatum (Sweet Pittosporum)	6	14.7	1.6	8.5	No		3.3	0.00%	Nil		Retain	TPZ Fencing	
T51	Melaleuca linarifolia (Snow in Summer)	6	21.9	1.9	11.8	No		0	0.00%	Nil		Retain	TPZ Fencing	
T52	Angophora costata (Sydney Red Gum)	12	58.6	2.3	17.3	No		0	0.00%	Nil		Retain	TPZ Fencing	
T53	Angophora costata (Sydney Red Gum)	10	16.3	1.8	9.6	No		0	0.00%	Nil		Retain	TPZ Fencing	
T54	Casuarina glauca (Swamp-Oak)	12	23.9	1.9	11.1	No		9.57	0.00%	Nil		Retain	TPZ Fencing	
T55	Casuarina glauca (Swamp-Oak)	12	13.1	1.8	9.6	No		56.4	0.00%	Nil		Retain	TPZ Fencing	
T56	Casuarina glauca (Swamp-Oak)	14	95.7	2.1	14.2	No		27.6	0.00%	Nil		Retain	TPZ Fencing	
T57	Casuarina glauca (Swamp-Oak)	13	30.6	2.1	13.6	No		24.9	0.00%	Nil		Retain	TPZ Fencing	

Tree ID	Tree Species	Height (M)	TPZ Area (M2)	SRZ Radius (M)	SRZ Area (M2)	In Development Footprint	In SRZ	TPZ Encroachment (M2)	TPZ Encroachment %	In Footprint/ Major/ Minor/ Nil	Encroachment Type	Retain/ Remove	Generic Tree Protection Measures	Specific Tree Protection Measures
T58	Casuarina glauca (Swamp-Oak)	14	46.3	2.3	15.9	No		47.8	0.00%	Nil		Retain	TPZ Fencing	
T59	Casuarina glauca (Swamp-Oak)	15	43.5	2.2	14.6	No		0	0.00%	Nil		Retain	TPZ Fencing	
T60	Callistemon viminalis (Weeping Bottlebrush)	6	72.4	2.3	16.3	No		0	8.47%	Minor	TPZ extend onto subject site, minor encroachment	Retain	TPZ Fencing	
T61	Callistemon viminalis (Weeping Bottlebrush)	6	65.3	2.2	15.6	No		0	6.52%	Minor	TPZ extend onto subject site, minor encroachment	Retain	TPZ Fencing	
T62	Magnolia grandiflora (White magnolia)	7	33.0	2.0	12.5	Yes		144.73	0.00%	In Footprint	New tennis courts	Remove		
T63	Melaleuca quinquenervia (Broad-Leafed Paperbark)	15	289.5	3.5	37.6	Yes		0	0.00%	In Footprint	New tennis courts	Remove		
T64	Syzygium paniculatum (Magenta Lilly Pilly)	9	49.3	2.3	15.9	Yes		0	0.00%	In Footprint	New tennis courts	Remove		
T65	Syzygium paniculatum (Magenta Lilly Pilly)	15	136.8	2.7	22.4	Yes		0	0.00%	In Footprint	New tennis courts	Remove		
T66	Cupressus species (Conifer)	9	21.9	2.0	12.9	Yes		75	0.00%	In Footprint	New tennis courts	Remove		
T67	Cupressus species (Conifer)	10	38.0	2.1	13.6	Yes			0.00%	In Footprint	New tennis courts	Remove		
T68	Archontophoenix spp.	8	14.7	2.3	17.3	Yes			0.00%	In Footprint	New tennis courts	Remove		

Tree ID	Tree Species	Height (M)	TPZ Area (M2)	SRZ Radius (M)	SRZ Area (M2)	In Development Footprint	In SRZ	TPZ Encroachment (M2)	TPZ Encroachment %	In Footprint/ Major/ Minor/ Nil	Encroachment Type	Retain/ Remove	Generic Tree Protection Measures	Specific Tree Protection Measures
	(Alex/Bagalow Palm)													
T69	Ficus benjimina (Weeping Fig)	6	38.0	2.0	12.5	Yes			0.00%	In Footprint	New tennis courts	Remove		
T70	Callistemon viminalis (Weeping Bottlebrush)	6	58.6	2.3	17.3	No			0.00%	Nil		Retain	TPZ Fencing	
T71	Callistemon viminalis (Weeping Bottlebrush)	6	87.6	2.4	18.2	No			0.00%	Nil		Retain	TPZ Fencing	
T72	Casuarina glauca (Swamp-Oak)	13	52.3	2.3	15.9	No			0.00%	Nil		Retain	TPZ Fencing	
T73	Casuarina glauca (Swamp-Oak)	13	35.5	2.2	15.6	No			0.00%	Nil		Retain	TPZ Fencing	
T74	Casuarina glauca (Swamp-Oak)	13	18.1	2.3	15.9	No			0.00%	Nil		Retain	TPZ Fencing	
T75	Casuarina glauca (Swamp-Oak)	13	28.3	2.0	12.5	No			0.00%	Nil		Retain	TPZ Fencing	
T76	Casuarina glauca (Swamp-Oak)	13	28.3	2.0	12.5	No			0.00%	Nil		Retain	TPZ Fencing	
T77	Casuarina glauca (Swamp-Oak)	13	58.6	2.3	16.3	No			0.00%	Nil		Retain	TPZ Fencing	
T78	Casuarina glauca (Swamp-Oak)	13	18.1	1.9	11.8	No			0.00%	Nil		Retain	TPZ Fencing	
T79	Casuarina glauca (Swamp-Oak)	13	46.3	2.3	16.9	No			0.00%	Nil		Retain	TPZ Fencing	
T80	Casuarina glauca (Swamp-Oak)	13	40.7	2.1	14.2	No			0.00%	Nil		Retain	TPZ Fencing	
T81	Casuarina glauca (Swamp-Oak)	13	28.3	2.0	12.5	No			0.00%	Nil		Retain	TPZ Fencing	
T82	Casuarina glauca (Swamp-Oak)	13	28.3	2.0	12.5	No			0.00%	Nil		Retain	TPZ Fencing	

Tree ID	Tree Species	Height (M)	TPZ Area (M2)	SRZ Radius (M)	SRZ Area (M2)	In Development Footprint	In SRZ	TPZ Encroachment (M2)	TPZ Encroachment %	In Footprint/ Major/ Minor/ Nil	Encroachment Type	Retain/ Remove	Generic Tree Protection Measures	Specific Tree Protection Measures
T83	Casuarina glauca (Swamp-Oak)	13	28.3	2.0	12.5	No			0.00%	Nil		Retain	TPZ Fencing	
T84	Casuarina glauca (Swamp-Oak)	13	28.3	2.0	12.5	No			0.00%	Nil		Retain	TPZ Fencing	
T85	Casuarina glauca (Swamp-Oak)	13	28.3	2.0	12.5	No			0.00%	Nil		Retain	TPZ Fencing	
T86	Casuarina glauca (Swamp-Oak)	13	28.3	2.0	12.5	No			0.00%	Nil		Retain	TPZ Fencing	
T87	Casuarina glauca (Swamp-Oak)	13	99.9	2.4	17.6	No			0.00%	Nil		Retain	TPZ Fencing	
T88	Casuarina glauca (Swamp-Oak)	13	52.3	2.3	15.9	No			0.00%	Nil		Retain	TPZ Fencing	
T89	Casuarina glauca (Swamp-Oak)	13	28.3	2.0	12.5	No			0.00%	Nil		Retain	TPZ Fencing	
T90	Casuarina glauca (Swamp-Oak)	13	28.3	2.0	12.5	No			0.00%	Nil		Retain	TPZ Fencing	
T91	Casuarina glauca (Swamp-Oak)	13	35.5	2.1	13.2	No			0.00%	Nil		Retain	TPZ Fencing	
T92	Casuarina glauca (Swamp-Oak)	13	58.6	2.2	15.6	No			0.00%	Nil		Retain	TPZ Fencing	
T93	Casuarina glauca (Swamp-Oak)	13	28.3	2.0	12.5	No			0.00%	Nil		Retain	TPZ Fencing	
T94	Casuarina glauca (Swamp-Oak)	13	28.3	2.0	12.5	No			0.00%	Nil		Retain	TPZ Fencing	
T95	Casuarina glauca (Swamp-Oak)	13	46.3	2.3	15.9	No			0.00%	Nil		Retain	TPZ Fencing	
T96	Casuarina glauca (Swamp-Oak)	13	76.0	2.4	18.2	No			0.00%	Nil		Retain	TPZ Fencing	
T97	Casuarina glauca (Swamp-Oak)	13	95.7	2.5	18.9	No			3.45%	Minor	New carpark	Retain	TPZ Fencing	
T98	Casuarina glauca (Swamp-Oak)	13	28.3	2.0	12.5	No			0.00%	Nil		Retain	TPZ Fencing	

Tree ID	Tree Species	Height (M)	TPZ Area (M2)	SRZ Radius (M)	SRZ Area (M2)	In Development Footprint	In SRZ	TPZ Encroachment (M2)	TPZ Encroachment %	In Footprint/ Major/ Minor/ Nil	Encroachment Type	Retain/ Remove	Generic Tree Protection Measures	Specific Tree Protection Measures
T99	Casuarina glauca (Swamp-Oak)	13	38.0	2.1	14.2	No			0.00%	Nil		Retain	TPZ Fencing	
T100	Casuarina glauca (Swamp-Oak)	13	40.7	2.1	13.9	No			0.00%	Nil		Retain	TPZ Fencing	
T101	Casuarina glauca (Swamp-Oak)	13	162.9	2.8	24.6	No			5.88%	Minor	New carpark	Retain	TPZ Fencing	
T102	Melaleuca quinquenervia (Broad-Leafed Paperbark)	18	443.4	3.5	37.8	No			12.72%	Major	New carpark	Retain	TPZ Fencing	Employ tree sensitive construction for the carpark i.e. build at grade with no excavation, or project arborist supervision to ensure all roots are cut cleanly and employ remediation plan for remainder of TPZ to encourage replacement root growth.
T103	Melaleuca quinquenervia (Broad-Leafed Paperbark)	14	350.3	3.3	34.4	No			7.88%	Minor	New carpark	Retain	TPZ Fencing	
T104	Melaleuca quinquenervia (Broad-Leafed Paperbark)	15	358.3	3.3	33.8	No			6.95%	Minor	New carpark	Retain	TPZ Fencing	
T105	Melaleuca quinquenervia (Broad-Leafed Paperbark)	15	452.4	3.3	34.1	No			10.57%	Major	New carpark	Retain	TPZ Fencing	Employ tree sensitive construction for the carpark i.e. build at grade with no excavation, or project arborist supervision to ensure all roots are cut cleanly and employ remediation plan for remainder of TPZ to encourage replacement root growth.
T106	Glochidion ferdinandi (Cheese Tree)	6	52.3	2.3	16.9	No			0.00%	Nil		Retain	TPZ Fencing	
T107	Glochidion ferdinandi (Cheese Tree)	7	95.7	2.6	20.8	No			0.00%	Nil		Retain	TPZ Fencing	

Tree ID	Tree Species	Height (M)	TPZ Area (M2)	SRZ Radius (M)	SRZ Area (M2)	In Development Footprint	In SRZ	TPZ Encroachment (M2)	TPZ Encroachment %	In Footprint/ Major/ Minor/ Nil	Encroachment Type	Retain/ Remove	Generic Tree Protection Measures	Specific Tree Protection Measures
T108	Glochidion ferdinandi (Cheese Tree)	8	52.3	2.4	18.6	No			0.00%	Nil		Retain	TPZ Fencing	
T109	Melaleuca quinquenervia (Broad-Leafed Paperbark)	18	684.4	3.8	45.6	No			21.15%	Major	New carpark and access road	Retain	TPZ Fencing	Tree is loacted on Pittwater Rd. which is separated from the subject site via a sandstone retaining wall. No foreseen impact.
T110	Melaleuca quinquenervia (Broad-Leafed Paperbark)	15	203.1	3.0	27.9	No			0.00%	Nil		Retain	TPZ Fencing	
T111	Glochidion ferdinandi (Cheese Tree)	8	72.4	2.6	20.8	No			0.00%	Nil		Retain	TPZ Fencing	
T112	Casuarina glauca (Swamp-Oak)	7	12.6	1.6	8.5	No			0.00%	Nil		Retain	TPZ Fencing	
T113	Melaleuca quinquenervia (Broad-Leafed Paperbark)	18	358.3	3.7	43.7	No			20.93%	Major	Realligned stormwater and wetland area	Retain	TPZ Fencing	Tree is loacted on Pittwater Rd. which is separated from the subject site via a sandstone retaining wall. No foreseen impact.
T114	Syagrus romanzoffiana (Cocos Palm)	12	35.5	2.1	13.6	Yes			0.00%	In Footprint	New Tennis courts	Remove		

13 APPENDIX 2: STARS

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. An example of its use in an Arboricultural report is shown as Appendix A.

Tree Significance - Assessment Criteria

1. 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 Councils 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.

2. Medium Significance in landscape

- The tree is in fair-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*.

3. Low Significance in landscape

- The tree is in fair-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/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 monocultural stand in its entirety e.g. hedge.

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

Tree Life Expectancy	Tree Significance				
	High	Medium	Low		
Long >40 years					
Medium 15-40 years					
Short <1-15 years					
Remove / Dead					

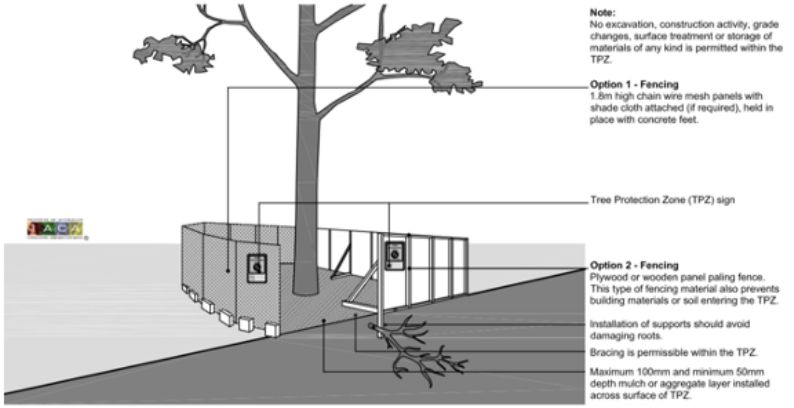
Legend for Matrix Assessment	
	Priority for Retention (High) – These trees are considered important for retention and should be retained and protected. Design modification and re-location of building/s should be considered to accommodate the setbacks as prescribed by the Australian Standard 4970 *Protection of tree on development sites*. Tree sensitive construction measures must be implemented if works are to proceed within the Tree Protection Zone.
	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.
	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.
	Priority for Removal – These trees are considered hazardous, or in irreversible decline, or weeds and should be removed irrespective of development.

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

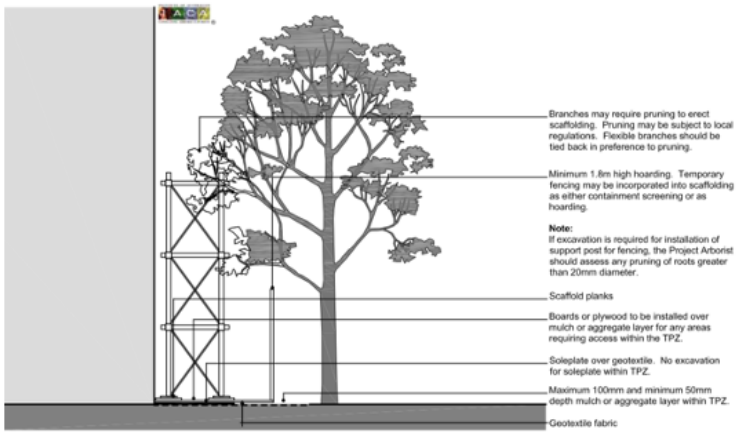
14 APPENDIX 3: SULE

	1. Long	2. Medium	3. Short	4. Removal	5. Moved or Replaced
	Trees that appeared to be retainable at the time of assessment for more than 40 years with an acceptable level of risk.	Trees that appeared to be retainable at the time of assessment for 15 – 40 years with an acceptable level of risk.	Trees that appeared to be retainable at the time of assessment for 5 – 15 years with an acceptable level of risk.	Trees that should be removed within the next 5 years.	Trees which can be reliably moved or replaced.
A	Structurally sound trees located in positions that can accommodate future growth.	Trees that may only live between 15 and 40 years.	Trees that may only live between 5 and 15 more years.	Dead, dying, suppressed or declining trees through disease or inhospitable conditions.	Small trees less than 5m in height.
B	Trees that could be made suitable for retention in the long term by remedial tree care.	Trees that may live for more than 40 years but would be removed for safety or nuisance reasons.	Trees that may live for more than 15 years but would be removed for safety or nuisance reasons.	Dangerous trees through instability on recent loss of adjacent trees.	Young trees less than 15 years old but over 5m in heights
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 would 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.	Damaged trees through structural defects including cavities, decay, included bark, wounds or poor form.	Trees that have been pruned to artificially control growth.
D		Trees that could be made suitable for retention in the medium term by remedial tree care.	Trees that require substantial remedial tree care and are only suitable for retention in the short term.	Damaged trees that are clearly not safe to retain.	
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 plantings.	
F				Trees that are damaging or may cause damage to existing structures within 5 years.	
G				Trees that will become dangerous after removal of other trees for reasons given in (A) to (F).	

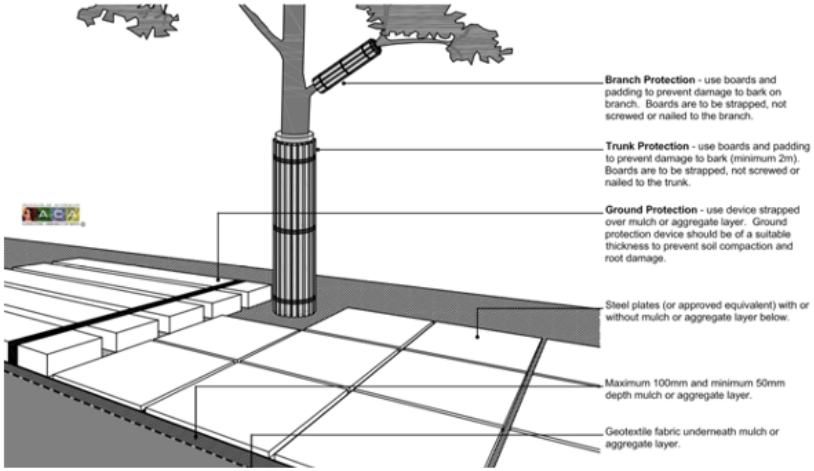
15 APPENDIX 4: TREE PROTECTION (GENERIC)



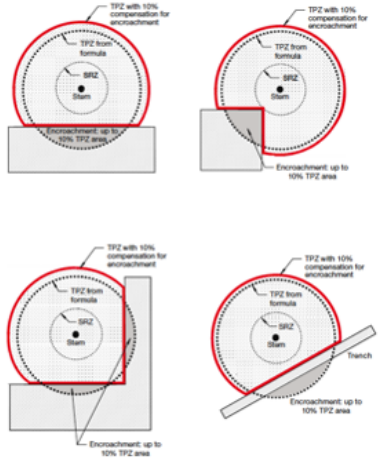
1. Tree Protection Fencing



2. Scaffolding Within TPZ

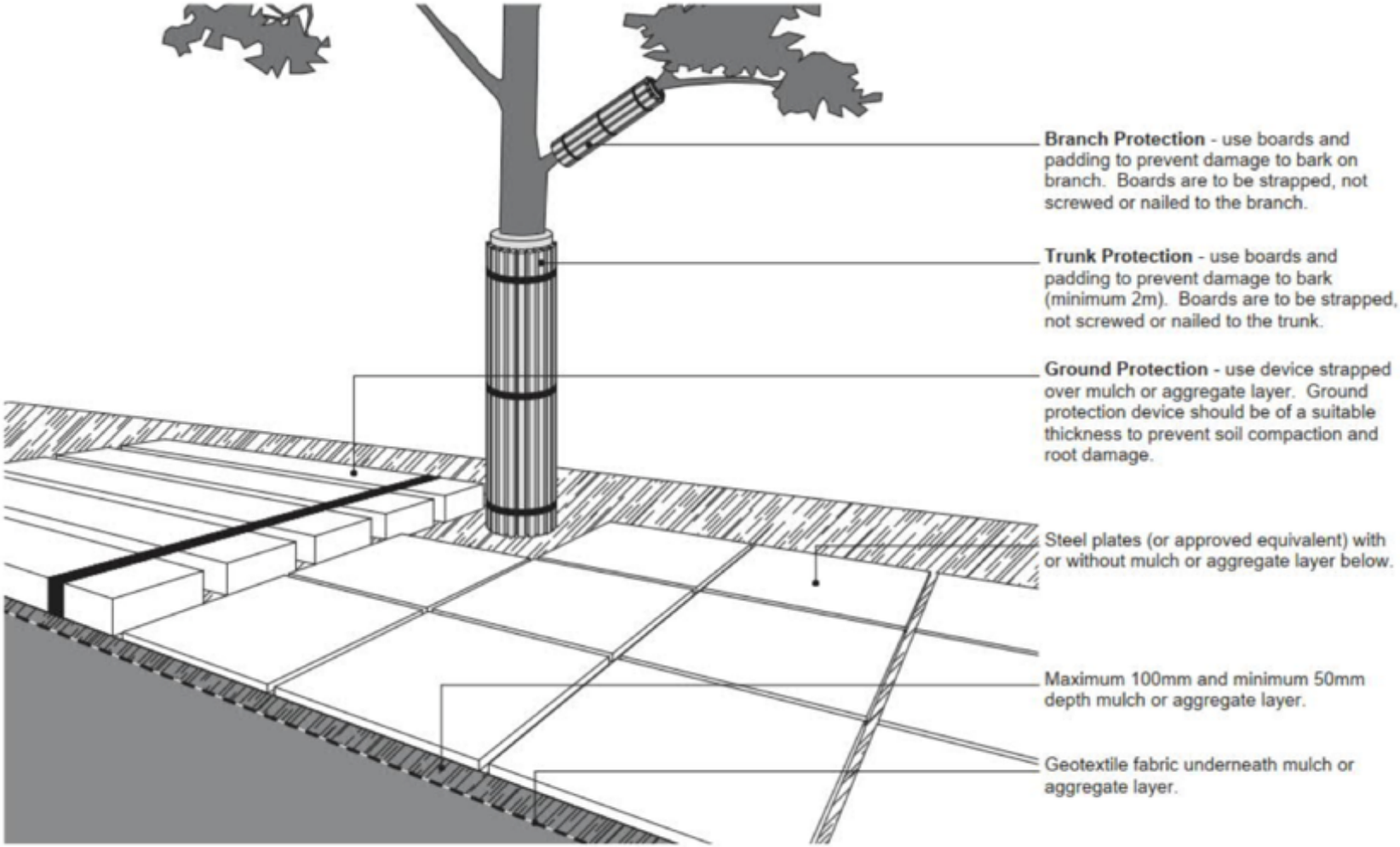


3. Examples Of Trunk, Branch and Ground Protection

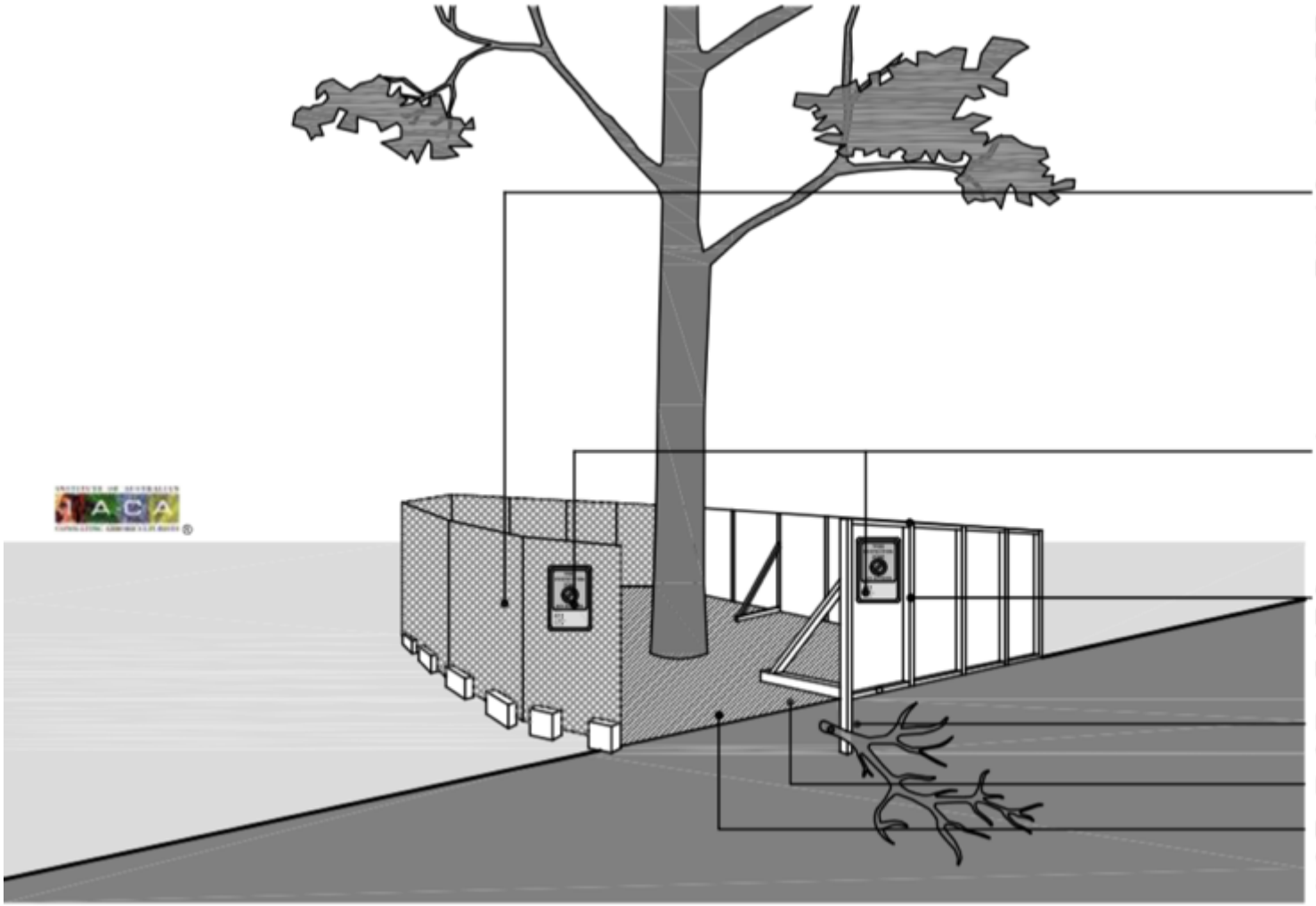


4. TPZ Encroachment Compensation

16 TRUNK AND GROUND PROTECTION



17 TPZ FENCING



Note:
No excavation, construction activity, grade changes, surface treatment or storage of materials of any kind is permitted within the TPZ.

Option 1 - Fencing
1.8m high chain wire mesh panels with shade cloth attached (if required), held in place with concrete feet.

Tree Protection Zone (TPZ) sign

Option 2 - Fencing
Plywood or wooden panel paling fence. This type of fencing material also prevents building materials or soil entering the TPZ.

Installation of supports should avoid damaging roots.

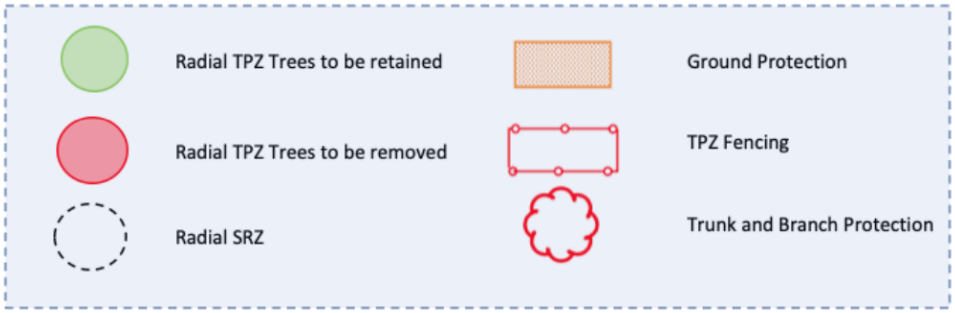
Bracing is permissible within the TPZ.

Maximum 100mm and minimum 50mm depth mulch or aggregate layer installed across surface of TPZ.

18 SITE DRAWINGS

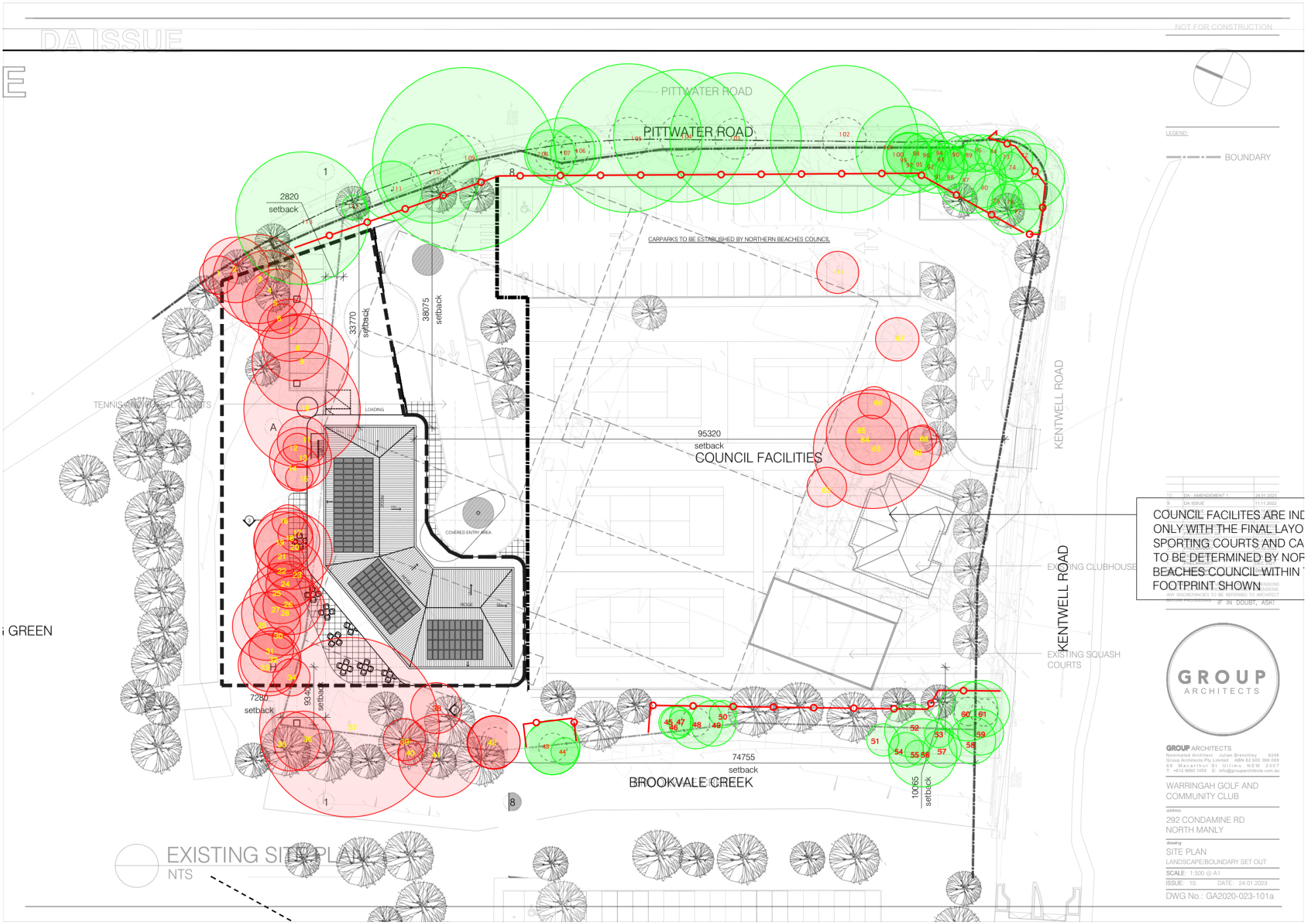
DRAWING 1: TREE LOCATION PLAN/TREE PROTECTION PLAN

SITE DRAWING LEGEND



DA ISSUE

NOT FOR CONSTRUCTION



COUNCIL FACILITES ARE IND
ONLY WITH THE FINAL LAYO
SPORTING COURTS AND CA
TO BE DETERMINED BY NOR
BEACHES COUNCIL WITHIN
FOOTPRINT SHOWN

GREEN

EXISTING SITE PLAN
NTS

10.	DA - AMENDEMENT 1	24.01.2023
9.	DA ISSUE	11.11.2022

ANY DISCREPANCIES TO BE REFERRED TO ARCHITECT BEFORE PROCEEDING IF IN DOUBT, ASK!

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WARRINGAH GOLF AND
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address
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drawing
SITE PLAN
LANDSCAPE/BOUNDARY SET OUT

SCALE: 1:500 @ A1

ISSUE: 10. DATE: 24.01.2023

DWG No.: GA2020-023-101a