8 HOPE AVENUE, NORTH MANLY, NSW 2100

ARBORICULTURAL IMPACT ASSESSMENT

Date May 2019

Clients Mr Bretton Pack and Mrs Jenny Pack

LGA Northern Beaches Council - Warringah

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CONTENTS

PRELIMINARY TREE ASSESSMENT

1 SUMMARY

There are three sections to this report.

This first section is a Preliminary Tree Assessment of trees growing at the site.

Development is proposed for the site and trees located within 5 metres of proposed works have been assessed.

Trees within the subject area are protected under Warringah Local Environmental Plan 2011 (WLEP2011).

A Visual Tree Assessment was undertaken of ten (10) trees within the subject area that are located near to proposed works. Trees were also assessed for Useful Life Expectancy and Landscape Significance, and rated with Retention Values so that planning decisions could be made regarding the retention of the highest number of most significant trees.

In summary it was found that:

Four (4) trees have a High Retention Value, being Trees 2, 5, 7 and 8.

Five (5) trees have a Medium Retention Value, being Trees 3, 4, 6, 9, and 10.

One (1) tree has a Low Retention Value, Tree1, with further assessment recommended to determine if the tree is a candidate for removal due to observed defects (cavities with decay) in the basal area.

IMPORTANT NOTE Excavation, or rock cutting and removal that may be required within or near to the TPZ of any tree that is to be retained shall be required to be undertaken with extreme care to prevent collapse of the sandy topsoils or deeper soil profiles, where roots may be located. Sheet piling on the line of excavation may be recommended to be used to prevent potential collapse of soil profiles.

2 INTRODUCTION

2.1 Reason for the report

This report has been commissioned by the site owners Mr Bretton Pack and Mrs Jenny Pack, to accompany a Development Application to Northern Beaches Council - Warringah for proposed works on the site.

2.2 Aims of the report

The aims of this report are to:

- Provide relevant information to the client, architects and Northern Beaches Council – Warringah regarding trees located in areas of the site where development is proposed.
- Assess the dimensions, health, condition and other characteristics of site trees, including any obvious defective structures.
- From the collected data, determine retention values, useful life expectancies, and the contribution to the site in terms of significance and amenity, of site trees.

- Provide planning and design options to prevent unnecessary removal of trees and to minimise impacts on retained trees.
- Comply with the requirements of *Australian Standard Protection of Trees on Development Sites AS-4970-2009.*

2.3 The site, and relevant development controls

The site is located at 8 Hope Avenue, North Manly, NSW, in the Northern Beaches Council – Warringah local government area (LGA).

The land is controlled by Warringah Local Environmental Plan 2011 (WLEP2011).

Warringah Council DCP 2011 (WDCP2011) Part A, Part E - E1 Private Property Tree Management, and Appendices 8, 9, 11 and 12 have been referred to in the preparation of this report.

- Protected trees in the Northern Beaches Council LGA as at 21 February 2019 (*Trees on Private Property*) are generally trees over 5 metres in height, of species that are not included on the exempt tree species list.
- Trees and vegetation within 2 metres of an approved building (not including decks, patios, pergolas or sheds even if attached to a main building) are also not prescribed.

The site is zoned Low Density Residential.

2.4 Qualifications of consulting arborist, author of report

The author of this report has AQF Level 5 qualification as required in WDCP2011.

2.1 Site location - topography, wind and aspect

The part of the site that is the subject of this report is located on the lower side of a southeast facing slope, mainly exposed to winds from southeast through to west. The topography is generally on natural grades.

The area is described on the Tree Location Plan TP01 (Appendix D) of this report, based on the site survey.

Figure 1: Aerial view of site (courtesy of Property Search, Northern Beaches Council website).

2.2 Site description, vegetation and soils

The group of trees in the lower area of the site, fronting Hope Avenue, contains a stand of locally indigenous trees in a natural setting. There are large sandstone rock outcrops amongst the trees.

An old stone-walled garage on Hope Avenue is accessed from the house on the ridge above by means of old paths, steps and low walls that wind down the natural contours.

Site trees are generally mature specimens of *Angophora costata* (Sydney Red Gum) and *Corymbia gummifera* (Spotted Gum) being local tree species.

Topsoil was observed to be sandy.

Under planting is of native and exotic groundcover and shrub species.

3 METHOD

3.1 Trees on development sites

This report refers to the Australian Standard *Protection of Trees on Development Sites AS4970-2009* for guidance on the principles for protecting trees on land subject to development.

3.2 Visual Tree Assessment (VTA)

Site inspection on 16 June 2017 was undertaken to assess the trees from ground level only. No aerial inspections were made. A Visual Tree Assessment (VTA) of the biological and mechanical characteristics of the tree was undertaken (Mattheck, Bethge and Weber 2015).

Observations from ground level included, but were not limited to:

- Species identification and tree characteristics.
- Dimensions - height estimated by eye, canopy spread with tape measure,
- Diameter of the stem at breast height of 1.4 metres above ground level at the base of tree (DBH), and diameter of the stem at the base, above the root flare, (DAB) were determined by measuring the circumference with tape at these points, then by calculation.
- Canopy health and condition - foliage density, size and colour; location, size and quantity of dieback; deadwood; epicormic growth; and signs of stress.
- Branches - signs of structural defects, insect and animal activity, and disease. Previous pruning was noted.
- Stem - the base of the stem and root crown area was inspected for signs of cavities, wounds, decay, basal flare, degree of lean, soil upheaval, root damage, surface roots and structural defects.
- Photographs were taken.

3.3 Soils

Soil profile investigation and testing were not undertaken.

3.4 Other site observations

- Proximity of trees to buildings and structures.
- Aspect and protection/exposure to prevailing winds.
- Overland flow path of water.
- Species, dimensions and location of other trees and vegetation in the trees' proximity.
- Signs of erosion, recent excavation, construction works, and level changes.
- Site usage by people and vehicles.

3.5 Summary of assessment methodologies

Type of assessment	Description	Source	Appendix/Location
VTA	Visual Tree Assessment (VTA) of the biological and mechanical characteristics of trees was undertaken (Mattheck, Bethge and Weber)	Mattheck, Bethge and Weber (2015)	Appendix A
ULE	Useful Life Expectancy (ULE) categories (updated 01/04/01)	Barrell, Jeremy (2001)	Appendix B
Landscape Significance LS	IACA Significance of a Tree, Assessment Rating System (STARS)© based on tree condition and form; heritage, ecological and amenity values; was applied according to the assessment criteria.	IACA Significance of a Tree, Assessment Rating System (STARS)© Institute of Australian Consulting Arborists (IACA 2010)©	Appendix C
Retention Value RV	IACA Significance of a Tree, Assessment Rating System (STARS)© Table 1.0 Tree Retention Value – Priority Matrix combines the Landscape Significance rating with Estimated Life Expectancy, to determine Retention Value (RV),	IACA Significance of a Tree, Assessment Rating System (STARS)© Institute of Australian Consulting Arborists (IACA 2010)©	Appendix C
TPZ	Tree Protection Zones were calculated from the DBH of trees	AS4970-2009	Appendix A
SRZ	Structural Root Zones were calculated from the DAB of trees	AS4970-2009	Appendix A

3.6 Plans and diagrams

Assessed trees are shown and numbered on Tree Location Plan TP01 (Appendix D), based on the Survey provided.

The following plans and drawings were relied upon for this arboricultural assessment.

Author	Title	Reference	Date	Drawing Number and Version
CMS Surveyors Pty Ltd	Level and Detail Survey	14830detail	20.05.2016	Sheet 1
Alluvial Landscape Architects	Landscape and Garage Floor Plan	AL18 004	02.05.2019	L_201 Rev D

4 RESULTS AND OBSERVATIONS

4.1 Visual Tree Assessment (VTA)

Detailed results are shown on Tree Assessment Schedule (Appendix A).

4.2 Tree Significance Schedule

The following is a summary of assessed and determined values, as per the methodology outlined in 3.5.

Tree No.	Species Name	Common Name	ULE	Landscape Significance (LS)	Retention Value (RV)
1	Angophora costata	Sydney Red Gum	Short/Remove?	M	L?
2	Corymbia maculata	Spotted Gum	Medium	H	H
3	Camellia sasanqua	Small leaf Camellia	Medium	M	M
4	Angophora costata	Sydney Red Gum	Medium	M	M
5	Angophora costata	Sydney Red Gum	Long	H	H
6	Angophora costata	Sydney Red Gum	Medium	M	M
7	Angophora costata	Sydney Red Gum	Medium	H	H
8	Angophora costata	Sydney Red Gum	Medium	H	H
9	Camellia sasanqua	Small leaf Camellia	Medium	M	M
10	Angophora costata	Sydney Red Gum	Medium	M	M

KEY

ULE: Short 5-15 years **Medium** 15-40 years **Long** 40+years

Landscape Significance and Retention Values: H High **M** Medium **L** Low **R** Removal

? Further testing recommended

4.3 Exempt or weed species

Exempt species under WLEP2011 that are located within the subject area include *Pittosporum undulatum*, under 8 metres in height. These trees were not assessed.

4.4 Tree Protection Zones and Structural Root Zones

Refer to calculated values in Tree Assessment Schedule (Appendix A).

5 Discussion

5.1 Age of trees and general description

The majority of site trees are semi-mature and mature *Angophora costata* (Sydney Red Gum). It is reasonable to assume that the mature trees are remnant from before the time of development of the existing house (50 years?) with the younger trees having self-seeded, as this is common for the species in this location.

5.2 Landscape Significance rating (LS)

Four trees have High Landscape Significance.

Six trees have Medium Landscape Significance.

5.3 Useful Life Expectancy (ULE)

Trees 2, 3, 4, 6, 7, 8, 9 and 10 have a Medium ULE. (Medium ULE trees appear to be retainable at the time of assessment for **15–40 years** with an acceptable level of risk, assuming reasonable maintenance).

Tree 1 has a Short ULE due to an identified structural defect – this tree is strongly recommended to be tested with Picus® Sonic Tomograph, or Resistograph® (or both) to identify the extent of the cavity at the base of the tree, to determine if the tree is a candidate for removal. The stability of the tree may be suspect, and the tree may be required to be removed in the short term. (Trees with Short ULE are only retainable for 5-15 years with an acceptable level of risk, assuming reasonable maintenance).

Tree 5 is a semi mature tree with a Long ULE. (Long ULE trees appear to be retainable at the time of assessment for **more than 40 years** with an acceptable level of risk, assuming reasonable maintenance).

5.4 Retention Values

To estimate the retention value of the trees, the ages discussed in 5.1 were assumed.

Tree 1 has been rated with Low Retention Value, due to the structural defect/cavity at the base.

- Trees with Low Retention Value are not considered to be important for retention, and do not require special planning considerations to be implemented to enable their retention.

Trees 3, 4, 6, 9 and 10 are rated with Medium Retention Value.

- Trees with Medium Retention Value may be retained and protected, however are considered to be less critical for retention. Their retention should remain a priority, however, and removal considered only if all planning and design options for building and other structures have been considered.

Tree 2, 5, 7 and 8 have High Retention Values.

- Trees assigned High Retention Value are recommended to be retained as a priority. This may require design, placement of buildings and infrastructure so as to minimise any adverse impact with respect to the Tree Protection Zones. The extent of the canopy with regards to proposed development building height must be considered in site and building design and placement, and significant pruning of canopy or roots of these trees is not generally acceptable.

5.5 Tree 1 *Angophora costata* (Sydney Red Gum)

Figure 2: Note cavity at base of Tree 1 - extent of hollow in basal area of tree to be investigated. Probe extends 300mm into this hole on South side. Another wound with active decay is present on Eastern side. The tree is located near the old garage wall.

Figure 3: Group of trees to east of old garage retaining wall. Pittosporum undulatum is an exempt species and may be removed without requiring Council permission, when under 8 metres in height. ***NOTE THAT IT IS HIGHLY LIKELY THAT ROOTS OF BOTH TREE 1 AND TREE 2 WILL BE PRESENT UP TO THE LINE OF THE GARAGE WALL.*** *There may be roots within the wall. Ideally the old garage wall will be left in situ so as not to disturb the tree roots. New walls could be built within the footprint of the old wall.*

6 RECOMMENDATIONS

6.1 Considerations regarding tree retention and removal in site development

Tree 1 has been rated with Low Retention Value, due to the structural defect/cavity at the base.

- Trees with Low Retention Value are not considered to be important for retention, and do not require special planning considerations to be implemented to enable their retention.

Trees 3, 4, 6, 9 and 10 are rated with Medium Retention Value.

- Trees with Medium Retention Value may be retained and protected, however are considered to be less critical for retention. Their retention should remain a priority, however, and removal considered only if all planning and design options for building and other structures have been considered.

Tree 2, 5, 7 and 8 have High Retention Values.

Trees assigned High Retention Value are recommended to be retained as a priority. This may require design, placement of buildings and infrastructure so as to minimise any adverse impact with respect to the Tree Protection Zones. The extent of the canopy with regards to proposed development building height must be considered in site and building design and placement, and significant pruning of canopy or roots of these trees is not generally acceptable.

IMPORTANT NOTE Excavation, or rock cutting and removal that may be required within or near to the TPZ of any tree that is to be retained shall be required to be undertaken with extreme care to prevent collapse of the sandy topsoils or deeper soil profiles, where roots may be located. Sheet piling on the line of excavation is strongly recommended to be used to prevent potential collapse of soil profiles.

DEVELOPMENT IMPACT ASSESSMENT

7 SUMMARY

7.1 Development impacts on site trees

- **No protected trees are proposed to be removed in the proposal.**
- The new garage is to be built within the old garage building footprint on the western side. The proposed new garage floor level is approximately 200mm lower than the floor or the old garage, and excavation at ground level is proposed. **The proposed new garage footprint is within the TPZs of Tree 1, Tree 2 and Tree 5.**
- Excavation is proposed to the north and to the east of the old garage for the new garage to be constructed. The excavation and walls shall be required to be built outside the SRZs of any site trees due to the extent of excavation required and the impact that this may have on tree stability or health. **Excavation is proposed within the TPZs of Tree 1, Tree 2 and Tree 5 and is on the theoretical line of the SRZs of Tree 2 and Tree 5.**
- **It should be noted that it is highly likely that there are roots of Tree 1, Tree 2 and Tree 5 present up to the line of the old garage wall. There may even be roots growing within the existing wall structure.** Pending engineers' advice, ideally the old garage wall on the western side will be left in situ so as not to disturb the roots of Tree 1 and Tree 2. The new wall would preferably be built within the footprint of the old wall.
- Excavation, or rock cutting and removal that may be required within or near to the TPZ of any tree that is to be retained shall be required to be undertaken with extreme care to prevent collapse of the sandy topsoils or deeper soil profiles, where roots may be located. ***Sheet piling on the line of all excavation is strongly recommended to be used, to prevent potential collapse of soil profiles.***
- With careful management, there will be an acceptable impact on Tree 1. Encroachment into the TPZ of the new garage wall, if built on the same line as existing, and the piered, above-ground steps is an approximate area of 5 square metres, or 11% of the TPZ area of 45 sqm. **Proposed piers for the above-ground steps are within the SRZ of Tree 1.** The new steps shall be required to be supported on individual piers, the locations of which are to be hand dug prior to final pier locations being finalized. This is a requirement of works within the root zones of retained trees, so as to locate roots of significant dimension (over 30mm in diameter) to enable assessment of the number, direction and dimensions of roots that are present, and therefore enable decisions as to which roots are possible to be removed.
- There will be a marginal encroachment, which is considered to be an acceptable impact on Tree 2, if managed carefully. Encroachment into the TPZ of the new garage wall, if built on the same line as existing, and the piered, above-ground steps is an approximate area of 5 square metres. **Proposed excavation for the new driveway is within the TPZ of Tree 2,** a further 10 square metres of encroachment**.** In total there is an impact of approximately 15 square metres or 8% of the TPZ area of 186 sqm. The SRZ is at 3.1 metres from the tree, which is approximately on the line of the old garage. **Proposed piers for steps are within the SRZ of Tree 2.** The new elevated stairs shall be required to be supported on individual piers, the locations of which are to be hand dug prior to final pier locations being finalized. This is a requirement of works within the root zones of retained trees, so as to locate roots of significant dimension (over 30mm

in diameter) to enable assessment of the number, direction and dimensions of roots that are present, and therefore enable decisions as to which roots are possible to be removed.

- **Important Note regarding Tree 2**: It must be taken into account that there may not be sufficient compensatory TPZ, contiguous to the TPZ, for new roots to develop if a significant number of roots are negatively impacted by the proposed works. It is noted that the neighbouring property has undertaken development works within the TPZ of the tree, which may have reduced the root volume opportunity available for compensatory development to ensure tree stability and health. A significant proportion of the TPZ for compensatory root growth is anticipated to be located in the neighbouring property. This must be taken into consideration in future decisions regarding additional root removal that is not currently anticipated.

- Retaining walls are proposed on the eastern side of the new garage, for the inclinator, and these shall be required to be built outside the SRZs of any site trees or neighbouring trees due to the extent of excavation required and the impact that this may have on tree stability or health. **Proposed retaining walls are within the TPZ of Tree 5.**

- There may potentially be a major encroachment on the TPZ of Tree 5. This will require root mapping investigation to determine the feasibility of the proposal. Encroachment into the TPZ for excavation and construction of the new garage wall to the north, assuming a cut batter of one metre beyond the proposed wall line, is an approximate area of 7 square metres of the TPZ. Further encroachment into the TPZ to excavate and build the retaining walls around the inclinator is an additional 7 square metres. In total there is an impact of approximately 14 square metres or 25% of the TPZ area of 55 sqm. **Generally, structural, tension roots are located uphill of trees but this is not always the case, especially on sites with rock outcrops. Root mapping needs to be undertaken to determine where roots are located, their dimensions and direction and number, and thus enable decisions to be made as to how many roots may be able to be severed for the proposed excavation on two sides of the tree (to the south and east). Root location cannot be accurately predicted from surface observation.** The root mapping should be undertaken on the lines of the retaining walls and also the proposed garage wall to the north. It may be that the retaining walls may be required to be set back further away from the tree. Root mapping must be undertaken by accepted, non- destructive means, by hand, and supervised by an arborist.

- Elevated boardwalk and steps, and an inclinator, are proposed throughout the remainder of the front setback. Old stone steps and paths are to be retained in situ. **Proposed piers for steps, boardwalk and inclinator will most likely be within the SRZs of most, if not all, retained trees**. All of these new elevated structures shall be required to be supported on individual piers, the locations of which are to be hand dug prior to final pier locations being finalized. This is a requirement of works within the root zones of retained trees, so as to locate roots of significant dimension (over 30mm in diameter) to enable assessment of the number, direction and dimensions of roots that are present, and therefore enable decisions as to which roots are possible to be removed.

- No trenching for services or other excavation, piers or footings, and/or additional structures above ground, shall be approved in the TPZ and SRZ of any trees unless it can be proven than the impact on roots is negligible. This may necessitate below-ground root investigation prior to design or installation of services/structures to determine the potential impact on the tree/trees and may not be possible – the viability and stability of a retained tree will depend on the size, number and location of roots that may be required to be severed.

7.2 Tree protection and specification

- Tree Protection Fencing to be erected, to exclude construction workers, storage of materials etc from the TPZ of all trees to be retained to a practical extent. Refer to the Tree Protection Plan and Specification for further direction
- Work in the vicinity of site trees will require additional care by site construction (building and landscape) managers and workers, and supervision by project arborist, so as not to damage roots during excavation and construction, or during the landscape works that are proposed.
- Planting that is proposed within the TPZ of retained trees that have High Retention Values should be with tubestock only.

7.3 Pruning

Any canopy pruning that is required shall be carried out as per the requirements of *Standards Australia 2007*, *Pruning of Amenity Trees*, *AS 4373-2007.*

7.4 Monitoring

All retained site trees should be monitored regularly (annually or bi-annually) by an experienced, qualified arborist to note any change in their vigour and development of defects.

8 INTRODUCTION

8.1 Reason for the report

This section forms the second stage of reporting and planning, and follows on from the first stage of tree assessment, analysis of significance, and determination of retention values of site trees, contained in the Preliminary Tree Assessment.

8.2 Aims of the report

The aims of this section of the report are to:

- Review development plans and the impact on trees to be retained. Architectural and landscape plans are to be designed so as to retain in the proposed development the greatest number of trees with most significance.
- Describe the site trees that are proposed to be retained and protected, and trees proposed to be removed, based on the plans for proposed development. These trees have been selected for retention or removal, as prioritised and discussed in the Preliminary Tree Assessment.
- Describe the requirement for tree protection measures. These will be further detailed in the third stage of reporting, the Tree Protection Plan and Specification.
- Comply with the requirements of *Australian Standard Protection of Trees on Development Sites AS 4970-2009.*

8.3 The proposed works

The proposed construction works include:

- Demolition of an existing house old garage and driveway, and construction of a new garage, driveway, elevated boardwalk, inclinator, retaining walls and associated landscape works.

9 METHOD

9.1 Schedule of plans

The plans and drawings as listed in 3.6 were relied upon for this assessment.

10 RESULTS AND OBSERVATIONS

10.1 Tree Retention Schedule

Tree removal and retention as shown in the following schedule have been determined from the impacts of proposed development, as shown on plans listed in 3.6.

Tree No.	Species Name	Common Name	TPZ (RADIUS FROM CENTRE OF TREE IN METRES)	SRZ (RADIUS FROM CENTRE OF TREE IN METRES)	Recommendation REMOVE/ RETAIN/ SPECIAL COMMENTS
1	Angophora costata	Sydney Red Gum	3.8	2.1	RETAIN, unless further investigation recommends REMOVAL.
2	Corymbia maculata	Spotted Gum	7.7	3.1	RETAIN
3	Camellia sasanqua	Small-leaf Camellia	2	1.5	RETAIN
4	Angophora costata	Sydney Red Gum	3.6	2.2	RETAIN
5	Angophora costata	Sydney Red Gum	4.2	2.4	RETAIN
6	Angophora costata	Sydney Red Gum	3.1	2.2	RETAIN
7	Angophora costata (2 stems or two trees adjacent)	Sydney Red Gum	6.1, 2.8	2.9, 1.9	RETAIN
8	Angophora costata	Sydney Red Gum	6.1	2.4	RETAIN
9	Camellia sasanqua	Small-leaf Camellia	3	2.3	RETAIN
10	Angophora costata	Sydney Red Gum	2.2	1.7	RETAIN

11 DISCUSSION

11.1 Tree Protection Zone (TPZ) and Structural Root Zone (SRZ)

Table 4.2 Tree Significance Schedule lists the ULE, Landscape Significance and Retention Values for trees.

The Tree Location Plan TLP-01 (Appendix D) shows the location and numbering for all assessed trees.

Tree Retention Schedule (Table 10.1) lists the TPZs and SRZs of trees to be retained in the proposal.

Tree Protection Zones (TPZ) and Structural Root Zones (SRZ) are areas described by a radial distance measured from the centre of the trees, based on calculations determined from Australian Standard *Protection of trees on development sites 4970-2009.*

- **The TPZ is defined as 'a specified area above and below ground, and at a given distance from the trunk, set aside for the protection of a tree's roots and crown, to provide for the viability and stability of a tree to be retained where it is potentially subject to damage by development'.**
- **The TPZ is an area within which construction of buildings and other structures, trenching, soil level changes, use of machinery, storage of site materials, at minimum, should be excluded. The TPZ is the theoretical minimum area which is required for maintaining a viable tree.**
- **The SRZ is defined as 'the area around the base of a tree required for the tree's stability in the ground. The woody root growth and soil cohesion in this area are necessary to hold the tree upright. The SRZ is nominally circular with the trunk at its centre and is expressed by its radius in metres. This zone considers a tree's structural stability only, not the root zone required for a tree's vigour and long-term viability, which will usually be a much larger area'.**
- **The SRZ is an area within which no excavation or construction should encroach. The SRZ is the area in which roots required for stability are typically found. If an encroachment is considered into the SRZ then this must be proven to be of no impact to the structural roots, by preliminary root mapping.**

Some encroachment into the TPZ may be possible depending on site conditions and tree location, species, age, vigour, condition and canopy spread, presence of existing structures (or other trees) that may be limiting or affecting root growth.

A 10% encroachment into the TPZ may be considered to be allowable provided that there is compensatory area contiguous to the TPZ - this may be advised on a site- and tree-specific basis.

Encroachments over 10% into the TPZ, if contemplated, may require preliminary root mapping to determine the potential impact on the tree and may not be possible – the viability and stability of a retained tree will depend on the size, number and location of roots that may be required to be severed in the proposal.

11.2 Clause 3.3.4 of AS4970

Clause 3.3.4 from the *Australian Standard for Protection of trees on development sites AS4970 2009* describes considerations that may be taken into account when determining encroachments into the TPZ:

- Species' tolerance to root disturbance,

- Age and vigour of tree,
- The presence of existing or past structures or obstacles which may affect root growth,
- Adoption of tree-sensitive construction methods such as pier and beam, suspended slabs, discontinuous footings that would minimise impact on root systems.

A major encroachment is considered to be between 15 – 35% of the TPZ (root zone) impacted. Tree sensitive design must be adopted if a major encroachment into a TPZ is contemplated.

A marginal encroachment of between 10-15% without undertaking root mapping may be considered to be acceptable, but will be dependent upon a tree's vigour etc and tolerance to root disturbance.

12 PROPOSED DEVELOPMENT AND IMPACTS ON TREES

12.1 The Proposal

- **No protected trees are proposed to be removed in the proposal.**
- The new garage is to be built within the old garage building footprint on the western side. The proposed new garage floor level is approximately 200mm lower than the floor or the old garage, and excavation at ground level is proposed. **The proposed new garage footprint is within the TPZs of Tree 1, Tree 2 and Tree 5.**
- Excavation is proposed to the north and to the east of the old garage for the new garage to be constructed. The excavation and walls shall be required to be built outside the SRZs of any site trees due to the extent of excavation required and the impact that this may have on tree stability or health. **Excavation is proposed within the TPZs of Tree 1, Tree 2 and Tree 5 and is on the theoretical line of the SRZs of Tree 2 and Tree 5.**
- A new concrete driveway is proposed to replace the old stone paved driveway. The level of the proposed new driveway will be lower than existing and excavation is proposed. **Proposed excavation is within the TPZ of Tree 2.**
- Elevated boardwalk and steps, and an inclinator, are proposed throughout the remainder of the front setback. Old stone steps and paths are to be retained in situ. All of these new elevated structures shall be required to be supported on individual piers, the locations of which are to be hand dug prior to final pier locations being finalized. This is a requirement of works within the root zones of retained trees, so as to locate roots of significant dimension (over 30mm in diameter) to enable assessment of the number, direction and dimensions of roots that are present, and therefore enable decisions as to which roots are possible to be removed. **Proposed piers for steps, boardwalk and inclinator will most likely be within the SRZs of most, if not all, retained trees**.
- Retaining walls are proposed on the eastern side of the new garage, for the inclinator, and these shall be required to be built outside the SRZs of any site trees or neighbouring trees due to the extent of excavation required and the impact that this may have on tree stability or health. **Proposed retaining walls are within the TPZ of Tree 5.**

12.2 Building works – impacts on trees to be retained

Works are proposed within the Structural Root Zones of three (3) trees: Tree 1, Tree 2 and Tree 5.

Tree 2 and Tree 5 are trees with High Landscape Significance and High Retention Values.

It should be noted that it is highly likely that there are roots of Tree 1, Tree 2 and Tree 5 present up to the line of the old garage wall. There may even be roots growing within the existing wall structure.

Pending engineers' advice, ideally the old garage wall on the western side will be left in situ so as not to disturb the roots of Tree 1 and Tree 2. New walls would preferably be built within the footprint of the old wall, pending engineers' advice.

Excavation, or rock cutting and removal that may be required within or near to the TPZ of any tree that is to be retained shall be required to be undertaken with extreme care to prevent collapse of the sandy topsoils or deeper soil profiles, where roots may be located. ***Sheet piling on the line of all excavation is strongly recommended to be used, to prevent potential collapse of soil profiles.***

12.3 Impacts on Tree 1 *Angophora costata* (Sydney Red Gum)

Tree 1 is an *Angophora costata* which is recommended for testing at the base to investigate the extent of the decay in the cavities present at the base of the tree. This testing is recommended to be undertaken by Picus® Sonic Tomograph, or Resistograph® (or both) to identify the extent of the cavity at the base of the tree, to determine if the tree is a candidate for removal. The stability of the tree may be suspect, and the tree may be required to be removed in the short term. If testing shows that the tree should be removed then this may be the outcome.

If the tree does not require removal, and is considered to be viable for retention for the short term of 5 – 15 years, say, then the tree may be able to be retained in the proposal.

The TPZ of Tree 1 is a circular area described by a 3.8 metre radius measured from the centre of the tree.

There will be an acceptable impact on Tree 1. Encroachment into the TPZ of the new garage wall, if built on the same line as existing as described in 12.2 , and the piered, above ground steps is an approximate area of 5 square metres, or 11% of the TPZ area of 45 sqm.

Proposed piers for steps are within the SRZ of Tree 1. The new elevated stairs shall be required to be supported on individual piers, the locations of which are to be hand dug prior to final pier locations being finalized. This is a requirement of works within the root zones of retained trees, so as to locate roots of significant dimension (over 30mm in diameter) to enable assessment of the number, direction and dimensions of roots that are present, and therefore enable decisions as to which roots are possible to be removed.

Care will be required during demolition and excavation so as to prevent soil slippage in the TPZ. Sheet piling is recommended if the old garage wall has to be removed. Pending engineers' advice, ideally the old garage wall on the western side will be left in situ so as not to disturb the roots of Tree 1 and Tree 2. New walls would preferably be built within the footprint of the old wall, pending engineers' advice.

The TPZ should be fenced off from builders during works as far as is practical to prevent any access, storage etc. Refer to Tree Protection Plan general guidelines.

12.4 Impacts on Tree 2 *Corymbia maculata* (Spotted Gum)

The TPZ of Tree 2 is a circular area described by a 7.7 metre radius measured from the centre of the tree.

There will be a marginal encroachment, which is considered to be an acceptable impact on Tree 2 if managed carefully.
Encroachment into the TPZ of the new garage wall, if built on the same line as existing as described in 12.2, and the piered, above-ground steps is an approximate area of 5 square metres. Further encroachment into the TPZ to excavate and build the new driveway is an additional 10 square metres. In total there is an impact of approximately 15 square metres or 8% of the TPZ area of 186 sqm.

The SRZ is at 3.1 metres from the tree, approximately on the line of the old garage. **Proposed piers for steps are within the SRZ of Tree 2.**

The new elevated stairs shall be required to be supported on individual piers, the locations of which are to be hand dug prior to final pier locations being finalized. This is a requirement of works within the root zones of retained trees, so as to locate roots of significant dimension (over 30mm in diameter) to enable assessment of the number, direction and dimensions of roots that are present, and therefore enable decisions as to which roots are possible to be removed.

Important Note: It must be taken into account that there may not be sufficient compensatory TPZ, contiguous to the TPZ, for new roots to develop if a significant number of roots are negatively impacted by the proposed works. It is noted that the neighbouring property has undertaken development works within the TPZ of the tree, which may have reduced the root volume opportunity available for compensatory development to ensure tree stability and health. A significant proportion of the TPZ for compensatory root growth is anticipated to be located in the neighbouring property.

Care will be required during demolition and excavation so as to prevent soil slippage in the TPZ. Sheet piling is recommended if the old garage wall has to be removed. Pending engineers' advice, ideally the old garage wall on the western side will be left in situ so as not to disturb the roots of Tree 1 and Tree 2. New walls would preferably be built within the footprint of the old wall, pending engineers' advice.

Care will be required in removal of the old driveway and excavation for the new driveway. There shall be no further encroachment into the TPZ further than the existing retaining wall of the old driveway, as is shown on the proposed plans.

The TPZ should be fenced off from builders during works as far as is practical to prevent any access, storage etc. Refer to Tree Protection Plan general guidelines.

12.5 Impacts on Tree 5 *Angophora costata* (Sydney Red Gum)

The TPZ of Tree 5 is a circular area described by a 4.2 metre radius measured from the centre of the tree.

There may potentially be a major encroachment on the TPZ of Tree 2. This will require root mapping investigation to determine the feasibility of the proposal.

Generally, structural, tension roots are located uphill of trees but this is not always the case, especially on sites with rock outcrops. Root mapping needs to be undertaken to determine where roots are located, their dimensions and direction and number, and thus enable decisions to be made as to how many roots may be able to be severed for the proposed excavation on two sides of the tree (to the south and east). Root location cannot be accurately predicted from surface observation.

Development Impact Assessment

Encroachment into the TPZ for excavation and construction of the new garage wall to the north, assuming a cut batter of one metre beyond the proposed wall line, is an approximate area of 7 square metres of the TPZ. Further encroachment into the TPZ to excavate and build the retaining walls around the inclinator is an additional 7 square metres. In total there is an impact of approximately 14 square metres or 25% of the TPZ area of 55 sqm.

The root mapping should be undertaken on the lines of the retaining walls and also the proposed garage wall to the north. It may be that the retaining walls may be required to be set back further away from the tree. Root mapping must be undertaken by accepted, non- destructive means, by hand, and supervised by an arborist.

The SRZ is at 2.4 metres from the tree. No major works are proposed, nor should they be allowed, within the SRZ of this tree.

The new elevated boardwalk and stairs shall be required to be supported on individual piers, the locations of which are to be hand dug prior to final pier locations being finalized. This is a requirement of works within the root zones of retained trees, so as to locate roots of significant dimension (over 30mm in diameter) to enable assessment of the number, direction and dimensions of roots that are present, and therefore enable decisions as to which roots are possible to be removed.

Care will be required during demolition and excavation so as to prevent soil slippage in the TPZ. Sheet piling is strongly recommended.

The TPZ should be fenced off from builders during works as far as is practical to prevent any access, storage etc. Refer to Tree Protection Plan general guidelines.

13 Conclusions and Recommendations

13.1 Development impacts on site trees

- **No protected trees are proposed to be removed in the proposal.**
- The new garage is to be built within the old garage building footprint on the western side. The proposed new garage floor level is approximately 200mm lower than the floor or the old garage, and excavation at ground level is proposed. **The proposed new garage footprint is within the TPZs of Tree 1, Tree 2 and Tree 5.**
- Excavation is proposed to the north and to the east of the old garage for the new garage to be constructed. The excavation and walls shall be required to be built outside the SRZs of any site trees due to the extent of excavation required and the impact that this may have on tree stability or health. **Excavation is proposed within the TPZs of Tree 1, Tree 2 and Tree 5 and is on the theoretical line of the SRZs of Tree 2 and Tree 5.**
- **It should be noted that it is highly likely that there are roots of Tree 1, Tree 2 and Tree 5 present up to the line of the old garage wall. There may even be roots growing within the existing wall structure.** Pending engineers' advice, ideally the old garage wall on the western side will be left in situ so as not to disturb the roots of Tree 1 and Tree 2. The new wall would preferably be built within the footprint of the old wall.
- Excavation, or rock cutting and removal that may be required within or near to the TPZ of any tree that is to be retained shall be required to be undertaken with extreme care to prevent collapse of the sandy topsoils or deeper soil profiles,

where roots may be located. ***Sheet piling on the line of all excavation is strongly recommended to be used, to prevent potential collapse of soil profiles.***

- With careful management, there will be an acceptable impact on Tree 1. Encroachment into the TPZ of the new garage wall, if built on the same line as existing, and the piered, above-ground steps is an approximate area of 5 square metres, or 11% of the TPZ area of 45 sqm. **Proposed piers for the above-ground steps are within the SRZ of Tree 1.** The new steps shall be required to be supported on individual piers, the locations of which are to be hand dug prior to final pier locations being finalized. This is a requirement of works within the root zones of retained trees, so as to locate roots of significant dimension (over 30mm in diameter) to enable assessment of the number, direction and dimensions of roots that are present, and therefore enable decisions as to which roots are possible to be removed.

- There will be a marginal encroachment, which is considered to be an acceptable impact on Tree 2, if managed carefully. Encroachment into the TPZ of the new garage wall, if built on the same line as existing, and the piered, above-ground steps is an approximate area of 5 square metres. **Proposed excavation for the new driveway is within the TPZ of Tree 2,** a further 10 square metres of encroachment**.** In total there is an impact of approximately 15 square metres or 8% of the TPZ area of 186 sqm. The SRZ is at 3.1 metres from the tree, which is approximately on the line of the old garage. **Proposed piers for steps are within the SRZ of Tree 2.** The new elevated stairs shall be required to be supported on individual piers, the locations of which are to be hand dug prior to final pier locations being finalized. This is a requirement of works within the root zones of retained trees, so as to locate roots of significant dimension (over 30mm in diameter) to enable assessment of the number, direction and dimensions of roots that are present, and therefore enable decisions as to which roots are possible to be removed.

- **Important Note regarding Tree 2**: It must be taken into account that there may not be sufficient compensatory TPZ, contiguous to the TPZ, for new roots to develop if a significant number of roots are negatively impacted by the proposed works. It is noted that the neighbouring property has undertaken development works within the TPZ of the tree, which may have reduced the root volume opportunity available for compensatory development to ensure tree stability and health. A significant proportion of the TPZ for compensatory root growth is anticipated to be located in the neighbouring property. This must be taken into consideration in future decisions regarding additional root removal that is not currently anticipated.

- Retaining walls are proposed on the eastern side of the new garage, for the inclinator, and these shall be required to be built outside the SRZs of any site trees or neighbouring trees due to the extent of excavation required and the impact that this may have on tree stability or health. **Proposed retaining walls are within the TPZ of Tree 5.**

- There may potentially be a major encroachment on the TPZ of Tree 5. This will require root mapping investigation to determine the feasibility of the proposal. Encroachment into the TPZ for excavation and construction of the new garage wall to the north, assuming a cut batter of one metre beyond the proposed wall line, is an approximate area of 7 square metres of the TPZ. Further encroachment into the TPZ to excavate and build the retaining walls around the inclinator is an additional 7 square metres. In total there is an impact of approximately 14 square metres or 25% of the TPZ area of 55 sqm. **Generally, structural, tension roots are located uphill of trees but this is not always the case, especially on sites with rock outcrops. Root mapping needs to be undertaken to determine where roots are located, their dimensions and direction and number, and thus enable decisions to be made as to how many roots may be able to be severed for the proposed excavation on two sides of the tree (to the south and east). Root location cannot**

be accurately predicted from surface observation. The root mapping should be undertaken on the lines of the retaining walls and also the proposed garage wall to the north. It may be that the retaining walls may be required to be set back further away from the tree. Root mapping must be undertaken by accepted, non- destructive means, by hand, and supervised by an arborist.

- Elevated boardwalk and steps, and an inclinator, are proposed throughout the remainder of the front setback. Old stone steps and paths are to be retained in situ. **Proposed piers for steps, boardwalk and inclinator will most likely be within the SRZs of most, if not all, retained trees**. All of these new elevated structures shall be required to be supported on individual piers, the locations of which are to be hand dug prior to final pier locations being finalized. This is a requirement of works within the root zones of retained trees, so as to locate roots of significant dimension (over 30mm in diameter) to enable assessment of the number, direction and dimensions of roots that are present, and therefore enable decisions as to which roots are possible to be removed.

- No trenching for services or other excavation, piers or footings, and/or additional structures above ground, shall be approved in the TPZ and SRZ of any trees unless it can be proven than the impact on roots is negligible. This may necessitate below-ground root investigation prior to design or installation of services/structures to determine the potential impact on the tree/trees and may not be possible – the viability and stability of a retained tree will depend on the size, number and location of roots that may be required to be severed.

13.2 Tree protection and specification

- Tree Protection Fencing to be erected, to exclude construction workers, storage of materials etc from the TPZ of all trees to be retained to a practical extent. Refer to the Tree Protection Plan and Specification for further direction
- Work in the vicinity of site trees will require additional care by site construction (building and landscape) managers and workers, and supervision by project arborist, so as not to damage roots during excavation and construction, or during the landscape works that are proposed.
- Planting that is proposed within the TPZ of retained trees that have High Retention Values should be with tubestock only.

13.3 Pruning

Any canopy pruning that is required shall be carried out as per the requirements of *Standards Australia 2007*, *Pruning of Amenity Trees*, *AS 4373-2007.*

13.4 Monitoring

All retained site trees should be monitored regularly (annually or bi-annually) by an experienced, qualified arborist to note any change in their vigour and development of defects.

TREE PROTECTION PLAN AND SPECIFICATION

14 SUMMARY

This section of the report provides general Tree Protection Plan and Specification measure for tree protection works to be implemented at the proposed development, as detailed in the previous Preliminary Tree Assessment and Development Impact Assessment.

15 INTRODUCTION AND SCOPE OF WORKS

15.1 Reason for the report

This section forms the third stage of reporting and planning.

The first stage, Preliminary Tree Assessment, included tree assessment, analysis of significance, and determination of retention values of site trees.

The second stage, the Development Impact Assessment, examined the impact on trees to be retained and removed, and made recommendation as to how the site may be managed in order to minimise any negative impacts by construction on site trees to be retained.

This third stage in planning, the Tree Protection Plan and Specification, will provide specifications for the required Tree Protection measures to be implemented, as recommended in the Development Impact Assessment.

All works are to comply with the requirements of *Australian Standard Protection of Trees on Development Sites AS 4970-2009.*

15.2 Aims

The aims of this Tree Protection Plan and Specification are to:

- identify the responsibilities of the project arborist for site developers and managers, and to
- specify general tree protection works required to protect retained trees on the proposed development site.

15.3 The role of the project arborist

An AQF5-qualified consulting arborist (hereafter referred to as 'the project arborist') may be required to:

- inspect and assess and supervise works within the TPZ of trees,
- specify and supervise any pruning works,
- specify and monitor compliance of tree protection measures,
- specify and certify remediation works, and to
- provide written statement of compliance at specific milestones in accordance with AS4970- 2009.

15.4 Scope of works for the project arborist

PRE-CONSTRUCTION

The project arborist may be required to:

- Mark trees for pruning, retention, removal or transplanting, with reference to approved plans and documentation.
- Specify all pruning works.
- Certify all pruning, removal and transplanting on completion of these works.
- Tree Protection: the Project arborist shall certify that all tree protection measures have been installed in compliance with the Tree Protection Plan and Specification.

THROUGHOUT THE CONSTRUCTION PROCESS.

The project arborist may be required to provide reports and/or certification to Council at the following specific hold-points/milestones:

- Completion of site establishment.
- Installation of services.
- Installation of footings or slabs.
- Erection of scaffolding, if required, near trees.
- Works within Tree Protection Zones.

POST- CONSTRUCTION CERTIFICATION

At completion of the defects liability period, the project arborist may be required to certify that all tree protection measures throughout the construction and landscaping works have complied with all plans, specifications, and reports prepared by the project arborist and with the Conditions as specified in Development Application approval/Notification of Determination Conditions of Consent.

16 TREE PROTECTION PLANS AND DETAILS

16.1 Site specific information and reasons for them

- Erection of Tree Protection Fencing to enclose a practical TPZ exclusion area for Trees 1, 9 and 10 is recommended.
- **Work in the vicinity of Trees 1, 2 and 5 will require a high level of care in site management, so as not to damage significant roots or remove an excessive amount of roots that are located within the TPZ of these trees, during demolition and excavation. Soil slippage may be required to be prevented by shoring or contiguous sheet piling.**

17 SPECIFICATION FOR TREE PROTECTION

17.1 Refer to Landscape Plan LP01 (Appendix E) for:

- location of trees to be retained and protected.

17.2 Pre-construction scope of works

- Prior to any construction works, the project arborist is to:
- Mark trees for pruning, retention, removal or transplanting, with reference to approved plans and documentation.
- Specify (and supervise, if required) pruning works.
- Certify all pruning and tree removal on completion of these works.

- Supervise installation of tree protection measures, and certify that all tree protection measures have been installed in compliance with the Tree Protection Plan and Specification.

PRUNING AND TREE REMOVAL

- Approved tree removal and pruning works are to be carried out before the installation of TPF and other protection measures such as may be required when scaffolding is to be installed within the TPZ.
- The project arborist shall mark trees for pruning, retention, removal or transplanting, with reference to approved plans and documentation.
- The project arborist shall supervise any pruning required and tree removal works.
- Pruning works are to be carried out as per AS4373-2007.
- Tree removal work shall not damage trees to be retained.
- Vehicles used for tree removal works may require limited movement within TPZs. The arborist is to supervise.
- Stumps to be removed within a TPZ must be removed so as to not damage or disturb roots of trees to be retained. The arborist is to supervise.

INSTALLATION OF TREE PROTECTION FENCING

- Refer to Diagrams 1 to 3 for types of fencing and other protection measures.
- The TPZ is a restricted area and TPF is to be installed prior to site establishment.
- The TPF is to be retained intact until works are completed.
- Permission for works within the TPZ must be sought and approved by Northern Beaches/Pittwater Council.
- These works are to be supervised by the project arborist, and any additional works that may arise during the progress of site works must be reviewed by the project arborist and be acceptable to Council before the works are carried out. Failure to do this proactively may result in the arborist being unable to certify the works.

ACTIVITIES THAT ARE RESTRICTED FROM WITHIN THE TPZ (AS PER AS4970-2009)

- Machine excavation including trenching
- Excavation for silt fencing
- Cultivation
- Storage
- Preparation of chemicals, including preparation of cement products
- Parking of vehicles and plant
- Re-fueling
- Dumping of waste
- Wash-down and cleaning of equipment
- Lighting of fires
- Soil level changes
- Temporary or permanent installation of utilities and signs, and
- Physical damage to the tree.

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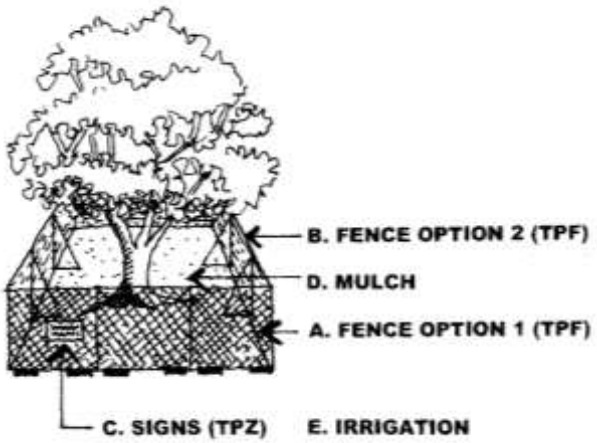


Diagram 1 TREE PROTECTIVE FENCING (TPF)

A. Fence Option 1 (TPF)
1.8 metre high chain wire mesh panels with shade cloth attached if required, to be held in place with concrete blocks.
B. Fence Option 2 (TPF)
1.8 metre high plywood or wooden panel/paling fence (prevents soil or building contaminants from coming under fence when panels are laid flush to ground).
C. Signs (TPZ)
Tree Protection Zone Signs
D. Mulch
50mm to 100mm thick layer of organic mulch, or aggregate, installed across surface area of TPZ.
E. Irrigation
Irrigation to arborist's advice.

TREE PROTECTION MEASURES TO BE INSTALLED WHEN TPF REQUIRED TEMPORARY REMOVAL, OR WHEN FENCING MUST BE LOCATED WITHIN THE TPZ – TRUNK AND BRANCH PROTECTION

The materials and positioning of protection as shown in Diagrams 2 and 3 are to be specified by the project arborist on site. A minimum of 2 metres in height is recommended. Temporary powerlines, guys and stays are not to be attached to the tree. Nails are not to be driven into the trunks or branches.

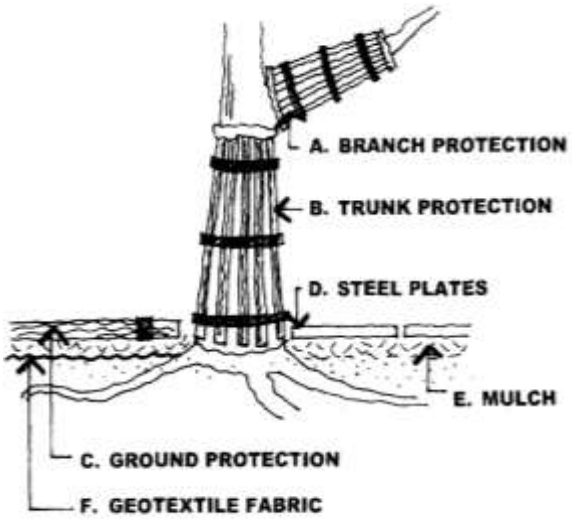


Diagram 2 TYPES OF BRANCH, TRUNK AND GROUND PROTECTION

A. Branch Protection
Prevent bark damage by use of timber boards and padding strapped to branch. (Do not use nails or screws).
B. Trunk Protection
Prevent bark damage by use of timber boards and padding for at least 2 metres above ground level. (Do not use nails or screws). Also refer to Detail Diagram 3.
C. Ground Protection
Install a suitable device eg timber rumble boards strapped together, above mulch or aggregate. The device shall be thick enough to prevent soil compaction and also to prevent compression or damage to roots.
D. Steel Plates
Steel plates (or similar, as approved by arborist) may be laid with, or without, mulch or aggregate under.
E. Mulch
Minimum 50mm thick, maximum 100mm thick, organic mulch or aggregate.
F. Geotextile fabric
Geotextile fabric laid under mulch or aggregate layer.

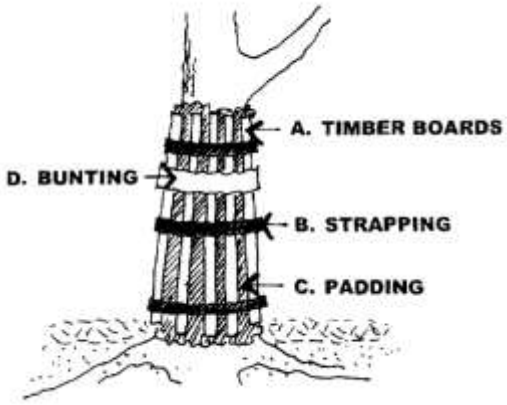


Diagram 3 DETAIL TRUNK PROTECTION

A. TIMBER BOARDS
Pine timber 3 metres x 50mm x 50mm at 150mm centres.
B. STRAPPING
Secure timber at no less than 3 locations with galvanised hoop strapping (or similar).
Do not use nails or screws.
C. PADDING
Insert expansion joint padding at minimum of three points to prevent timber from touching trunk.
D. BUNTING
Secure high visibility bunting at around 2 metres above ground level for visual reinforcement.

17.3 Scope of works for tree protection during construction

GENERAL

During construction the following situations will require the arborist's input and on-site supervision. (These may be in addition to the predetermined number of site inspections that shall be agreed upon).

- Demolition, bulk earthworks, installation of sediment control works and drainage works near the TPZ.
- Installation of services, footings and slabs near the TPZ.
- Temporary construction work required within TPZs – ground protection, scaffolding (erection and moving).
- Hand excavation of roots at perimeter of TPZs.
- Changes arising from building works that are different to approved plans.
- Landscaping, including installation of landscape structures such as paths, walls, soil topdressing and cultivation, planting, lighting and irrigation.

GROUND PROTECTION

If temporary access for machinery is required into the TPZ, additional ground protection measures will be required (ie. in addition to mulching). Refer to Diagram 2. This is to prevent root damage and soil compaction within the TPZ.

HAND EXCAVATION AND ROOT PROTECTION DURING EXCAVATION

Proposed works where inside Tree Protection Zones, must have minimal impact on root systems. Without prior investigation it is unknown if any large diameter roots are present.

Wounds shall not be treated with dressings or with paints.

Temporary protection of exposed roots may be required, to prevent drying out, by use of jute mesh or hessian sheeting laid in multiple layers over the exposed roots and soil profile, to the full depth of the root zone. This is to be pegged in place and kept moist for the duration of root zone exposure.

INSTALLING UNDERGROUND SERVICES WITHIN THE TPZ

Proposed works have been designed to reduce impacts on root systems. However without prior investigation it is unknown if any large diameter roots are present at the perimeter of, or extend past the TPZ of trees nominated for retention.

Should any large roots be found in locations where proposed services are to be laid then the work methods outlined above are to be adopted. The project arborist must be consulted.

17.4 Maintaining the TPZ

MULCHING

The area within the TPZ shall be mulched. The mulch shall be maintained to a depth of 50-100mm using material that complies with AS4454. However, the arborist may determine if mulch is required in areas where there is existing turf, gardens or mulch, and additional mulching may not be required.

WATERING

Temporary irrigation will be required in the TPZ of all site trees. This is be maintained for the duration of construction works until final certification. The project arborist shall monitor soil water and adjust if necessary.

WEED REMOVAL

All weeds within the TPZ shall be removed by hand without soil disturbance, or shall be removed by use of species-appropriate herbicides by qualified operators.

17.5 Scope of works post-construction

REMOVAL OF TREE PROTECTION FENCING

TPF shall not be removed until all construction and landscaping works have been completed at Practical Completion.

DEFECTS LIABILITY PERIOD

Should any works be required during the defects liability period, such works shall not injure trees.

REFERENCES

BOOKS AND JOURNALS

Mattheck, C, Bethge, K & Weber, K 2015, *The Body Language of Trees*, Karlsruhe Institute of Technology, Germany.
Standards Australia 2009, *Protection of Trees on Development Sites*, AS 4970-2009, Standards Australia, Sydney.
Standards Australia 2007, *Pruning of Amenity Trees*, AS 4373-2007, Standards Australia, Sydney.

WEBSITES

https://www.northernbeaches.nsw.gov.au

APPENDICES

Appendix A	**Tree Assessment Schedule** – including explanation of categories
Appendix B	**Useful Life Expectancy (ULE) Categories**
Appendix C	**Methodology for Determining Tree Retention Values (STARS©)**
Appendix D	**Tree Location Plan TP-01**
Appendix E	**Proposed Works Plan PWP-01**

APPENDIX A TREE ASSESSMENT SCHEDULE

Site address: 8 Hope Avenue, North Manly, NSW Date of assessment: 16 June 2017 Assessed by: Selena Hannan
Trees over five (5) metres high were assessed for this report.

Tree No.	*Species* Common Name	Height (m)	Canopy spread (m) N,E,S,W	DBH or multi (mm)	DAB (mm)	Age	Health/ Vitality	Condition	Comments	ULE	LSR	RV	TPZ (m) radius	SRZ (m) radius
1	***Angophora costata*** **Sydney Red Gum**	14	1,8,6,0	320	340	SM	F	F	Local indigenous species. Suppressed form. Codominant stems at 1.8 metres AGL, slight inclusion at junction, with bulges developing under junction. Cavity at base on south side, at least 300mm (angled) depth. Wound with decay at base on eastern side. Tapping in basal area of stem indicates presence of hollow, extent not known. 10% deadwood. Canopy fair vitality. Located close to wall of old stone garage. **Recommended action**: Picus or Resistograph test to determine extent of cavity at base. **Note**: *Pittosporum undulatum* < 8 metres high adjacent to garage wall, exempt species.	Short (5-15)	M	L	3.8	2.1
2	***Corymbia maculata*** **Spotted Gum**	25	5,6,7,8	640	830	M	G	G	Local indigenous species. Codominant stems at 6 metres AGL, minor bulges developing under junction. 10% deadwood, <5% twig dieback, no epicormic growth apparent. Basal area appears sound. Noted path (recently?) constructed in neighbour's property.	Med (15-40 +)	H	H	7.7	3.1

3	***Camellia sasanqua*** **Small leaf Camellia**	6	3,1,1,2	80	100	M	F	G	Exotic species. Typical of species, no obvious defects.	Med (15-40)	M	M	2	1.5
4	***Angophora costata*** **Sydney Red Gum**	20	3,7,2,1	300	370	SM	F	F	Local indigenous species. Suppressed form. Stem twisted and bent. 15% epicormics in canopy. No obvious problems at root collar. Small canopy volume for height, sparse canopy. Vertical growth splits from base. Large diameter deadwood present. No dieback.	Med (15-40)	M	M	3.6	2.2
5	***Angophora costata*** **Sydney Red Gum**	18	3,4,6,3	350	450	SM	G	F-G	Local indigenous species. >10% large diameter deadwood present. Somewhat suppressed. No obvious defects at base.	Long (40+)	H	H	4.2	2.4
6	***Angophora costata*** **Sydney Red Gum**	16	0,4,7,1	260	380	SM	F-G	F	Local indigenous species. Suppressed form. Low in foliage volume. Canopy heavily weighted to east and south (phototropism). Minor epicormics in canopy. No obvious defects at base. 15% large diameter deadwood present. Bend in stem at 2 metres AGL. Slight bulge on western side developing.	Med (15-40)	M	M	3.1	2.2
7	***Angophora costata*** **Sydney Red Gum**	25	6,4,5,8	510, 230	740, 260	M	F-G	G	Local indigenous species. Two trees adjacent (or one with two stems). Canopies of both stems somewhat low in foliage size and volume. Suppressed form. Epicormics in canopy 10%. >10% large diameter deadwood present. Pruned to clear neighbouring house. Minor bulges in larger stem. Several necrotic bark patches (bruise? borer?). Smaller stem has bulge developing at bend – monitor for possible hollow developing here. Old stub cuts.	Med (15-40)	H	H	6.1 2.8	2.9 1.9

8	***Angophora costata*** **Sydney Red Gum**	20	2,7,5,3	510	460	M	G	F-G	Local indigenous species. Stem bent in two places, self-corrected. Small canopy volume for height. <10% large diameter deadwood.	Med (15-40)	H	H	6.1	2.4
9	***Camellia sasanqua*** **Small leaf Camellia**	6	3,3,3,3	multi	400	M	G	G	Exotic species, typical form, multi-stemmed.	Med (15-40)	M	M	3	2.3
10	***Angophora costata*** **Sydney Red Gum**	10	2,2,2,2	180	200	SM	F	F	Local indigenous species. Suppressed form, small canopy volume, growing through Tree 9.	Med (15-40)	M	M	2.2	1.7

Key and explanation of table categories, and common abbreviations

Height is the approximate height of the tree in metres, from base of stem to top of crown.

Canopy Spread is the approximate length in metres of the branches/canopy of the tree, measured from the stem/trunk to North, South, East and West.

DBH (in millimetres) is the approximate Diameter of tree stem/s (trunk) measured at Breast Height ie. at 1.4 metres above ground level, unless noted otherwise.

DAB (in millimetres) is the approximate Diameter at the Base of the tree, measured just above the root buttress.

Age classes: I is immature, EM is Early Mature, SM is Semi Mature, LM is Late Mature, OM is Over Mature, D is Dead.

Health is classed as P Poor, F Fair, G Good. Tree vigour is an indication of health. Assessment includes crown density, leaf colour, pest and disease presence/resilience, dieback amount and type.

Condition is classed as P Poor, F Fair, G Good. A tree may be in good health but have poor condition due to structural defects such as weak branch/stem junctions, cavities, cracks, signs of root plate failure etc. The tree's environment (proximity to other trees, soil types and profiles, water supply, aspect and topography) may modify its form and growth habit, and its condition.

ULE Useful Life Expectancy – Barrell etc refer to Appendix B for detail of categories.

LSR Landscape Significance Rating, of High, Medium and Low, based on IACA SIGNIFICANCE OF A TREE - ASSESSMENT RATING SYSTEM (STARS)© (IACA2010) ©. This rating system utilises structured qualitative criteria to assist in determining the retention value for a tree.

RV Retention Value, of High, Medium, Low, or Removal, is based on Useful Life Expectancy and Landscape Significance, as derived from the matrix of IACA SIGNIFICANCE OF A TREE - ASSESSMENT RATING SYSTEM (STARS)© (IACA2010) ©

TPZ Tree Protection Zone, expressed as a radial distance in metres, measured from the centre of the tree. It is defined in the Australian Standard *Protection of Trees on Development Sites*, AS 4970-2009 as 'a specified area above and below ground and at a given distance from the trunk set aside for the protection of a tree's roots and crown to provide for the viability and stability of a tree to be retained where it is potentially subject to damage by development'.

SRZ Structural Root Zone, expressed as a radial distance in metres, measured from the centre of the tree. It is defined in the Australian Standard *Protection of Trees on Development Sites*, AS 4970-2009 as 'the area around the base of a tree required for a tree's stability in the ground. The woody growth and soil cohesion in this area are necessary to hold the tree upright. The SRZ is nominally circular with the trunk at its centre and is expressed by its radius in metres. This zone considers a tree's structural stability only, not the root zone required for a tree's vigour and long-term viability, which will usually be a much larger area".

AGL Above Ground Level (distance) **LGA** Local Government Area

APPENDIX B ULE

USEFUL LIFE EXPECTANCY (ULE) CATEGORIES (after Barrell, updated 01/04/01)

1 Long ULE: Trees that appeared to be retainable at the time of assessment for **more than 40 years** with an acceptable level of risk, assuming reasonable maintenance:

- **A** Structurally sound trees located in positions that can accommodate future growth.
- **B** Trees that could be made suitable for retention in the long term by remedial tree care.
- **C** Trees of special significance for historical, commemorative or rarity reasons that would warrant extraordinary efforts to secure their long term retention.

2 Medium ULE: Trees that appeared to be retainable at the time of assessment for **15–40 years** with an acceptable level of risk, assuming reasonable maintenance:

- **A** Trees that may only live between 15 and 40 more years.
- **B** Trees that could live for more than 40 years but may be removed for safety or nuisance reasons.
- **C** Trees that could live for more than 40 years but may be removed to prevent interference with more suitable individuals or to provide space for new planting.
- **D** Trees that could be made suitable for retention in the medium term by remedial tree care.

3 Short ULE: Trees that appeared to be retainable at the time of assessment for **5–15 years** with an acceptable level of risk, assuming reasonable maintenance:

- **A** Trees that may only live between 5 and 15 more years.
- **B** Trees that could live for more than 15 years but may be removed for safety or nuisance reasons.
- **C** Trees that could live for more than 15 years but may be removed to prevent interference with more suitable individuals or to provide space for new planting.
- **D** Trees that require substantial remedial tree care and are only suitable for retention in the short term.

4 Remove: Trees that should be removed **within the next 5 years**.

- **A** Dead, dying, suppressed or declining trees because of disease or inhospitable conditions.
- **B** Dangerous trees because of instability or recent loss of adjacent trees.
- **C** Dangerous trees because of structural defects including cavities, decay, included bark, wounds or poor form.
- **D** Damaged trees that are clearly not safe to retain.
- **E** Trees that could live for more than 5 years but may be removed to prevent interference with more suitable individuals or to provide space for new planting.
- **F** Trees that are damaging or may cause damage to existing structures within 5 years.
- **G** Trees that will become dangerous after removal of other trees for the reasons given in A to F.
- **H** Trees in categories (a) to (g) that have a high wildlife habitat value and, with appropriate treatment, could be retained subject to regular review.

5 Small, young or regularly pruned: Trees that can be reliably moved or replaced.

- **A** Small trees less than 5m in height.
- **B** Young trees less than 15 years old but over 5m in height.
- **C** Formal hedges and trees intended for regular pruning to artificially control growth.

APPENDIX C METHODOLOGY FOR DETERMINING TREE RETENTION VALUES

IACA SIGNIFICANCE OF A TREE - ASSESSMENT RATING SYSTEM (STARS)© (IACA2010) ©

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

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

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

TREE SIGNIFICANCE - ASSESSMENT CRITERIA

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.

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.

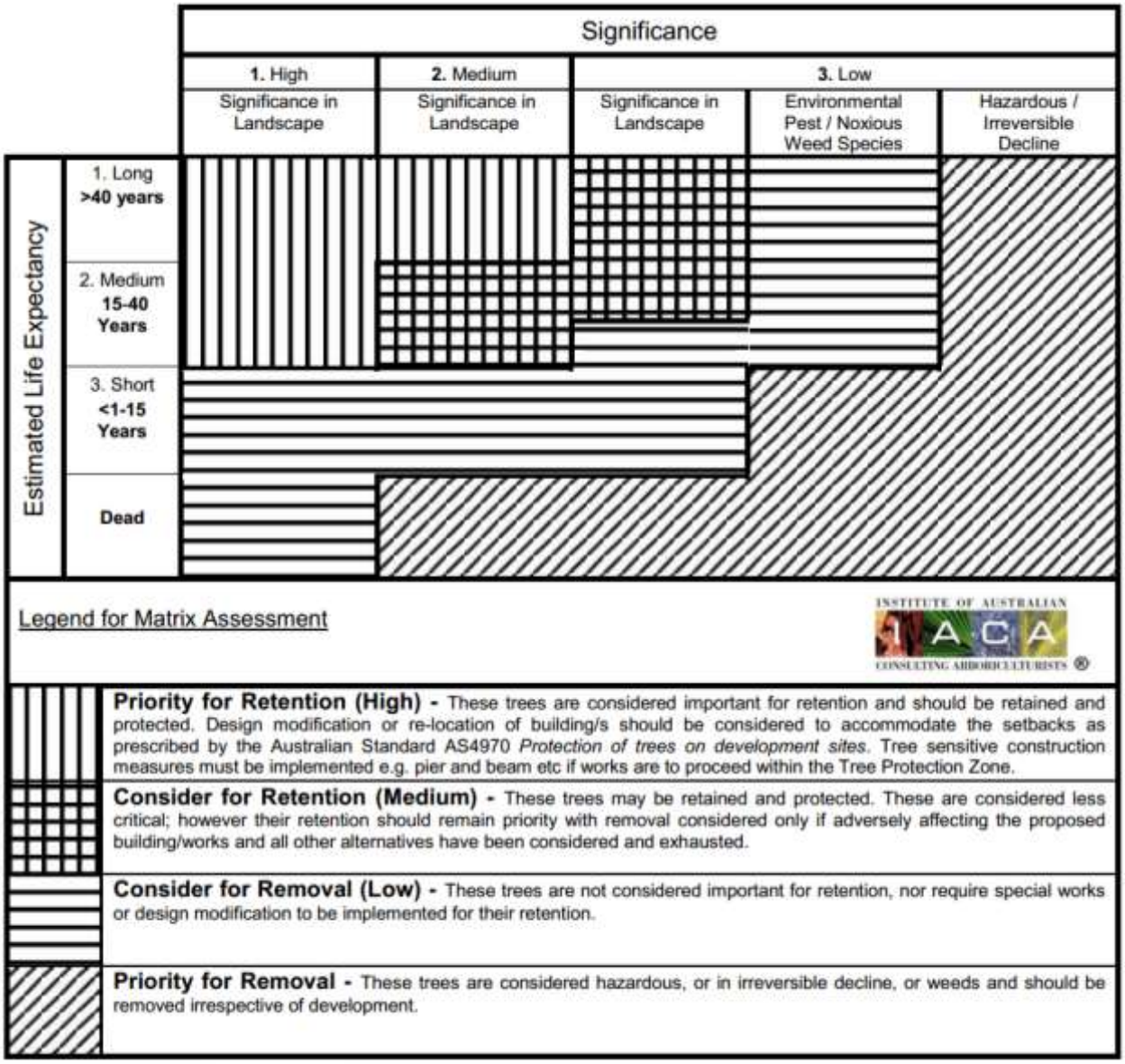
<u>Environmental Pest / Noxious Weed Species</u>

- The tree is an Environmental Pest Species due to its invasiveness or poisonous/ allergenic properties,
- The tree is a declared noxious weed by legislation.

<u>Hazardous/Irreversible Decline</u>

- 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.

TABLE 1.0 TREE RETENTION VALUE - PRIORITY MATRIX



USE OF THIS DOCUMENT AND REFERENCING

The IACA Significance of a Tree, Assessment Rating System (STARS) is free to use, but only in its entirety and must be cited as follows:

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

REFERENCES

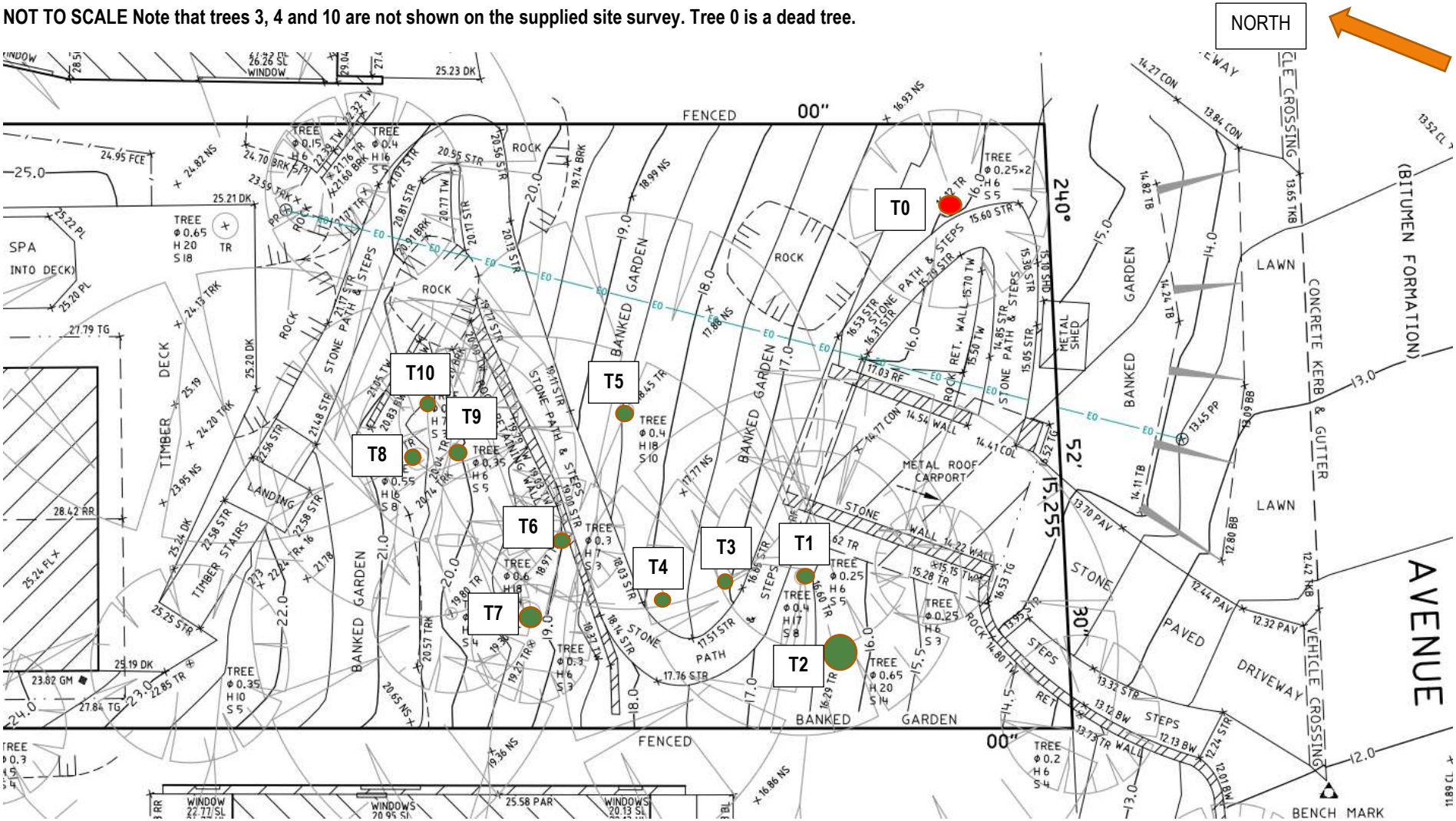
Australia ICOMOS Inc. 1999, The Burra Charter - The Australian ICOMOS Charter for Places of Cultural Significance, International Council of Monuments and Sites, www.icomos.org/australia

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

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

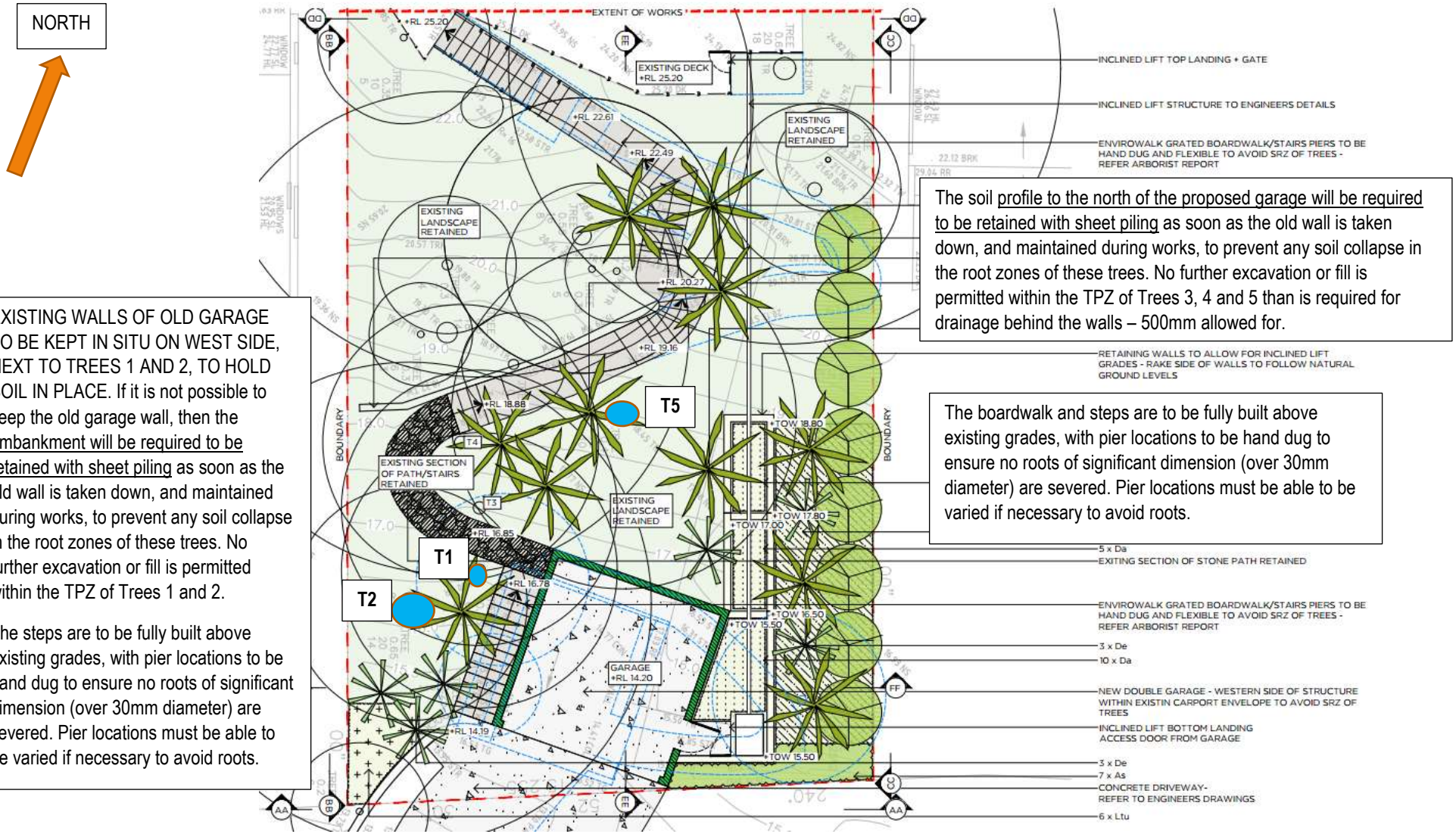
APPENDIX D TREE LOCATION PLAN TP-01

NOT TO SCALE Note that trees 3, 4 and 10 are not shown on the supplied site survey. Tree 0 is a dead tree.



APPENDIX E PROPOSED WORKS PLAN PWP-01

NOT TO SCALE



The soil profile to the north of the proposed garage will be required to be retained with sheet piling as soon as the old wall is taken down, and maintained during works, to prevent any soil collapse in the root zones of these trees. No further excavation or fill is permitted within the TPZ of Trees 3, 4 and 5 than is required for drainage behind the walls – 500mm allowed for.

EXISTING WALLS OF OLD GARAGE TO BE KEPT IN SITU ON WEST SIDE, NEXT TO TREES 1 AND 2, TO HOLD SOIL IN PLACE. If it is not possible to keep the old garage wall, then the embankment will be required to be retained with sheet piling as soon as the old wall is taken down, and maintained during works, to prevent any soil collapse in the root zones of these trees. No further excavation or fill is permitted within the TPZ of Trees 1 and 2.

The steps are to be fully built above existing grades, with pier locations to be hand dug to ensure no roots of significant dimension (over 30mm diameter) are severed. Pier locations must be able to be varied if necessary to avoid roots.

The boardwalk and steps are to be fully built above existing grades, with pier locations to be hand dug to ensure no roots of significant dimension (over 30mm diameter) are severed. Pier locations must be able to be varied if necessary to avoid roots.