



CREATIVE **PLANNING** SOLUTIONS

ARBORICULTURAL IMPACT ASSESSMENT

Proposed Residential Development & Subdivision
43, 45 & 49 Warriewood Road, Warriewood NSW 2102

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TABLE OF CONTENTS

1	EXECUTIVE SUMMARY	1
2	INTRODUCTION.....	2
2.1	Background.....	2
2.2	Objectives	2
2.3	Legislation & Regulating Documents	2
2.4	Documentation Received	3
2.5	The Site.....	3
2.6	Proposed Development.....	3
2.7	Limitations.....	3
3	METHODOLOGY	5
3.1	Methodology	5
4	OBSERVATIONS.....	7
4.1	General	7
4.2	Tree Preservation Order.....	7
4.3	The Trees	7
5	DISCUSSION.....	9
5.1	Impact Assessment.....	9
5.2	Trees Recommended for Removal	9
5.3	Trees Recommended for Retention & Protection.....	10
5.4	Ancillary Construction Related Impacts	11
6	CONCLUSION.....	12
6.1	Proposed Development Impact.....	12
7	RECOMMENDATIONS.....	13
7.1	Tree Removal	13
7.2	Tree Retention & Protection.....	13
7.3	Replacement Planting	13
8	REFERENCES.....	15

APPENDICIES

APPENDIX 1 - TREE ASSESSMENT SCHEDULE

APPENDIX 2 - TREE LOCATION PLAN

APPENDIX 3 - IACA SIGNIFICANCE OF A TREE, ASSESSMENT RATING SYSTEM (STARS)

APPENDIX 4 - EXTRACT FROM AS4970-2009 PROTECTION OF TREES ON DEVELOPMENT SITES

APPENDIX 5 - GENERAL TREE PROTECTION SPECIFICATION

APPENDIX 6 - TYPICAL TREE PROTECTION DETAILS

1 EXECUTIVE SUMMARY

This Arboricultural Impact Assessment was commissioned by Mr Tarun Chadha of Archidrome on the 16th of August 2021. The report relates to thirty (30) trees and groups of trees within and adjoining the site at 43, 45 & 49 Warriewood Road, Warriewood within Northern Beaches Council local government area. The report provides evaluation of the likely impact to existing trees as a result of the proposed building and construction works associated with the subdivision and residential development.

Should the development proceed in its current form, the following is recommended:

- Removal of twelve (12) 'exempt' trees and groups of trees (**Trees 1, 2, 3, 4, 5, 6, 7, 11, 13, 14, 27 & 28** (group)) which are not protected under Section B4.22 of Pittwater 21 DCP due to being undesirable species;
- Removal of four (4) site trees (**Trees 8, 12, 15 & 16** (group)) of 'Medium' & 'High' retention value due to impacts resulting from the proposed construction and building works;
- Retention and protection of seven (7) trees (**Trees 9, 17, 18, 23, 25, 29 & 30**) which are to suffer a major (>10%) incursion to the TPZ;
- Retention and protection of three (3) trees (**Trees 19, 22 & 24**) which are to suffer a minor (<10%) incursion to the TPZ;
- Retention and protection of four (4) trees (**Trees 10, 20, 21 & 26**) which are located sufficiently away from the proposed construction works and are unlikely to be impacted;

Detailed tree protection measures in accordance with **Appendix 5** will be required for those trees outside of the building envelopes and away from the construction works which are to be retained to ensure no inadvertent impacts are sustained from construction related activities.

Replacement planting should be carried out in accordance with the recommendations contained within **Section 7.3** to ensure those trees removed are adequately compensated for.

2 INTRODUCTION

2.1 Background

This Arboricultural Impact Assessment was commissioned by Mr Tarun Chadha of Archidrome on the 16th of August 2021 to evaluate the potential impacts of proposed development works on existing trees located on the subject site at 43, 45 & 49 Warriewood Road, Warriewood (Refer to **Figure 1**).

Accordingly, the purpose of this report is to assess the potential impact of the proposed construction works on the subject trees, as well as provide recommendations for amendments to the design or construction methodology where necessary to minimise any adverse impacts. The report also provides recommended tree protection measures to ensure the long-term preservation of the trees to be retained where appropriate as well as replacement planting to compensate for any tree removals.

2.2 Objectives

This report has been prepared to assess the level of impact development works are likely to cause to existing trees and make a determination as to whether trees will be adversely affected. The report will aim to provide guidance as to those trees requiring removal, retention or protection in accordance with the provisions of *AS4970-2009 Protection of trees on development sites*. Where necessary, it will also provide recommendations for design modifications and any replacement planting. As such, the objectives of this report are as follows:

- Assess the current site and growing conditions of trees;
- Assess the current health, condition, lifespan & significance of the trees within the site;
- Identify relative retention values of trees within the site;
- Calculate anticipated encroachment levels resulting from proposed works;
- Determine the likely impact as a result of the calculated encroachments;
- Assess potential for retention and protection of trees where possible;
- Advise any design modifications necessary to retain important trees;
- Recommend tree and root sensitive design and construction methodologies to mitigate impacts to trees to be retained;
- Inform of any tree removal necessary due to unsustainable impacts;
- Provide guidance and recommendations for any replacement planting necessary.

No aerial inspection, root mapping or internal diagnostic testing has been carried out as part of this report. Additionally, no cation exchange capacity testing or plant tissue analysis has been undertaken.

2.3 Legislation & Regulating Documents

This Arboricultural Impact Assessment has considered the following regulatory documents:

- *State Environmental Planning Policy (Biodiversity and Conservation) 2021*
- *Pittwater Local Environmental Plan 2014 (PLEP2014)*
- *Pittwater 21 Development Control Plan 2012 (PDCP2012)*
- *Pittwater DCP 21 Appendices*
- *Greater Sydney Regional Strategic Weed Management Plan 2017-2022 (GSRSWMP)*

2.4 Documentation Received

The following documents were received and have been relied upon for this Assessment:

Table 2 – Documentation received and reviewed as part of the Arboricultural Impact Assessment

Document Description	Author	Revision No. / Date
Architectural Plans	Archidrome	R-10 / 14 December 2023
Landscape Plans	Creative Planning Solutions	Rev. F / 14 December 2023
Civil Engineering Plans	ACOR Consultants	C / 15 December 2023
Detail Survey 1	CMS Surveyors	1 / 16 December 2016
Detail Survey 2	Summit Geomatic	A / 21 July 2021

Note: care has been taken to obtain all information from reliable sources; however, the author makes no representations, guarantees or warranties as to the accuracy of information provided by others. No other information has been reviewed, should this become available impacts may be subject to change.

2.5 The Site

The site is known as 43, 45 & 49 Warriewood Road, Warriewood and is legally described as Lot 2 DP972209, Lot 2 DP 349085 and Lot 1 DP 349085. The site is located on the southern side of Warriewood Road and consists of two (2) dilapidated dwellings, outbuildings and disused greenhouses which has a rear boundary to Narrabeen Creek. Vehicular access is available from Warriewood Road. (Refer to **Figure 1** below).

The site has an even and consistent grade falling from the Warriewood Road frontage towards the central portion of the site whereby the grade evens and flattens towards the Narrabeen Creek rear boundary. The rear portion of the site is heavily vegetated whilst the central and upper portions are attributed to rows of greenhouses and the existing dwellings.

2.6 Proposed Development

The proposed development is for demolition of existing structures, subdivision of the existing allotments and construction of a new residential development inclusive of a new roadway, pedestrian through site link, new landscaping and stormwater infrastructure (Refer to **Figure 2** below).

The proposed works are generally restricted to the upper portion of the site fronting Warriewood Road with existing bushland areas to the rear of the site largely to be retained as existing apart from necessary bushland regenerations works. Those works considered likely to impact the existing trees on site include the significant modification of existing levels (excavation and fill), construction of new dwellings and allotments, new roadway, stormwater infrastructure and the pedestrian through site link.

2.7 Limitations

Trees are living organisms whose health and condition can change rapidly. The conclusions and recommendations in this report are valid for one (1) year only from the date of the report, unless otherwise stated. Any changes to the site as it stands at present, for example building extensions, excavation works, importing of soils, extreme weather events etc. will invalidate this report. Any reproduction of this report must be in full colour using the report in its entirety.



Figure 1 - Aerial image indicating subject site (outlined red)



Figure 2 – Landscape Plan extract showing the proposed layout of the development.

3 METHODOLOGY

3.1 Methodology

3.1.1 Site Inspection

A site inspection was carried out by the author with the subject trees and the general growing environment evaluated on the 17th of August 2021. The weather at the time of inspection was dry and sunny with clear visibility.

The subject trees were inspected visually from ground level with the following information recorded and provided in tabulated form at **Appendix 1**:

- Tree Species (Botanical & Common Name);
- Approximate height;
- Approximate canopy spread;
- Trunk Diameter (measured at 1.4 metres from ground level);
- Trunk Diameter at base (above root crown);
- Age class;
- Health & vigour; using foliage size, colour, extension growth, presence of disease or pest infestation, canopy density, presence of deadwood, dieback and epicormic growth as indicators;
- Condition; using visible evidence of structural defects, instability, evidence of previous pruning and physical damage as indicators;
- Suitability of the tree to the site and its existing location;
- Safe Useful Life Expectancy (SULE).

3.1.2 Safe Useful Life Expectancy (SULE)

The remaining Safe Useful Life Expectancy of a tree is an estimate of the sustainability of the tree in the landscape, calculated based on an estimate of the average age of the species in an urban area, less its estimated current age. The life expectancy of each tree has been further modified where necessary in consideration of its current health, vigour, condition and suitability to the site. The estimated SULE of each tree is shown in **Appendix 1**.

The following ranges have been allocated to each tree:

- Long SULE: Trees that appear to be retainable with an acceptable level of risk for > 40 years.
- Medium SULE: Trees that appear to be retainable with an acceptable level of risk for 15 to 40 years.
- Short SULE: Trees that appear to be retainable with an acceptable level of risk for 5–15 years.
- Remove: Trees with a high level of risk that would need removing within the next 5 years.
- Small, Young or Regularly Pruned.

3.1.3 Landscape Significance

The landscape significance of a tree is an essential criterion to establish the importance that a particular tree may have on a site. Several factors contribute towards the assessment of a tree's significance including but not limited to condition and vigour, form, visual prominence, heritage status, indigeneity, legislative protection, cultural sentiment and future growth potential.

For the purposes of this report the Australian Institute of Consulting Arborists (IACA) Significance of a Tree, Assessment Rating System (STARS)® has been utilised. 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.

Appendix 3 provides a full outline of assessment criteria for each significance rating as per IACA STARS (2010).

3.1.4 Retention Value

Retention values have been determined for each tree on site to establish a hierarchy for tree retention. Retention values are based on estimated life spans and their associated landscape significance rating in accordance with the Tree Retention Value Priority Matrix. This matrix established the following retention values and can be found at **Appendix 3** with attributed retention values found within **Appendix 1**:

- Priority for Retention (High)
- Consider for Retention (Medium)
- Consider for Removal (Low)
- Priority for Removal

3.1.5 AS4970-2009 Protection of Trees on Development Sites

The Australian Standard, AS4970-2009- '*Protection of trees on development sites*', has been used as a guide to provide recommendations for the assessed trees. The Standard provides guidance on the principles for protecting trees on land subject to development as well as principles for determining viability of tree retention. Terminology and recommended methods are consistent with AS4970-2009.

3.1.6 Tree Protection Zones

The assessed trees have been allocated Tree Protection Zones (TPZ). The Australian Standard, AS4970-2009- '*Protection of trees on development sites*', has been used as a guide in the allocation of TPZs for the assessed trees. The TPZ is calculated based on trunk (stem) diameter at breast height (DBH), measured at 1.4 metres above ground level. The radius of the TPZ is calculated by multiplying the trees DBH by 12. The method provides a TPZ that addresses health and growing requirements of a tree as well as the trees stability. TPZ distances are measured as a radius from the centre of the trunk at (or near) ground level. The maximum TPZ should be no more than 15m radius and the minimum TPZ should be no less than 2m radius.

An extract of the AS4970-2009 for calculating TPZ has been provided at **Appendix 4** for reference.

3.1.7 Structural Root Zone

The assessed trees have been allocated Structural Root Zones (SRZ). The Australian Standard, AS4970-2009 - '*Protection of trees on development sites*', has been used as a guide in the allocation of SRZ's for the assessed trees. The SRZ is a radial area extending outwards from the centre of the trunk and is calculated as follows:

$$\text{SRZ (Radius)} = (D \times 50)^{0.42} \times 0.64$$

4 OBSERVATIONS

4.1 General

The site area subject to this assessment was observed as highly disturbed with a high level of weed infestation. Species observed varied including exotic, native and locally indigenous species. Trees within the front portion of the site appeared to be planted specimens with some potentially remnant trees observed within the rear densely vegetated area which are not to be impacted. Health, vigour and condition was highly varied across the trees forming part of the assessment. Root zones of assessed trees were generally observed as modified groundcover within deep soil areas.

It was noted during the site inspection that significant civil construction works have been recently undertaken by Sydney Water within the lower portion of the site and within the adjoining allotments for the establishment of new trunk drainage and sewer infrastructure.

4.2 Tree Preservation Order

The Pittwater 21 Development Control Plan, Section B4.22 Preservation of Trees and Bushland Vegetation applies to all land, waterways and Bushland covered by the Pittwater Local Environmental Plan 2014 which includes the subject site. The provisions generally protect any tree over five (5) metres in height and require a Vegetation Clearing permit for any removal of such trees.

4.3 The Trees

A total of thirty (30) trees and groups of trees (**Trees 1-30**) were observed within the subject site and adjoining allotments which have been surveyed as part of this assessment. All tree data recorded on site has been tabulated and is contained at **Appendix 1**. Each tree has been provided with an identification number for reference purposes and is denoted on the attached Tree Location Plan at **Appendix 2**.

Trees 1-8, 11-20, & 22-28 were observed to be located within the site boundaries. These trees were generally located within two distinct areas, being; the front half of the site adjoining Warriewood Road and within the more densely vegetated area within the rear of the site.

Twelve (12) site trees and groups of trees are classified as 'Exempt Species' under Section B4.22 of Pittwater 21 DCP and do not require Council consent for removal. This includes **Trees 1, 2, 3, 4, 5, 6, 7, 11, 13, 14, 27 & 28** (group).

Trees 9 & 10 are located on the adjoining allotment to the east at No.41 Warriewood Road and appear to have been retained as part of major subdivision and land clearing works.

Tree 21 is located on the adjoining allotment to the west at No.53 Warriewood Road and is located directly adjacent to the newly constructed pedestrian through site link which is to continue through the subject site.

Trees 29 & 30 were observed to be located outside the site boundaries within the adjoining allotment to the east at No.41 Warriewood Road. A recently constructed roadway and retaining wall have been constructed directly adjacent.

Dense and inaccessible vegetation was observed within the rear portion of the site which does not form part of this assessment given it is not to be impacted by the proposed development works. Trees located on the northern and western fringe of this densely vegetated area have been included within the assessment given the location of a pedestrian through site link and potential for impact.

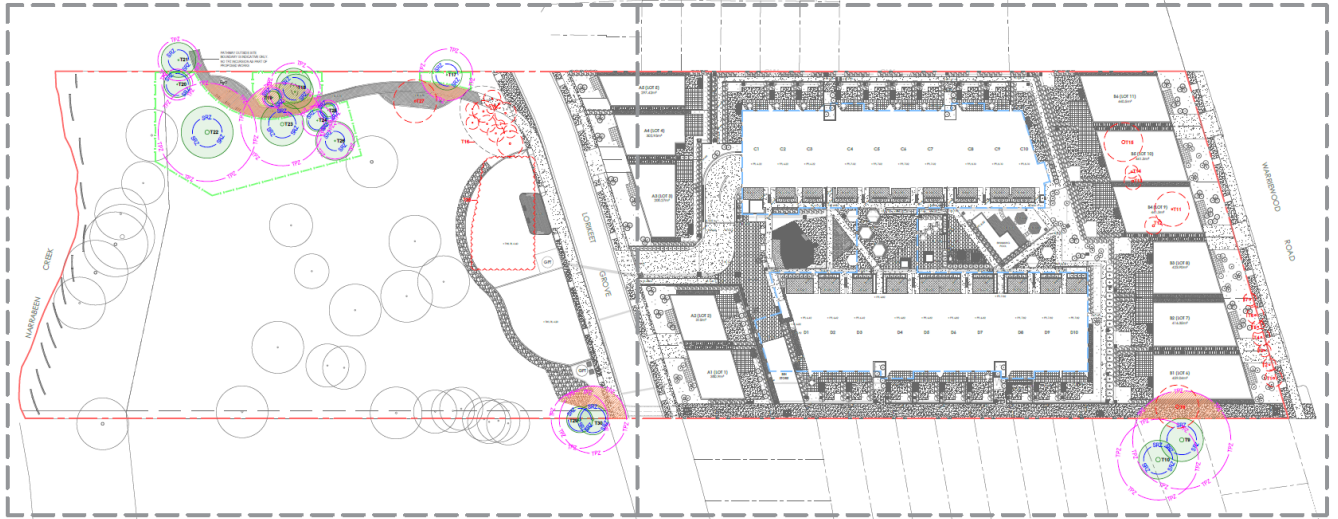


Figure 3 – Tree Location Plan extract: refer to Appendix 2 for full Tree Location Plan

5 DISCUSSION

5.1 Impact Assessment

The impact assessment is to calculate the incursions to the root zones and canopies as a result of the proposed demolition and construction works and evaluate the likely impact of the proposed works on the subject trees. A summary of the impacts anticipated are contained within the Tree Schedule at **Appendix 1**. Additionally, plans demonstrating the level of incursion and conflict to TPZ's and SRZ's can be found at **Appendix 2**. As part of the assessment the following criteria have been considered:

- Existing Relative Levels (R.L.);
- Proposed Relative Levels;
- Tree Protection Zones (TPZ);
- Structural Root Zones (SRZ);
- Footprint of the proposed development (incl. stormwater and services) and temporary structures (scaffolding, hoardings etc.);
- Incursions to the TPZ & SRZ, including estimated cut & fill beyond the building footprint;
- Incursions to the tree canopy from the building envelope and temporary structures;
- Pruning necessary for building clearance;
- Remediation works for soil contaminants;
- Species tolerance to disturbance; and
- Assessment of the likely impact of the works on existing trees.

5.2 Trees Recommended for Removal

Based on the plans supplied, should the proposed development proceed in its current form it is recommended that a total of sixteen (16) trees and groups of trees be removed. Removals have been recommended based upon tree locations within the footprint of proposed hard paving areas, decking areas and site re-grading works. Refer to **Appendix 2** for a plan indicating the location of trees that will require removal (dashed red).

5.2.1 Protected Trees – Removal Required

Three (3) individual protected trees (**Trees 8, 12 & 15**) and one (1) group of protected trees (**Tree 16**) are to be subjected to full encroachment as a result of the proposed construction works. These works include establishment of new hard paving areas as overall re-grading of the site for civil drainage purposes. Given their location, these trees are unable to be retained. Despite this, it is considered that their removal can be suitably offset by the proposed landscape scheme which is to include a significant number of replacement trees as well as the remediation of the endemic bushland area within the southern portion of the site.

5.2.2 Exempt Trees – Removal Required

Twelve (12) additional trees and groups of trees are to be subjected to full encroachment as a result of the proposed construction works. This includes **Trees 1, 2, 3, 4, 5, 6, 7, 11, 13, 14, 27 & 28** (group) which are located within the footprint of proposed decking areas and overall site re-grading works. These trees are exempt from protection under Section B4.22 of Pittwater 21 DCP due to being undesirable species and may be removed from the without Council consent.

5.3 Trees Recommended for Retention & Protection

Should the proposed works proceed in their current form, it is recommended that fourteen (14) trees be retained and protected given the proposed works are unlikely to result in any significant negative impacts to the long-term health and viability of these trees pending implementation of required tree protection measures. This includes **Trees 9, 10, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 29 & 30**. Refer to **Appendix 2** for a plan indicating the location of trees that are to be retained and protected (shaded green).

5.3.1 Major Impact

As per AS4970-2009 *Protection of trees on development sites*, seven (7) trees are to suffer a 'Major' (>10%) but generally sustainable level of incursion to the TPZ as a result of the construction works occurring within the nominal TPZ's. This includes **Trees 9, (23%), 17 (18%), 18 (17%), 23 (15%), 25 (18%), 29 (12%) & 30 (27%)**. Works relate to construction of the proposed through-site link pedestrian pathway, site regrading works and stormwater infrastructure.

Tree 9 is to be impacted by the proposed stormwater and site re-grading works to occur to the north-west. The works are to result in an encroachment to the TPZ of 23% with no works to occur within the SRZ. Excavation for the proposed stormwater must be undertaken in a sensitive manner in accordance with the Section 13 & 14 of **Appendix 5** to mitigate impacts.

Trees 17, 18, 23, & 25 are to be impacted by the new pedestrian pathway which will result in incursion to TPZ's of 18%, 17%, 15% and 18% respectively. Works are also to be undertaken in the SRZ of Trees 23 & 25. An existing unsealed roadway access currently exists directly adjacent to these trees which has resulted in a high level of compaction on the TPZ areas. Provided the pathway is constructed above the existing grade in a root sensitive manner as detailed in **Appendix 5**, the works are unlikely to result in any long-term impact.

Trees 29 & 30 are to be impacted by the proposed stormwater, hard paving and site re-grading works resulting in encroachments of 12% and 27% to the respective TPZs with works also occurring within the SRZ of each tree. Excavation for the proposed stormwater infrastructure must be undertaken in a sensitive manner in accordance with the Section 13 & 14 of **Appendix 5** to mitigate impacts.

5.3.2 Minor Impact

As per AS4970-2009 *Protection of trees on development sites*, three (3) trees are to suffer a 'Minor' (<10%) and sustainable level of incursion to the TPZ as a result of the construction works occurring within the nominal TPZ's. This includes **Trees 19 (2%), 22 (7%) & 24 (5%)** which are to be impacted by works required to establish the proposed through-site link pedestrian pathway. These works are considered tolerable provided they are carried out in a root sensitive manner and suitable protection measures are implemented as detailed in **Appendix 5**.

5.3.3 Trees Unaffected by Development

Based on the plans supplied and referenced above, the proposed construction works are unlikely to result in any impact to four (4) existing trees given their distance from the proposed works and nil encroachment to Tree Protection Zones. This includes **Tree 10, 20, 21 & 26**. Subject to suitable tree protection in accordance with **Appendix 5**, these trees are unlikely to be impacted.

5.4 Ancillary Construction Related Impacts

Vehicles, machinery and equipment requiring access to the site have potential to result in inadvertent impacts to those trees being retained including compaction of the root zone, soil disturbance, physical damage to roots, trunk damage etc. and as such will require management.

Furthermore, storage and stockpiling of material may result in similar impacts and will require management. In this regard, protection for those trees to be retained is to be carried out in accordance with **Appendix 5**.

6 CONCLUSION

6.1 Proposed Development Impact

Based on the plans and information supplied, the proposal would result in the following impacts to existing trees on site:

- Removal of twelve (12) 'exempt' trees and groups of trees (**Trees 1, 2, 3, 4, 5, 6, 7, 11, 13, 14, 27 & 28** (group)) which are not protected under Section B4.22 of Pittwater 21 DCP due to being undesirable species;
- Removal of four (4) site trees (**Trees 8, 12, 15 & 16** (group)) of 'Medium' & 'High' retention value due to impacts resulting from the proposed construction and building works;
- Retention and protection of seven (7) trees (**Trees 9, 17, 18, 23, 25, 29 & 30**) which are to suffer a major (>10%) incursion to the TPZ;
- Retention and protection of three (3) trees (**Trees 19, 22 & 24**) which are to suffer a minor (<10%) incursion to the TPZ;
- Retention and protection of four (4) trees (**Trees 10, 20, 21 & 26**) which are located sufficiently away from the proposed construction works and are unlikely to be impacted;

Detailed tree protection measures in accordance with **Appendix 5** will be required for those trees outside of the building envelopes which are to be retained to ensure no inadvertent impacts are sustained from construction related activities.

Specific recommendations as per **Section 7** will need to be adopted to ensure root sensitive construction techniques and methodology are employed which mitigate the potential negative impacts to retained trees.

Replacement planting as per **Section 7.3** will be required to compensate for the loss of amenity and impact to landscape character resulting from the proposed tree removal.

7 RECOMMENDATIONS

7.1 Tree Removal

Remove **Trees 1, 2, 3, 4, 5, 6, 7, 8, 11, 12, 13, 14, 15, 16** (group), **27 & 28** (group) (16 trees and groups of trees) to facilitate the proposed development works.

Development consent and relevant approvals must be obtained from the Northern Beaches Council prior to the removal or pruning of any tree protected under Section B4.22 of the Pittwater 21 Development Control Plan 2012.

All tree removal work is to be carried out by an experienced Arborist with minimum AQF Level 3 qualifications in accordance with AS4373-2007 - *Pruning of Amenity Trees*, Safe Work Australia Guide for Managing Risks of Tree Trimming and Removal Work (2016) and other applicable legislation.

7.2 Tree Retention & Protection

Retain and protect **Trees 9, 10, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 29 & 30** (14 trees) in accordance with the Tree Location Plan & Tree Protection Specification held at **Appendix 2 & 5**, AS497-2009 *Protection of trees on development sites* and the specific recommendations below:

7.2.1 Project Arborist Engagement

A Project Arborist experienced in tree protection on construction sites should be engaged prior to the commencement of any works on site. The Project Arborist shall monitor and report regularly to the Principal Certifying Authority (PCA) and the Applicant on the condition and protection of the retained trees during the works. The Project Arborist is to supervise and monitor any excavation, machine trenching or compacted fill placement within the TPZ of retained trees throughout construction.

7.3 Replacement Planting

In order to compensate for loss of amenity resulting from the removal of protected trees on site, replacement planting should be provided on site. This will ensure there is no incremental loss of canopy cover over time & the ecological value of trees on the site is maintained.

Accordingly, thirty (30) large growing (15m+) locally endemic compensatory canopy tree plantings should be provided on site planted at a minimum 45 litre pot size. The following species should be considered for replacement planting:

- *Casuarina glauca* (Swamp Oak)
- *Eucalyptus botryoides* (Bangalay)
- *Eucalyptus robusta* (Swam Mahogany)
- *Melaleuca quinquenervia* (Broad-leaved Paperbark)

Should you have any queries in relation to the information presented within the Arboricultural Impact Assessment, please feel free to contact me directly.

Sincerely,



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8 REFERENCES

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APPENDIX 1: TREE ASSESSMENT DATA - 43, 45 & 49 Warriewood Road, Warriewood

Tree No.	Genus & species Common Name	Height (m)	Crown Spread (m)	DBH (mm)	DGL (mm)	TPZ Radius (m)	SRZ Radius (m)	Age Class	Health / Vitality	Structure/ Condition	SULE Rating	Landscape Significance	Retention Value	Development Impact	Retain / Remove	Comments
1	<i>Cupressus sp.</i> Cypress	10	4	450	500	5.40	2.47	M	Good	Average	Medium 15-40yrs	Low	Low	Within footprint of proposed site re-grading works	Remove	Part of row of 7 x trees, pruned on northern side for powerline clearance. 1.5m of fill recently placed within southern portion of TPZ
2	<i>Cupressus sp.</i> Cypress	10	3	300	350	3.60	2.13	M	Good	Average	Medium 15-40yrs	Low	Low	Within footprint of proposed site re-grading works	Remove	Part of row of 7 x trees, pruned on northern side for powerline clearance. 1.5m of fill recently placed within southern portion of TPZ
3	<i>Cupressus sp.</i> Cypress	10	3	300	350	3.60	2.13	M	Good	Average	Medium 15-40yrs	Low	Low	Within footprint of proposed site re-grading works	Remove	Part of row of 7 x trees, pruned on northern side for powerline clearance. 1.5m of fill recently placed within southern portion of TPZ
4	<i>Cupressus sp.</i> Cypress	10	4	300	380	3.60	2.20	M	Good	Average	Medium 15-40yrs	Low	Low	Within footprint of proposed site re-grading works	Remove	Part of row of 7 x trees, pruned on northern side for powerline clearance. 1.5m of fill recently placed within southern portion of TPZ
5	<i>Cupressus sp.</i> Cypress	10	3	300	350	3.60	2.13	M	Good	Average	Medium 15-40yrs	Low	Low	Within footprint of proposed site re-grading works	Remove	Part of row of 7 x trees, pruned on northern side for powerline clearance. 1.5m of fill recently placed within southern portion of TPZ
6	<i>Cupressus sp.</i> Cypress	10	4	350	450	4.20	2.37	M	Good	Average	Medium 15-40yrs	Low	Low	Within footprint of proposed site re-grading works	Remove	Part of row of 7 x trees, pruned on northern side for powerline clearance. 1.5m of fill recently placed within southern portion of TPZ
7	<i>Cupressus sp.</i> Cypress	10	3	400	450	4.80	2.37	M	Good	Average	Medium 15-40yrs	Low	Low	Within footprint of proposed site re-grading works	Remove	Part of row of 7 x trees, pruned on northern side for powerline clearance. 1.5m of fill recently placed within southern portion of TPZ
8	<i>Eucalyptus robusta</i> Swamp Mahogany	15	10	800	950	9.60	3.24	M	Fair	Average	Medium 15-40yrs	High	High	Within footprint of proposed site re-grading works	Remove	15° lean & crown bias to west. Moderate level of medium-large & deadwood. 70% crown density. 1m of fill recently placed within western portion of TPZ
9	<i>Eucalyptus robusta</i> Swamp Mahogany	15	10	950	1100	11.40	3.44	M	Average	Average	Medium 15-40yrs	High	High	Major (23%) TPZ incursion	Retain & Protect	Failed and decayed co-dominant stem from ground level. Appears stable.
10	<i>Eucalyptus robusta</i> Swamp Mahogany	13	9	780	1050	9.36	3.38	M	Fair	Average	Medium 15-40yrs	High	High	No works proposed within TPZ	Retain & Protect	Twin included trunks from ground level. Failed stem at 1m with some decay evident & evidence of prior borers attack. Moderate level of epicormic growth.
11	<i>Grevillea robusta</i> Silky Oak	17	8	350	450	4.20	2.37	OM	Poor	Poor	Short 5-15yrs	Low	Priority for Removal	Within footprint of proposed site re-grading works	Remove	Exempt weed species under Part B4.22 of Pittwater 21 DCP.
12	<i>Araucaria columnaris</i> Cook Pine	16	4	500	600	6.00	2.67	M	Good	Average	Long 40yrs +	Medium	High	Within footprint of proposed site re-grading works	Remove	Mid & upper crown lean to north.
13	<i>Cupressus sp.</i> Cypress	13	4	450	500	5.40	2.47	M	Fair	Average	Medium 15-40yrs	Low	Low	Within footprint of proposed site re-grading works	Remove	Exempt species under Part B4.22 of Pittwater 21 DCP.
14	<i>Cupressus sp.</i> Cypress	10	3	350	400	4.20	2.25	M	Fair	Average	Medium 15-40yrs	Low	Low	Within footprint of proposed site re-grading works	Remove	Exempt species under Part B4.22 of Pittwater 21 DCP.
15	<i>Brachychiton discolor</i> Lacebark Tree	10	9	750	850	9.00	3.09	M	Average	Average	Medium 15-40yrs	Medium	Medium	Within footprint of proposed site re-grading works	Remove	Co-dominant stems form 1m, sparse foliage density.
16	13 x <i>Casuarina glauca</i> Swamp Oak	8	2	150 - 400	150 - 450	-	-	M	Average	Fair	Long 40yrs +	Medium	High	Within footprint of proposed hard paving & site re-grading works	Remove	Group of 13 x self sown small trees, slender forest forms.
17	<i>Casuarina glauca</i> Swamp Oak	12	7	500	550	6.00	2.57	M	Average	Fair	Long 40yrs +	Medium	High	Major (18%) TPZ incursion	Retain & Protect	5 x stems from ground level, sharing root plate, adjacent retaining wall. Recent significant excavation within SRZ to western side of tree within adjoining allotment - 2m of cut extending right up to trunk. Recent, significant compaction within TPZ from heavy vehicle operation
18	<i>Eucalyptus robusta</i> Swamp Mahogany	14	8	500	580	6.00	2.63	M	Fair	Average	Long 40yrs +	High	High	Major (17%) TPZ incursion	Retain & Protect	Low foliage density, minor mistletoe infestation, shared root plate. Recent, significant compaction within TPZ from heavy vehicle operation

Tree No.	Genus & species Common Name	Height (m)	Crown Spread (m)	DBH (mm)	DGL (mm)	TPZ Radius (m)	SRZ Radius (m)	Age Class	Health / Vitality	Structure/ Condition	SULE Rating	Landscape Significance	Retention Value	Development Impact	Retain / Remove	Comments
19	<i>Casuarina glauca</i> Swamp Oak	8	3	200	300	2.40	2.00	SM	Average	Fair	Long 40yrs +	Medium	High	Minor (2%) TPZ incursion	Retain & Protect	Crown bias to south. Recent, significant compaction within TPZ from heavy vehicle operation
20	<i>Eucalyptus robusta</i> Swamp Mahogany	14	6	300	400	3.60	2.25	M	Fair	Average	Medium 15-40yrs	High	High	No works proposed within TPZ	Retain & Protect	Crown heavily suppressed by adjacent Coral Tree, low foliage density. Recent, significant compaction within TPZ from heavy vehicle operation
21	<i>Eucalyptus robusta</i> Swamp Mahogany	15	8	400	450	4.80	2.37	M	Average	Average	Medium 15-40yrs	High	High	No works proposed within TPZ	Retain & Protect	Upper crown skewed to west, high level of deadwood within canopy. Recent, significant compaction within TPZ from heavy vehicle operation
22	<i>Eucalyptus robusta</i> Swamp Mahogany	18	12	950	1100	11.40	3.44	M	Average	Average	Medium 15-40yrs	High	High	Minor (7%) TPZ incursion	Retain & Protect	Significant compaction to TPZ from adjacent informal roadway, appears stressed with low foliage density. Recent, significant compaction within TPZ from heavy vehicle operation
23	<i>Eucalyptus robusta</i> Swamp Mahogany	14	10	800	900	9.60	3.17	M	Average	Average	Medium 15-40yrs	High	High	Major (15%) TPZ incursion + Major (16%) SRZ incursion	Retain & Protect	Sparse foliage density, cavity @ 7m west side, canker @ 2m south side. Recent, significant compaction within TPZ from heavy vehicle operation
24	<i>Eucalyptus robusta</i> Swamp Mahogany	10	5	300	350	3.60	2.13	M	Fair	Average	Long 40yrs +	High	High	Minor (5%) TPZ incursion	Retain & Protect	Lean to west, crown impacted by adjoining T25. Recent, significant compaction within TPZ from heavy vehicle operation
25	<i>Casuarina glauca</i> Swamp Oak	12	3	200	250	2.40	1.85	M	Average	Average	Long 40yrs +	Medium	High	Major (18%) TPZ incursion + Major (10%) SRZ incursion	Retain & Protect	Impacting T24, growing through canopy. Recent, significant compaction within TPZ from heavy vehicle operation
26	<i>Eucalyptus robusta</i> Swamp Mahogany	14	9	350	400	4.20	2.25	M	Average	Average	Short 5-15yrs	High	Low	No works proposed within TPZ	Retain & Protect	Sparse foliage density, upper crown dieback, high levels of deadwood. Recent, significant compaction within TPZ from heavy vehicle operation
27	<i>Erythrina x sykesii</i> Coral Tree	12	10	400	500	4.80	2.47	M	Good	Fair	Long 40yrs +	Low	Priority for Removal	Within footprint of proposed decking area	Remove	Exempt weed species under Part B4.22 of Pittwater 21 DCP.
28	<i>Erythrina x sykesii</i> Coral Tree	10	5	300 - 400	350 - 450	-	-	M	Good	Fair	Long 40yrs +	Low	Priority for Removal	Within footprint of proposed decking area & site re-grading works	Remove	Dense thicket. Exempt weed species under Part B4.22 of Pittwater 21 DCP.
29	<i>Casuarina glauca</i> Swamp Oak	18	7	550	600	6.60	2.67	M	Fair	Poor	Long 40yrs +	High	High	Major (12%) TPZ incursion + Minor (1%) SRZ incursion	Retain & Protect	Neighbouring tree, lean & canopy bias to west, heavily weighted, previous branch failures and some decay evident in basal region north side.
30	<i>Casuarina glauca</i> Swamp Oak	16	6	650	800	7.80	3.01	M	Fair	Fair	Long 40yrs +	High	High	Major (27%) TPZ incursion + Major (12%) SRZ incursion	Retain & Protect	Neighbouring tree, co-dominant stems from 6m, appears stable.

Tree Inspection Data Notes & Terminology

Tree No. (Tree Number)

The tree number associated to each tree located on or adjacent to the subject site. Relates to the Tree Location Plan held at Appendix 2.

Botanical Name and Common Name

The botanical and common name of each tree is identified and recorded. Occasionally the exact species name is unknown; sp. is recorded to indicate this.

Height, Crown Width and DBH

- The trees height and crown spread is recorded in metres (m);
- The tree DBH is recorded in millimetres (mm). DBH is an abbreviation of Diameter (of the trunk) measured at Breast Height (or 1.4m from the base of the trunk). If more than one trunk is present the DBH is calculated in accordance with AS4970-2009 Protection of Trees on Development Sites

Age Class

The age class of each tree is estimated as either:

- IM – Immature refers to well established but juvenile tree
- SM – Semi Mature, a tree that has not grown to mature size
- M – Mature, a tree that has reached mature size and will slowly increase in size over time
- OM – Over Mature, a tree that has been mature for a long period and is beginning to display signs of decline, e.g. large dead branches
- S – Senescent, an over mature tree that is now in decline

Health & Condition

The trees health and vigour is recorded as a measurement of:

Good - the tree does not appear to appear stressed with no excessive dieback, insect infestation, decay, deadwood or epicormic shoots

Average - the tree appears stressed and has some crown dieback, and /or a few epicormic shoots, and/or some deadwood in the crown and some new growth at branch tips. These trees may benefit from remediation of the growing environment to reduce stress and return it to good health

Fair - the tree may have areas of crown dieback, and/or epicormic shoots, and/or areas of decay, and/or reduced new growth at branch tips. These trees have been stressed for a short period of time, remediation of the growing environment may improve trees health

Poor - the tree may have large areas of crown dieback, and/or many epicormic shoots, and/or reduced new growth at branch tips. These trees have been stressed for a long period of time, remediation of the growing environment would not return the tree to good health.

SRZ (Structural Root Zone)

The SRZ is a radial area extending outwards from the centre of the trunk. This area contains the majority of the structural woody roots. This area is responsible primarily for stability. Root damage or root loss within this zone greatly increases the opportunity for decay fungi to ingress into the heartwood, causing internal decay in addition to destabilising the trees structural integrity. The SRZ is calculated as follows (This calculation is taken from the Australian Standard 4970 – 2009 Protection of Trees on Development Sites): $[D \times 50]0.42 \times 0.64$

TPZ (Tree Protection Zone)

The TPZ is a radial area measured by multiplying the DBH by twelve (12) or a circular area the size of the trees drip line, whichever is greater. This area contains the majority of the structural and feeder roots responsible for stability, gaseous exchange and water and nutrient uptake. Excavation, back filling, compaction or other disturbance should not occur in this area. The TPZ is used to identify the minimum area required for the safe retention of a given tree. This calculation is derived from the Australian Standard 4970-2009 Protection of Trees in Development Sites. An incursion up to 10% within the TPZ is potentially acceptable if no other option is available. A major encroachment (in excess of 10%) is required to be clearly justified by the Project Arborist and compensated for elsewhere. Justification methodology may vary depending on site or individual tree's health, vigour and ability to withstand disturbance and may require root investigation.

Landscape Significance

The landscape significance of a tree or group of trees is determined using a combination of health/vigour/condition, amenity, heritage and ecological values in accordance with IACA Significance of a Tree, Assessment Rating System (STARS)© (IACA 2010)©.

1. High Significance in Landscape**2. Medium Significance in Landscape****3. Low Significance in Landscape****Retention Value (RV)**

Determined by [1] tree free of visual defects and viable for retention, [2] viable for retention with minor faults which may reduce SULE, [3] trees which should not restrict development applications containing faults that are likely to become problematic in the short term, [4] trees to be considered for removal due to average condition.

High Retention - These trees are considered important for retention and should be retained and protected. Design modification or re-location of building/s should be considered to accommodate the setbacks as prescribed by the Australian Standard AS4970 Protection of trees on development sites. Tree sensitive construction measures must be implemented e.g. pier and beam etc. if works are to proceed within the Tree Protection Zone.

Medium Retention - 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.

Low Retention - 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.

S.U.L.E. Categories

Safe Useful Life Expectancy (after Barrell 1996, modified by the author). A trees S.U.L.E. category is the life expectancy of the tree modified first by its age, health, condition, safety and location. S.U.L.E. assessments may be modified as dictated by changes in trees health and environment.

Long - Appear retainable at the time of assessment for over 40 years with an acceptable degree of risk assuming reasonable maintenance.

Medium - Appear to be retainable at the time of assessment for 15 to 40 years with an acceptable degree of risk assuming reasonable maintenance.

Short - Trees appear to be retainable at the time of assessment for 5 to 15 years with an acceptable degree of risk assuming reasonable maintenance.

Very Short - Removal - Trees which should be scheduled for removal within the very short term or as specified within this report.

Small, Young or Regularly Pruned – Trees under 5m in height that can be easily moved or replaced, includes screen plantings or hedge lines.

Development Impact

Brief outline of the impact of the proposed development works or ancillary construction related activities likely to impact the tree.

Retain/Remove

The proposed removal or retention recommendation in light of the proposed development related impacts.

NOTES: This report acknowledges the current Australian Standards 'Protection of Trees on Development Sites' AS 4970 – 2009 with reference to the Tree Protection Zone (TPZ): being a combination of the root and crown area requiring protection. The TPZ takes into consideration the Structural Root Zone (SRZ): The area required for tree stability. Determined by AS4970 - 2009 Figure 1, Table of determining the SRZ, section 3.3.5 of the standards. The standard states where a greater than 10% encroachment occurs the arborist is to take into consideration the schedule of determining impacts as set within AS4970 s. 3.3.4. Encroachments are referred to within this report as major or minor encroachments (AS4970 s. 3.3.2 & 3.3.3). Below is the terminology used for estimated percentage of development incursion used within this report. To retain specific trees and ensure their viability, development must take into consideration protection of the TPZ radius. The extent of inclusion within the TPZ radius has been categorised within this report as follows:

<10% - negligible incursion

>10 - <15% - low to moderate level of incursion

>15 - <20% - moderate level of incursion

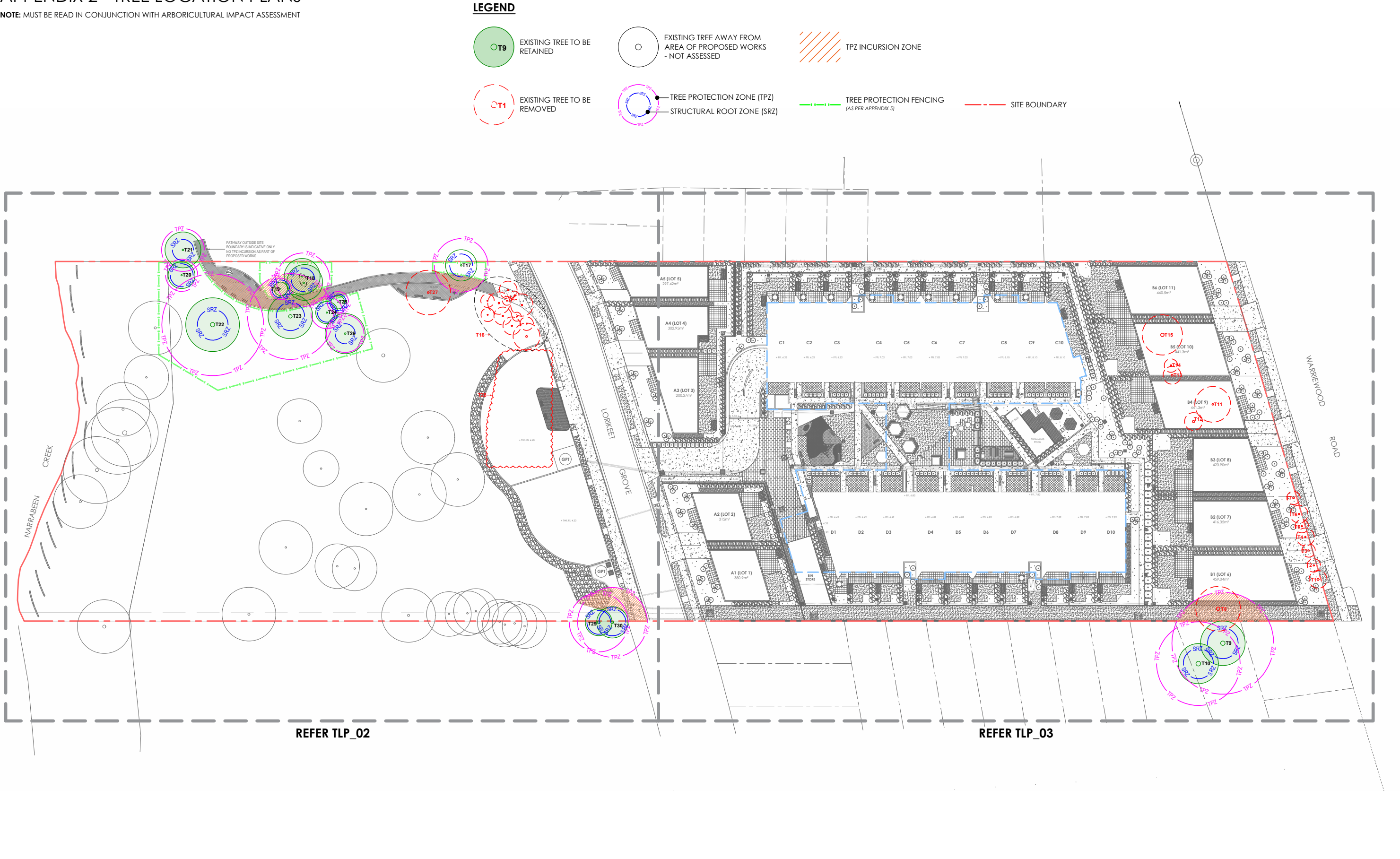
>20 - <25% - moderate to high level of incursion

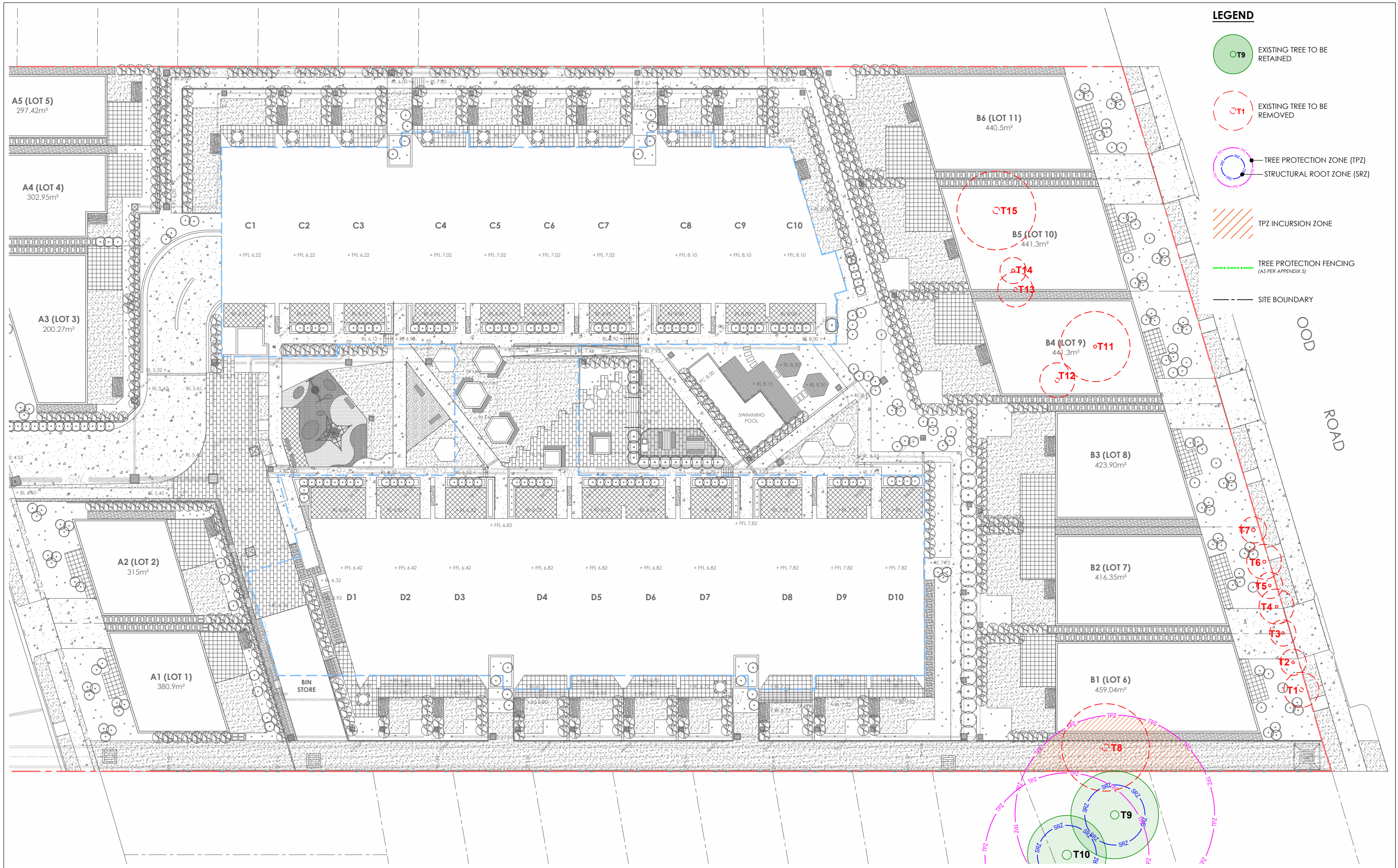
>25 - <35% - high level of incursion

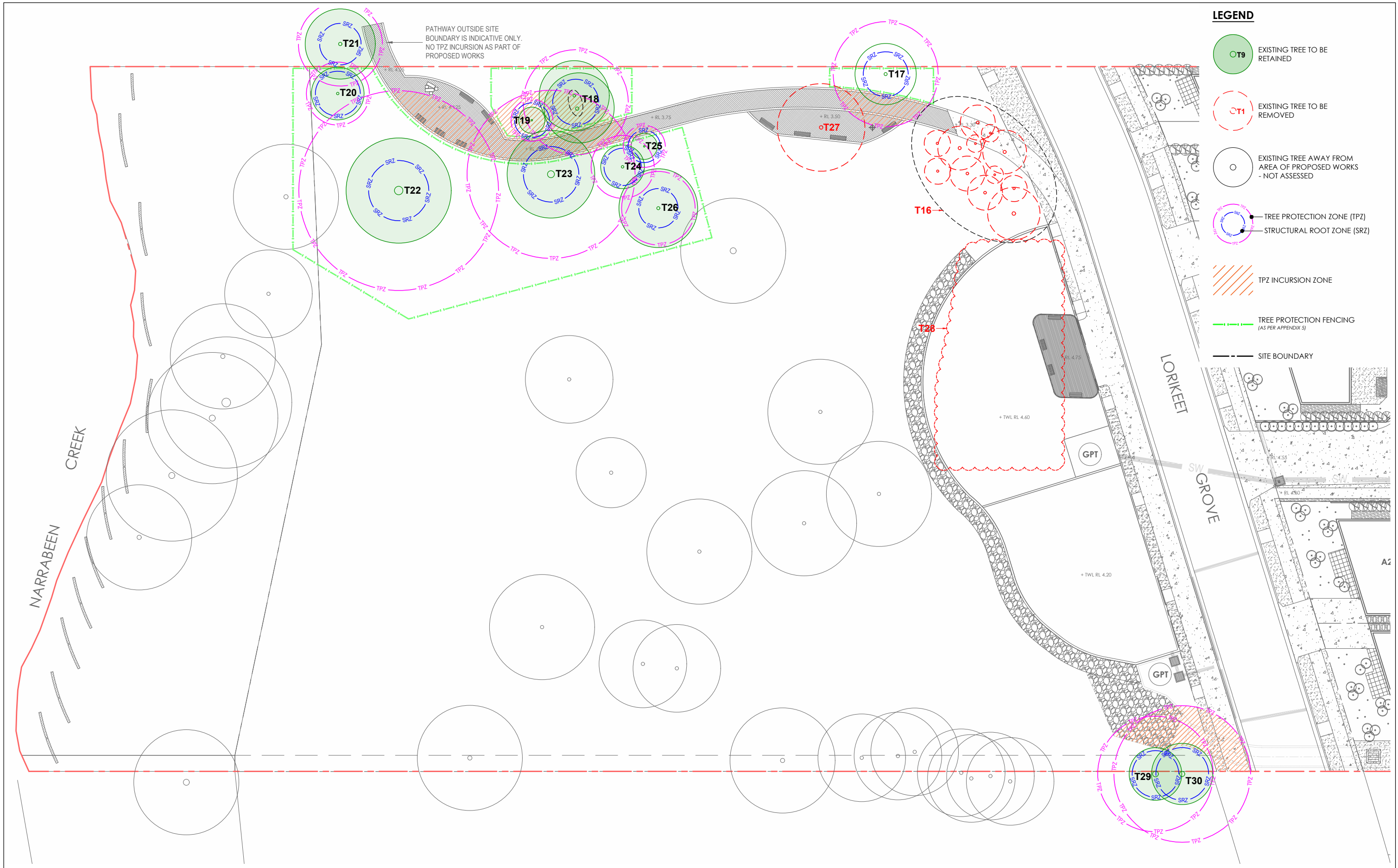
>35% - significant incursion within the TPZ

APPENDIX 2 - TREE LOCATION PLANS

NOTE: MUST BE READ IN CONJUNCTION WITH ARBORICULTURAL IMPACT ASSESSMENT







LEGEND

- EXISTING TREE TO BE RETAINED
- EXISTING TREE TO BE REMOVED
- EXISTING TREE AWAY FROM AREA OF PROPOSED WORKS - NOT ASSESSED
- TREE PROTECTION ZONE (TPZ)
- STRUCTURAL ROOT ZONE (SRZ)
- TPZ INCURSION ZONE
- TREE PROTECTION FENCING (AS PER APPENDIX 5)
- SITE BOUNDARY

Issue	Code	Issue Description	By	Chk	Date
B	CA	FOR APPROVAL	NZ	GT	18.12.23
A	CA	FOR APPROVAL	TP	GT	20.08.21

PRE - Preliminary CA - Council Approval T - Tender CON - Construction

APPENDIX 3

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.

Table 1.0 Tree Retention Value - Priority Matrix.

		Significance				
		1. High	2. Medium	3. Low		
		Significance in Landscape	Significance in Landscape	Significance in Landscape	Environmental Pest / Noxious Weed Species	Hazardous / Irreversible Decline
Estimated Life Expectancy	1. Long >40 years					
	2. Medium 15-40 Years					
	3. Short <1-15 Years					
	Dead					
Legend for Matrix Assessment 						
		Priority for Retention (High) - These trees are considered important for retention and should be retained and protected. Design modification or re-location of building/s should be considered to accommodate the setbacks as prescribed by the Australian Standard AS4970 <i>Protection of trees on development sites</i> . Tree sensitive construction measures must be implemented e.g. pier and beam etc 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.				

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

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

The following example shows the IACA **Significance** of a **Tree, Assessment Rating System** (STARS) used in an Arboricultural report.

Tree Significance

Determined by using the Tree Significance - Assessment Criteria of the *IACA Significance of a Tree, Assessment Rating System* (STARS)© (IACA, 2010), Appendix B.

Trees 14, 16, 17/3, 19 and 20/4 are of high significance with the remaining majority of medium significance and a few of low significance. Tree 14 is significant as a prominent specimen and a food source for indigenous avian fauna. Tree 16 as a non-locally indigenous planting is of good form and prominent *in situ*; Tree 17/3 as a stand of 6 street trees along the Davey Street frontage screening views to and from the site and contiguous with trees in Victoria Park extending the aesthetic influence of the urban canopy to the site. Similarly for Trees 20/4 as street trees in Long Road and Tree 19 as an extant exotic planting as a senescent component of the original landscaping. The trees of low significance are recent plantings as fruit trees – Avocados, and 1 Cootamundra Wattle as a non-locally indigenous tree in irreversible decline and potentially structurally unsound.

Significance Scale

1 – High
2 – Medium
3 – Low

Significance Scale	1	2	3
Tree No. / Stand No.	14, 16, 17/3, 19, 20/4	1/1, 2, 4, 5, 6, 7, 8, 9, 10, 11, 12/2, 15, 18, 21/5	3, 13, 22

Tree Retention Value

Determined by using the Retention Value - Priority Matrix of the *IACA Significance of a Tree, Assessment Rating System* (STARS)© (IACA, 2010), Appendix B.

Retention Value

High – Priority for Retention
Medium – Consider for Retention
Low – Consider for Removal
Remove - Priority for Removal

Retention Value	High Priority for Retention	Medium Consider for Retention	Low Consider for Removal	Remove Priority for Removal
Tree No. / Stand No.	1/1, 5, 17/3*, 19	2, 4, 6, 7, 8, 9, 10, 11, 14, 15, 16, 18, 20/4*, 21/5	3, 12/2, 13,	22

* Trees located within the neighbouring property and should be retained and protected.

APPENDIX 4 - EXTRACT FROM AS4970 2009 PROTECTION OF TREES ON DEVELOPMENT SITES

Section 3, Determining the tree protection zones of the selected trees

3.1 Tree protection zone (TPZ)

"The tree protection zone (TPZ) is the principal means of protecting trees on development sites. The TPZ is a combination of the root area and crown area requiring protection. It is an area isolated from construction disturbance, so that the tree remains viable."

The TPZ incorporates the structural root zone (SRZ) (refer to Clause 3.3.5)."

3.2 Determining the TPZ

The radius of the TPZ is calculated for each tree by multiplying its DBH x 12.

$$\text{TPZ} = \text{DBH} \times 12$$

where

DBH = trunk diameter measured at 1.4 m above ground

Radius is measured from the centre of the stem at ground level.

3.3.5 Structural root zone (SRZ)

"The SRZ is the area required for street stability. A larger area is required to maintain a viable tree. The SRZ only needs to be calculated when a major encroachment into a TPZ is proposed. Root investigation may provide more information on the extent of these roots."

Determining the SRZ

The radius of the TPZ is calculated for each tree by multiplying its DBH x 12.

$$\text{SRZ radius} = (D \times 50)^{0.42} \times 0.64$$

where

D = trunk diameter, in metres, measured above the root buttress.

Note: The SRZ for trees with trunk diameters less than 0.15 m will be 1.5 m (see Figure 1).

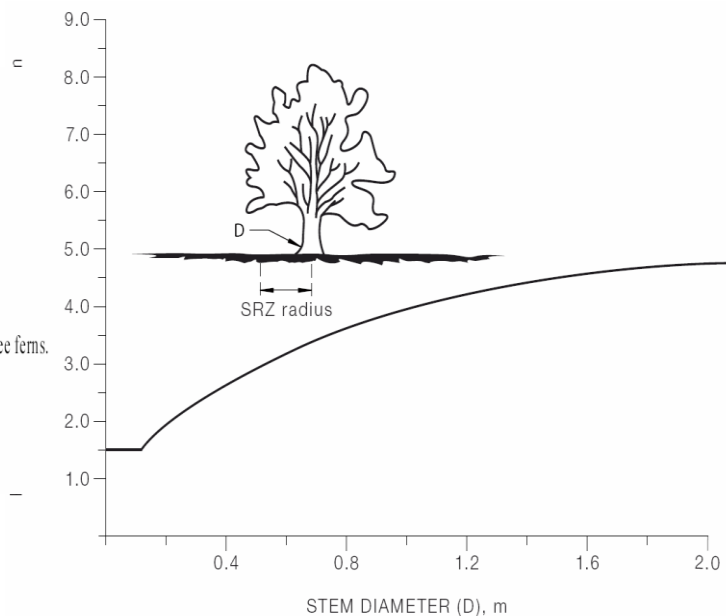
The curve can be expressed by the following formula:

$$R_{\text{SRZ}} = (D \times 50)^{0.42} \times 0.64$$

NOTES:

- 1 R_{SRZ} is the structural root zone radius.
- 2 D is the stem diameter measured immediately above root buttress.
- 3 The SRZ for trees less than 0.15 m diameter is 1.5 m.
- 4 The SRZ formula and graph do not apply to palms, other monocots, cycads and tree ferns.
- 5 This does not apply to trees with an asymmetrical root plate.

FIGURE 1 STRUCTURAL ROOT ZONE



APPENDIX 5 – GENERAL TREE PROTECTION SPECIFICATION

1.0 Appointment of Project Arborist

A Project Arborist shall be engaged prior the commencement of work on-site and monitor compliance with the protection measures. The Project Arborist shall inspect the tree protection measures and Compliance Certification shall be prepared by the Project Arborist for review by the Principal Certifying Authority prior to the release of the Compliance Certificate.

The Project Arborist shall have a minimum qualification equivalent (using the Australian Qualifications Framework) of Level 5 or above in Arboriculture.

2.0 Compliance

Contractors and site workers shall receive a copy of these specifications a minimum of 3 working days prior to commencing work on-site. Contractors and site workers undertaking works within the Tree Protection Zone shall sign the site log confirming they have read and understand these specifications, prior to undertaking works on-site.

The Project Arborist shall undertake regular site inspections and certify that the works are being undertaken in accordance with this specification.

Compliance Documentation shall be prepared by the Project Arborist following each site inspection. The Compliance Documentation shall include documentary evidence of compliance with the tree protection measures and methods as outlined within this Specification. Upon the completion of the works, a final assessment of the trees shall be undertaken by the Project Arborist and future recommended management strategies implemented as required.

3.0 Tree Removal

The trees to be removed shall be removed prior to the establishment of the tree protection measures. Tree removal works shall be undertaken in accordance with the *Workcover Code of Practice for the Amenity Tree Industry (1998)*. Tree and vegetation removal shall not damage the trees to be retained.

4.0 Tree Protection Zone

The trees to be retained shall be protected prior and during construction from activities that may result in an adverse effect on their health or structural condition. The area within the Tree Protection Zone (TPZ) shall exclude the following activities, unless otherwise stated:-

- Modification of existing soil levels, excavations and trenching
- Mechanical removal of vegetation
- Movement of natural rock
- Storage of materials, plant or equipment or erection of site sheds
- Affixing of signage or hoarding to the trees
- Preparation of building materials, refueling or disposal of waste materials and chemicals
- Lighting fires
- Movement of pedestrian or vehicular traffic
- Temporary or permanent location of services, or the works required for their installation
- Any other activities that may cause damage to the tree

5.0 Tree Protection Fencing

TPZ fencing shall be located at the perimeter of the TPZ. Where TPZ areas overlap, TPZ fencing may be combined to form a single larger TPZ area. The exact location of the fencing shall be confirmed through consultation between the Head Contractor/Project Manager and the Project Arborist prior to the commencement of works. Fencing may be setback to allow for demolition/construction access and for the installation of pavements only where appropriate ground protection is installed and approved by the Project Arborist.

As a minimum, the Tree Protection Fence shall consist of 1.8m high wire mesh panels supported by concrete feet. Panels shall be fastened together and supported to prevent sideways movement. The tree shall not be damaged during the installation of the Tree Protection Fencing. Refer to Typical Tree Protection Details (**Appendix 3**).

6.0 Site Management

Materials, waste storage, and temporary services shall not be located within the TPZ.

7.0 Scaffolding

Where possible, scaffolding shall not be located within the TPZ. Scaffolding shall not be in contact with the tree. As necessary, this shall be achieved by erecting scaffolding around branches. Branches shall be tied back and protected as deemed necessary by the Project Arborist. Refer to Typical Tree Protection Details (**Appendix 3**).

8.0 Works within the Tree Protection Zones

In some cases works within the TPZ may be authorized by the determining authority. These works shall be supervised by the Project Arborist. When undertaking works within the TPZ, care should be taken to avoid damage to the tree's root system, trunks and lower branches.

If roots (>25mm \varnothing) are encountered during the demolition, excavation and construction works, these roots must be retained in an undamaged condition and advice sought from the Project Arborist. Adjustment of final levels and design shall remain flexible to enable the retention of roots (>25mm \varnothing) where deemed necessary by the Project Arborist.

Drilling/piling machinery shall be of a suitable size to not damage the tree's roots, trunk, branches and crown. No clearance pruning is permitted to allow for machinery access. Machinery shall work in conjunction with an observer to ensure that adequate clearance from trees is maintained at all times.

9.0 Ground Protection

Where deemed necessary by the Project Arborist, machinery movements shall be restricted to areas of existing pavement or from areas of temporary ground protection such as ground mats or steel road plates. Refer to Typical Tree Protection Details (**Appendix 3**).

10.0 Trunk Protection

Where required by the Project Arborist, trunk protection shall be installed. Trunk protection shall be installed by wrapping padding (either carpet underlay or 10mm thick jute geotextile mat) around the trunk and first order branches to a minimum height of 2m. Timber battens (90 x 45mm) spaced at 150mm centres shall be strapped together and placed over the padding. Timber battens must not be fixed to the trees. Refer to Typical Tree Protection Details (**Appendix 3**).

11.0 Structure & Pavement Demolition

Demolition of existing structures/pavement within the TPZ shall be supervised by the Project Arborist. Machinery is to be excluded from the TPZ unless operating from the existing slabs, pavements or areas of ground protection (refer to Section 9.0). Machinery should not contact the tree's roots, trunk, branches and crown.

The existing pavement shall be carefully lifted to minimise damage to the underlying soil profile (or sub-base materials) and to prevent damage to tree roots. Wherever possible, existing sub-base materials shall remain in-situ.

When removing slab sections within TPZ, machinery shall work backwards out of the TPZ to ensure machinery remains on un-demolished sections of slab at all times. Wherever possible, footings or elements below grade shall be retained to minimise disturbance to the tree's roots.

Where deemed necessary by the Project Arborist, the structures shall be shattered prior to removal with a hand-operated pneumatic/electric breaker.

If roots (>25mmØ) are encountered during the demolition works, these roots must be retained in an undamaged condition and advice sought from the Project Arborist. Where the Project Arborist determines that the tree is using underground elements (i.e footings, pipes, rocks etc.) for support, these elements shall be left in-situ.

12.0 Underground Services

Underground service installation within the TPZ shall be supervised by the Project Arborist.

The installation of underground services shall be located outside of the TPZ. Where this is not possible, they shall be installed using either hydrovac or hand excavation methods with the services installed around/below roots (>25mmØ, or as determined by the Project Arborist).

Alternatively, boring methods may be used for underground service installation where the installation depth is greater than 800mm below existing grade. Excavations for starting and receiving pits for boring equipment shall be located outside of the TPZ or located to avoid roots (>25mmØ, or as determined by the Project Arborist).

13.0 Excavations, Root Protection & Root Pruning

Excavations and root pruning within the TPZ shall be supervised by the Project Arborist. Excavations within the TPZ shall be avoided wherever possible.

Excavations within the TPZ shall be undertaken by hand or using hydro vacuum excavation methods (or similar approved device) to protect tree roots. If there is any delay between excavation works and backfilling, exposed roots shall be protected from direct sunlight, drying out and extremes of temperature by covering with a 10mm thick jute mat. The mat shall be kept in a damp condition at all times.

Hand excavation and root pruning shall be undertaken along the excavation line prior to the commencement of mechanical excavation to prevent tearing and shattering damage to the roots from excavation equipment. Roots (>25mmØ) shall be pruned by the Project Arborist only. Roots (<25mmØ) may be pruned by the Principal Contractor. Root pruning shall be undertaken with clean, sharp secateurs or a pruning saw to ensure a smooth wound face, free from tears.

No over-excavation, battering or benching shall be undertaken beyond the footprint of any structure unless approved by the Project Arborist.

Damaged roots shall be pruned behind the damaged tissues with the final cut made to an undamaged part of the root.

APPENDIX 6 - TYPICAL TREE PROTECTION DETAILS

