Glenyss Laws
Consulting Arborist

Arboricultural Impact Assessment Report

Prepared for
Hyecorp Property Group

Site
Club Willoughby
26 Crabbes Avenue
North Willoughby

Date
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Revision A

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TABLE OF CONTENTS

1 Introduction

1.1 The following arboricultural impact assessment report was commissioned by Hyecorp Property Group. The report provides an assessment of forty-four (44) trees or hedges, within or on neighbouring properties to Club Willoughby, 26 Crabbes Avenue, North Willoughby.

1.2 The aim of the report is to determine the tree's landscape significance, condition and vigour, assess the impacts of the proposal and provide an arboricultural method statement to ensure the protection of retained trees during construction works.

1.3 The proposal entails demolition of existing structures and construction of a new club, seniors housing development and associated facilities.

1.4 The architectural and landscape plans indicate twenty-two (22) trees protected under Willoughby Council's Tree Management Controls are proposed for removal. However, the design is a major encroachment and will significantly reduce the life expectancy of an additional eleven (11) trees which are marked for retention. Tree removal will be amply compensated by planting over two hundred (200) advanced trees achieving mature heights between 5 to 25m as part of the Landscape Masterplan. Of the forty-four (44) trees assessed, eleven (11) high retention specimens can be retained and protected during construction.

2 Methodology

2.1 The trees were visually inspected from ground level to determine the crown condition, class, structural defects, decay, signs of stress, epicormic growth and dieback (refer Appendix A & B)

2.2 Useful Life Expectancy (ULE) was determined. A ULE rating provides an estimate of a tree's expected remaining life span and considers the age, life span of the species and considers the current condition, vigour and major defects (refer Appendix B).

2.3 A Significance of a Tree Assessment Rating System (STARS) was determined. A STARS rating establishes the contribution a tree has to the overall landscape, amenity qualities or importance due to species, size, historical/cultural planting or significance to the site (refer Appendix C).

2.4 No root exploration, internal probing or aerial inspection was performed.

2.5 Tree height was measured with a Nikon Forestry Pro and rounded to the nearest metre. Canopy spread, and tree age were estimated, while Diameter at Breast Height (DBH) and Diameter Above Root Buttress (DRB) was measured.

2.6 The comments and recommendations in this report are based on findings from a site inspection on 11 April 2018 and preliminary arboricultural assessment report dated 12 April 2018.

2.7 A list of literature used in the preparation of this report is provided in the bibliography section.

2.8 Plans viewed in preparing the report include:

- A detail and level plan dated 4/3/17 by C.M.S Surveyors Pty Ltd
- Landscape Drawing Nos C100, 100, 101 – 110, 301 – 306, 401 – 406 Issue C dated 21/6/19 by Site Image Landscape Architects
- Stormwater Management Plans 19013-DA-C01, Sheets 1 & 2 Rev A undated by IDC
- Drawing Nos DA-DP, DA2.01 - DA2.09, DA3.01 – 3.06 Rev A dated 14/6/19 by Hyecorp Property Group in collaboration with Amglen Pty Ltd.

3 Observations

3.1 The Site

3.1.1 The subject site is known as Club Willoughby and identified as Lots 4 – 11, Sec C, DP 6291, Lot 1, DP 950651, Lots 1 & 2, DP 950652, Lots A & B, DP 438684 and Lot B, DP 364487, 26 Crabbes Ave and 243-245 Penshurst St, Willoughby. The property is located on the southern side of Crabbes Ave and is bordered by retail properties to the west, and residential properties to the south and east (refer Figure 1).

Figure 1. Location 26 Crabbes Ave, Willoughby (Source Google Earth Image dated 12/3/18)

3.2 The Trees

3.2.1 Thirty-nine (39) individual trees and five (5) hedges were assessed. Details of the trees, their dimensions, condition, Useful Life Expectancy (ULE) and landscape significance (STARS) are attached in Appendix A.

4 Discussion

4.1 Tree Protection, Ecological and Heritage Significance

4.1.1 Tree Management Controls for Willoughby Council apply under section C.9 of Willoughby Council's DCP (WDCP) and SEPP2017 Trees in Non-Rural Areas. The controls protect most trees exceeding 4m in height or a trunk girth exceeding 600mm measured at 1.2m or a tree exceeding 3m in canopy spread, some exemptions apply. In addition, the controls protect all trees regardless of dimensions listed as;

- Vulnerable or Threatened or a component of a Threatened Ecological Community or the removal of which would constitute a key threatening process listed under the Threatened Species Conservation Act 1995,
- All trees listed as items under the Willoughby Natural Heritage Register,
- Native bushland vegetation regardless of dimensions on private property,
- All trees (regardless of dimensions) listed as items under the Willoughby Natural Heritage Register.

4.1.2 The property is not listed as an item of heritage nor does the property fall within a heritage conservation area under WLEP 2012.

4.1.3 All trees assessed are a mix of planted exotic and native species. No trees form part of an ecological community listed as vulnerable, endangered or critically endangered under the NSW Biodiversity Conservation Act 2016. In addition, no trees are listed within Council's Natural Heritage Register.

4.1.4 Applying the above all trees assessed are protected under the terms of Willoughby Council's Tree Management Controls.

4.2 Tree Retention Value and Landscape Significance

4.2.1 It is possible to determine a tree's significance and retention value based upon several factors including size, condition and maturity coupled with the methodologies STARS and ULE.

4.2.2 Generally trees identified as having a medium to long ULE, of high landscape value and neighbouring trees are given a high priority for retention in the design process.

Trees 6, 13, 15, 16, 19, 20, 25, 27, 31, 32, 33*, 34*, 35*, 36*, 37*, 38*, 39*, 40*, 41*, 42* & 43* meet this criteria

* Indicates street trees and trees or hedges on neighbouring properties, all endeavours must be pursued to ensure the appropriate Tree Protection Zones in Table 1 are accommodated.

4.2.3 Trees of high landscape significance with a short ULE should not be given importance for preservation, as these trees are, at best considered to be short term prospects only.

Trees 5, 14 & 17 meet this criteria

4.2.4 Trees identified with a medium landscape value together with a medium ULE and are less critical and may be marked for retention when design options to retain the tree have been exhausted.

Tree 2, 3, 4, 7, 9, 11, 12, 18, 21, 26 & 29 meet this criteria

4.2.5 Trees assessed with a short ULE and a medium to low STARS value are unsuitable for retention and should be removed. Council or the tree owner's approval must be sought prior to tree removal.

Trees 1, 8, 10, 22, 23, 24, 28 & 30 meet this criteria

4.3 Appropriate Development Setbacks

4.3.1 Australian Standard 4970-2009, Protection of trees on development sites, was established to provide appropriate guidelines to ensure the long-term viability and integrity of trees to be retained on development sites.

4.3.2 Tree Protection Zones (TPZ) are based on the diameter of the tree measured at 1.4 metres above ground level x 12 (refer Table 1 for calculated TPZ's). The TPZ is measured from the centre of the tree's trunk to the proposed edge of excavation/development works. The recommended setback is declared a TPZ where construction, trenching, soil level changes and use of machinery should be excluded.

4.3.3 The Structural Root Zone (SRZ) is the area required for stability, a far larger area is necessary to maintain a viable tree. Therefore, no excavation or construction shall encroach within the SRZ (refer Table 1 for calculated SRZ's). The SRZ is determined adopting the formula from AS4970-2009 where the SRZ radius = $(D \times 50)^{0.42} \times 0.64$. Where D = trunk diameter, in m, measured above the root buttress.

4.3.4 Under AS4970-2009 a minor encroachment of 10% of the area is allowable, provided this is compensated for elsewhere and contiguous to the TPZ. Should more than a 10% encroachment occur then the Project Arborist must demonstrate the tree can be protected and remain in a viable state.

4.3.5 Appropriate TPZ's for a monocotyledon, including palms, cycads and tree ferns should not be less than 1m outside the crown projection.

4.3.6 When determining the impacts of an encroachment into the TPZ, some consideration may be given to the following;

- The potential loss of root mass resulting from the encroachment determined by root mapping (number, size and percentage)
- Species tolerance to root disturbance
- Age and vigour of the trees
- The presence of existing or past structures (with solid footings) or obstacles which may affect root growth.

4.3.7 Tree sensitive construction techniques such as pier and beam, suspended slab systems or discontinuous footings can minimise the impact upon a tree's root system and must be adopted should a major encroachment into the TPZ be contemplated. A major encroachment is considered between 15 - 35% of the root zone impacted.

Tree No	Dripline of moncots Radius (m)	Total DBH (cm)	DRB (cm)	TPZ Radius (m)	TPZ Area (m^2)	SRZ Radius (m)
2	-	22	27	2.6	22	2.0
3	-	20	25	2.4	18	1.9
4	-	29	43	3.5	38	2.4
6	-	34	53	4.1	52	2.6
7	-	21	28	2.5	20	2.0
9	-	50	60	6.0	113	2.7
11	-	43	61	5.2	84	2.7
12	-	54	53	6.5	132	2.6
13	-	46	60	5.5	96	2.7
15	-	49	64	5.9	109	2.8
16	-	42	62	5.0	80	2.8
18	-	60	77	7.2	163	3.0
19	-	75	82	9.0	254	3.1
20	-	59	68	7.0	157	2.9
21	-	49	70	5.9	109	2.9
25	-	58	78	7.0	152	3.0
26	-	32	40	3.8	46	2.3
27	-	59	73	7.1	157	2.9
29	-	36	56	4.3	59	2.6
31	-	47	59	5.6	100	2.7
32	-	51	62	6.1	118	2.8
33*	-	50	60	6.0	113	2.7
34*	-	10	15	2.0	7	2.0
35*	-	20	22	2.4	18	1.8
36*	-	20	22	2.4	18	1.8
37*	-	40	46	4.8	72	2.4
38*	-	54	55	6.5	132	2.6
39*	-	14	16	2.0	9	2.0
40*	-	52	59	6.2	122	2.7
41*	-	38	46	4.6	65	2.4
42*	-	9	12	2.0	7	2.0
43*	-	53	59	6.4	127	2.7
44*	2.5	-	-	3.5	-	Nil to apply

Table 1 Calculated Tree Protection & Structural Root Zones.
* Indicates street trees and trees or hedges on neighbouring properties.

4.4 Proposed Development Impacts

4.4.1 **Trees 1 – 19 & 21 – 24** fall within the footprint of the proposed development, these trees cannot be retained under the current proposal.

4.4.2 **Tree 20** works proposed within the 7m TPZ include demolition of the existing low retaining walls, a set of stairs and pedestrian access to Crabbes Ave offset approx. 3.5m and the basement carpark offset at approx. 5.5m, the proposal is a major encroachment of > 25% of the TPZ. Perry (1982) states the majority of structural roots (roots > 30mm in diameter) are located within the top 30cm of the soil profile. Subsequently the removal of the existing planter bed/low retaining wall is likely to result in stability issues (refer Appendix D). The tree cannot be retained under the current proposal.

4.4.3 **Tree 25** works within the TPZ and SRZ include demolition of the existing kerb and bitumen paving, basement carpark offset at ~ 5.5m and ripping the sub grade by 100mm for the proposed landscaping. The buttress of the subject tree overhangs the existing kerb (refer Appendix D). Due to the existing bitumen it is expected most structural roots will be located close to the soil surface. The removal of the kerb, bitumen and ripping of the sub grade falls within the SRZ and is a major encroachment under clause 3.3.3 of AS4970. The extent of root disturbance will significantly reduce the trees useful life expectancy.

4.4.4 **Trees 26, 27, 29, & 31 & 32** works within the TPZ and SRZ include demolition of the existing kerb, bitumen carpark and ripping the sub grade to facilitate new plantings. Fine or feeder roots, which are responsible for water and nutrient absorption, occur primarily within the upper 10 – 20cm of the soil profile. Therefore, lowering the grade even by a few centimetres will cause extensive root damage and a progressive decline over a period of several months to several years. In addition, pruning to achieve hoarding clearances is likely to be required to Tree 32. The demolition of the kerb, bitumen and ripping of the sub grade falls within the SRZ and is a major encroachment of > 40% of the TPZ. The proposed works will significantly reduce the trees life expectancy.

4.4.5 **Tree 33** a 6m TPZ is estimated. Excavation is proposed offset at 6.0m and a combined rainwater and OSD tank is proposed offset at ~4.5m, equating to a minor and acceptable encroachment under Clause 3.3.2 of AS4970 of 6.5%. The tree can be retained, and it root system protected during construction.

4.4.6 **Trees 34 – 35** are neighbouring trees to be retained and protected, the stormwater detention pit is offset at ~ 4.5m, no encroachment of the TPZ is proposed.

4.4.7 **Tree 36** is a hedge of several X *Cupressocyparis leylandii* located on the neighbouring property, a 2.4m TPZ is estimated. Stairs are proposed to the basement carpark offset at approx. 3.0m which do not encroach within the TPZ. However, stormwater drainage lines are proposed which run through the neighbouring property to Horsley Ave. The proposal will require with the removal of the two most eastern specimens of the hedge to facilitate the proposal, alternatively directional boring methods directed at a dept of 0.8m should be pursued. If tree removal is sought the tree owner and Council's approval to remove will be required.

4.4.8 **Tree 37**, stormwater drainage lines are proposed offset at ~ 5.5m, no encroachment of the 4.8m TPZ is proposed. The tree can be retained, and its root zone protected.

4.4.9 **Tree 38** a 6.5m TPZ is estimated. Stormwater drainage lines are planned offset at ~ 5.5m. The proposal is a minor and acceptable encroachment of ~ 4% under clause 3.3.2 of AS4970. The tree can be retained, and its root zone protected.

4.4.10 **Tree 39** is a neighbouring hedge with an estimated 2.0m, no encroachment of the stormwater drainage is proposed. The hedge can be retained and it rootzone protected during the construction and landscape works.

4.4.11 **Tree 40** no works are proposed within the 6.2m TPZ. The street tree can be retained and protected.

4.4.12 **Tree 41** works within the 4.6m TPZ include excavation for the basement carparking offset at ~ 3.0m. The proposal is a marginal encroachment of ~ 12% of the TPZ.

4.4.13 **Tree 42** no works are proposed within the 2.0m TPZ, the tree can be retained and protected.

4.4.14 **Tree 43** works within the 6.4m TPZ and 2.7m SRZ include excavation for the basement car park offset at ~2.5m. The excavation is a major encroachment of approx. 27%. The long-term viability of the street tree cannot be maintained under the current proposal.

4.4.15 **Tree 44** no works are proposed within the 3.5m TPZ.

5 Conclusions/Recommendations

5.1 Forty-four (44) trees or hedges were assessed. The proposal seeks the demolish the existing structures and construct a new club, seniors living complex and associated facilities.

5.2 The supplied plans indicate twenty-two (22) trees protected under the terms of Council's Tree Management Controls are proposed for removal. This includes five (5) trees with a high retention value, eight (8) trees less critical for retention and nine (9) trees allocated a low retention value.

High Retention	Less Critical for Retention	Low Retention
6, 13, 15, 16 & 19	2, 3, 4, 9, 11, 12, 18 & 21	1, 5, 8 x 15, 10, 14, 17, 22, 23 & 24

Table 2. Trees listed within plans to be removed

5.3 The proposal is a major encroachment and will significantly reduce the life expectancy of the following eleven (11) trees marked for retention within the architectural and landscape plans.

High Retention	Less Critical for Retention	Low Retention
20, 25, 27,32, 36* x 2 & 43*	26, 29 & 31	28 & 30

Table 3. Trees indicated for retention with a major encroachment

5.4 The proposed stormwater drainage falls within the footprint of the two (2) most northern trees which form part of a hedge identified as Tree 36 located on a neighbouring property.

5.5 To compensate the loss of amenity and achieve a positive outcome, two hundred and six (206) exotic and native advanced trees ranging in height from 5 – 25m have been incorporated within the Landscape Plans.

5.6 The plans indicate eleven (11) trees of high landscape significance can be retained and protected as part of the proposal.

High Retention	Consider for Removal	Low Retention
33*, 34*, 35*, 36*, 37*, 38*, 39*, 40*, 41*, 42* & 44*	-	-

Table 4. Trees to be retained and protected

5.7 All trees to be retained shall be protected in accordance with the following Arboricultural Method Statement.

6 Arboricultural Method Statement

6.1 Pre-commencement and Arboricultural Hold Points

6.1.1 Prior to demolition and construction works, a Project Arborist shall be appointed to supervise all tree protection procedures detailed in this statement. The Project Arborist shall have a minimum level 5 AQF qualification in Arboriculture.

6.1.2 A pre-commencement site meeting shall take place between the Site Supervisor and the Project Arborist, the meeting is to take place before any development activity to determine specific arboricultural inspections and required tree protection.

6.1.3 Development Stage, this stage is subject to site monitoring by the Project Arborist at intervals as agreed at the pre-commencement site meeting. These visits are to ensure the protection measures are maintained in good order and works within the Tree Protection Zone (TPZ) meet with this Arboricultural Method Statement and AS4970.

6.1.4 It is the responsibility of the developer/site supervisor to provide a minimum 3 days' notice to the Project Arborist for the pre-determined witness points.

6.1.5 Any breaches to the Arboricultural Method Statement shall be reported immediately.

6.1.6 The following pre-determined stages are hold points and requires the attendance of the Project Arborist to document the works and demonstrate an inspection has taken place.

Hold Point	Action	Project Arborist Supervision
Tree Protection	The Site Arborist shall inspect the Tree Protection Fencing and any necessary Ground Protection complies with Table 1 Tree Protection Zones and Figure 3, page 16 AS4970. Trunk protection shall be installed to all street trees fronting the site.	Inspected, documented & certified by Project Arborist
Demolition Works	The Site Arborist shall be in attendance during the removal of any existing structures within the TPZ of retained trees.	Inspected, documented & certified by Project Arborist
Earth Works	The Site Arborist to monitor any earthworks within the TPZ's. **Note** these works must be undertaken by hand or with an air knife.	Inspected, documented & certified by Project Arborist
Practical Completion	The Site Arborist to inspect and assess the trees condition and provide certification of tree protection at all the above-mentioned Hold Points.	Inspected, documented & certified by Project Arborist

Table 5. Hold Points for Project Arborist Inspections

6.2 Tree Protection – to be installed prior to commencement of works

6.2.1 Trunk Protection shall be installed to the street trees on the Penshurst St frontage and Tree Protection Fencing shall be installed prior to commencement of works and be maintained in a good condition during the construction processes.

6.2.2 Trunk Protection shall be achieved by strapping hessian or carpet underlay around the trunk followed by placing 1.5 – 2.0m lengths of timbers (100 x 50mm) spaced at 100mm intervals and secured together with galvanised wire. The timber slats shall be strapped around the trunk to avoid mechanical injury or damage. No wire/nails or securing devices shall damage or contact the trunk.

6.2.3 Tree Protection shall consist of a 1.8m high chain link temporary fencing erected at the distances nominated in Table 1.

6.2.4 Weatherproof signage indicating the area is a Tree Protection Zone (TPZ) shall be displayed on the fence line at 10m intervals.

6.2.5 Signage shall be a minimum A4 and shall state No Access – Tree Protection Zone and include the contact details of the Site Foreman and Project Arborist.

6.2.6 Once erected, the TPF shall be regarded as sacrosanct and shall not be removed or altered without prior agreement of the project arborist.

6.2.7 Attention shall be given to ensuring the TPZ remains rigid and complete and excludes all construction activity and storage of materials.

6.2.8 If works are to occur within the TPZ the Project Arborist shall determine if appropriate ground protection is required. Should ground protection be necessary then the ground surface within the TPZ shall be protected with a geotextile overlaying the existing mulch. Thick recycled railway ballast shall be placed over the geotextile in accordance with Figure 4 of AS4970.

6.2.9 Mulch shall be spread within the TPZ's of the retained trees or as instructed by the project Arborist. The mulch shall consist of mixed leaf and fine woodchip mulch as certified to AS4454:2012 Composts, Soil Conditioners and Mulches. Mulch shall be spread to a depth of 75mm and maintained at this depth for the duration of works.

6.3 Restricted Activities

6.3.1 The following activities are restricted within the Tree Protection Zone;

- Parking of vehicles or plant
- Installation of temporary site offices or amenities.
- Wash down areas
- No mechanical excavation
- Preparation of chemicals including paint, cement or mortar.
- Vehicular movement
- Pedestrian access
- Excavation, trenching or tunnelling unless under the supervision of the Project Arborist
- No ground level changes are permitted

6.4 Installation of Services

6.4.1 Where feasible, all underground services will be routed & installed beyond the identified TPZ's. Where it is impossible to divert services beyond the TPZ's, detailed plans showing the proposed routing will be drawn in conjunction with advice from an AQF Level 5 Arborist.

6.4.2 The method for trenching within a TPZ shall either be by hand methods e.g. hand digging with a spade or trowel or an air spade. Trenchless technology such as directional underground boring shall be considered in the first instance.

6.4.3 Topsoil and subsoil excavated from the trench shall be deposited into separate piles and kept apart and covered until required for backfilling.

6.4.4 No roots > 30mm in diameter are to be severed without prior agreement with the Project Arborist.

6.4.5 In cases of extreme heat or unless the trench is to be backfilled within the same day, all exposed roots > 30mm in diameter shall be wrapped with damp hessian to prevent drying out.

6.4.6 Where is it necessary to sever any woody roots, they shall be clean cut with secateurs or a pruning saw.

6.4.7 The underground services shall be positioned below the network of protected roots without causing damage to roots > 30mm in diameter. The hessian shall be removed prior to backfilling.

6.5 Back filling

6.5.1 Once works have been completed, backfilling shall be undertaken by hand using the subsoil first. The subsoil shall be filled into the trench in layers of no > 20cm and each layer shall be gently consolidated. Once the subsoil has reached the level of the existing subsoil, the topsoil shall be placed on top until the original levels are reached.

6.6 Construction of masonry fences or retaining walls

6.6.1 Where retaining walls or masonry fences are proposed, exploratory hand excavation to a depth of 600mm will determine the presence of any woody roots > 30mm in diameter. Exploratory trenching shall be under the supervision of and documented by the Project Arborist.

6.6.2 In cases of extreme heat or unless the footings are to be backfilled within the same day, then the exposed roots shall be covered in damp hessian until back filling takes place.

6.6.3 Backfill shall be undertaken in accordance with section 6.5 of the method statement.

6.7 Soft and Hard Landscaping

6.7.1 Installation of soft or hard landscaping including paving, turf or plant material within the TPZ shall be undertaken by hand.

6.7.2 Planting holes are to be hand dug with a shovel or garden trowel.

6.8 Breach of tree protection

6.8.1 Any above or below ground damage (including soil compaction) to a protected tree shall be reported to the Project Arborist immediately.

6.8.2 Where activities occur which breach the tree protection measures, the Project Arborist shall be advised immediately and work within the TPZ be halted until an assessment has been made and any mitigation measures deemed necessary have been undertaken.

Any questions relating to this report should be addressed to the undersigned

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Qualified and Practicing Arborist/Horticulturist.
Since 1997

Assumptions/Disclaimer

Care has been taken to obtain all information from reliable sources. All data has been verified as far as possible. However, Glenyss Laws – Consulting Arborist can neither guarantee nor be responsible for the accuracy of information provided by others.

Unless stated otherwise:

- Information contained in this report covers only the trees that were examined and reflects the condition of the trees at the time of inspection: and
- The inspection was limited to visual examination of the subject trees without dissection, probing or coring.
- No risk assessment was commissioned or carried out as part of the investigation.
- Trees are living organisms whose health and condition can change rapidly. Any changes to the soil surrounds e.g. excavation or construction works or extreme weather events will invalidate this report.
- There is no warranty or guarantee, expressed or implied, that problems or deficiencies of the subject trees may not arise in the future.
- Any tree, whether it has a visible weakness or not, will fail if the forces applied exceed the strength of the tree or its parts.

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IACA
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APPENDIX A
Site Notes

Tree No	Tree Species	Age Class	DBH (mm)	DRB (mm)	Tree Height (M)	Crown Width (M)	Crown Condition	Crown Class	STARS	ULE	Root Zone/ Defects/ Services	Comments
1	*Cupressus macrocarpa* (Monterey Cypress)	O	260	300	7.5	4	2	S	3	4	Ga/-/-	Over mature, suppressed specimen. Past substantial pruning of lowest 1st order branches.
2	*Corymbia gummifera* (Red Bloodwood)	M	220	270	10	6	3	C	2	2	Ga/-/-	
3	*Eucalyptus species* (Gum)	S	200	250	13	4	4	C	2	2	Ga, Rt/-/-	
4	*Callistemon viminalis* (Bottlebrush)	M	150, 150, 170 & 80	430	7	5	4	C	2	2	Ga/-/-	
5	*Eucalyptus tereticornis* (Forest Red Gum)	M	490	590	15	8	3	D	1	3	Ga/D/-	Wound & associated decay in basal region to the south extends into root collar & encompasses ~ 1/3 of root collar. Sounding with an acoustic mallet produced a good resonance. Stressed specimen.
6	*Eucalyptus botryoides* (Bangalay)	M	340	530	13	10	3	C	1	2	Ga, Rt/-/-	Lerp infestation, common to the species. On a slight lean to the south.
7	*Eucalyptus botryoides* (Bangalay)	S	210	280	10	5	3	I	2	2	Ga, Rt/-/-	Lerp infestation, common to the species
8 x 16	*Callistemon viminalis* (Bottlebrush)	M	Ave 220	Ave 250	4 – 5	2 - 3	4	C	2	5	Rt/-/O	This is a hedge comprised of 16 x *Callistemon viminalis* planted at close intervals. Electricity substation within proximity to northern specimens.
9	*Jacaranda mimosifolia* (Jacaranda)	M	Est 500	600	14	12	4	D	2	2	Pa/-/-	Not plotted within survey plan approx. location only. Access to adjoining property limited & therefore VTA limited.
10	*Melaleuca quinquenervia* (Paperbark)	O	90, 130 & 100	310	5	4	2	D	3	3	Pa/-/-	Over mature specimen

Tree No	Tree Species	Age Class	DBH (mm)	DRB (mm)	Tree Height (M)	Crown Width (M)	Crown Condition	Crown Class	STARS	ULE	Root Zone/ Defects/ Services	Comments
11	*Melaleuca quinquenervia* (Paperbark)	M	220, 310 & 200	610	9	5	3	D	2	2	Pa/O/-	Fire damage to lower trunk
12	*Lophostemon confertus (Brush Box)*	M	@ 1.0m 540	530	10	10	3	I	2	2	Pa/O/-	Trunk has grown around star picket which was installed at time of planting as tree support
13	*Casuarina glauca* (Swamp Oak)	M	460	600	15	7	4	C	1	1	Pa/-/-	Crossed & rubbing lower branches. Forms codominant leaders at 3.5m union appears sound.
14	*Casuarina glauca* (Swamp Oak)	M	370	460	18	8	4	C	1	3	Pa/D/-	Forms codominant leaders at 2.5m union appears sound. Decay at point of old 1st order pruning cut, 2nd leader arises from point of decay.
15	*Casuarina glauca* (Swamp Oak)	M	490	640	16	7	4	C	1	1	Pa/-/-	Forms codominant leaders at 2.5m union appears sound.
16	*Casuarina glauca* (Swamp Oak)	M	420	620	17	6	4	C	1	1	Pa/-/-	On slight lean to the west - no contributing factors.
17	*Eucalyptus species* (Gum)	M	480	530	15	16	3	D	1	3	Pa/D/-	Decay in lower trunk to the north measuring 60cm x 15cm. The decay contains the stub of an of old wood decaying bracket fungus. Sounding area with an acoustic mallet produced a dull resonance.
18	*Corymbia citriodora* (Lemon-scented Gum)	M	600	770	16	15	4	D	2	2	Pa/F/-	Possible past storm damage or leader failure specimen forms 3 leaders at 4m.
19	*Eucalyptus camaldulensis* (River Red Gum)	M	750	820	18	18	3	D	1	2	Pa/-/-	Specimen has been crown raised at some point in the past with the pruning to collar of 13 x lowest 1st order branches between 100 – 250mm in diameter.
20	*Eucalyptus botryoides* (Bangalay)	M	590	680	19	14	4	D	1	2	Pa, Rt/T, B/-	Mudding in lower trunk attributed to past termite or borer activity.

Tree No	Tree Species	Age Class	DBH (mm)	DRB (mm)	Tree Height (M)	Crown Width (M)	Crown Condition	Crown Class	STARS	ULE	Root Zone/ Defects/ Services	Comments
21	*Casuarina cunninghamiana* (She-Oak)	M	490	700	17	10	4	D	2	2	Pa/-/-	Included bark in lowest 1st order branch attachment approx. 200mm in diameter at 5m from ground level
22	*Casuarina cunninghamiana* (She-Oak)	O	470	550	15	10	2	C	3	4	Pa/-/-	Specimen in irreversible decline
23	*Casuarina glauca* (Swamp Oak)	O	430	520	15	6	1	C	3	4	Pa/-/-	Specimen in irreversible decline
24	*Casuarina glauca* (Swamp Oak)	O	210 & 300		14	5	1	C	3	4	Pa/-/-	Specimen in irreversible decline
25	*Casuarina cunninghamiana* (She-Oak)	M	580	780	19	8	4	C	1	1	Pa/-/-	Lowest eastern 1st order branches substantially pruned to prevent leaf drop onto neighbour's roofline. Forms an asymmetrically biased canopy to the west as a result of pruning.
26	*Casuarina cunninghamiana* (She-Oak)	M	320	400	17	3	3	C	2	2	Pa/-/-	Substantial pruning of lowest eastern 1st order branches to prevent leaf drop onto neighbour's roofline
27	*Casuarina cunninghamiana* (She-Oak)	M	590	730	19	8	4	C	1	1	Pa/-/-	
28	*Casuarina cunninghamiana* (She-Oak)	M	230	270	14	2	3	S	3	3	Pa/-/-	Partially suppressed, poor vigour.
29	*Casuarina cunninghamiana* (She-Oak)	M	260 & 240	560	16	4	3	C	2	2	Pa/-/-	Forms codominant leaders at ground level – union appears sound.
30	*Casuarina cunninghamiana* (She-Oak)	M	220	290	15	2	2	S	3	3	Pa/-/-	Partially suppressed, poor vigour.

Tree No	Tree Species	Age Class	DBH (mm)	DRB (mm)	Tree Height (M)	Crown Width (M)	Crown Condition	Crown Class	STARS	ULE	Root Zone/ Defects/ Services	Comments
31	*Casuarina cunninghamiana* (She-Oak)	M	470	590	17	7	3	C	2	2	Pa/-/-	Holds medium volumes of deadwood between 30 – 100mm in diameter.
32	*Casuarina cunninghamiana* (She-Oak)	M	510	620	17	10	4	C	1	1	Pa/-/-	
33*	*Agonis flexuosa* (Willow Myrtle)	M	Est 320, 120, 250 x 2	600	7 – 8	8	3	D	2	1	Ga/-/-	Tree on adjoining property measured 1.9m offset to galvanised fence. Trees on adjoining properties are afforded a high retention value.
34*	Hedge of *x Cupressocyparis leylandii* (Leyland Cypress)	M	Est Average 100	-	3 – 4	-	4	C	1	2	Ga/-/-	Hedge on adjoining property affords screening. Trees on adjoining properties are afforded a high retention value
35*	Hedge of *Viburnum tinus* (Laurustinus)	M	Est 120-200	-	3	-	4	C	1	2	Ga/-/-	Hedge on adjoining property affords screening. Trees on adjoining properties are afforded a high retention value
36*	Hedge of *x Cupressocyparis leylandii* (Leyland Cypress)	M	Est 150-200	-	5 – 6	-	5	C	1	2	Ga/-/-	Hedge on adjoining property affords screening. Trees on adjoining properties are afforded a high retention value
37*	*Agonis flexuosa* (Willow Myrtle)	M	Est 400	Est 460	5	8	3	D	1	2	Ga/-/-	Tree on adjoining property Trees on adjoining properties are afforded a high retention value
38*	*Melaleuca bracteata* (Black Tea-Tree)	M	Est 400 & 350	Est 550	10	8	3	D	1	3	Ga/-/-	Tree on adjoining property planted hard to boundary, forms two leaders at ground level. Tip dieback within canopy, in early stages of senescence.
39*	Hedge of *Syzygium species (Lilly Pilly)*	M	Est 120	-	4 – 5	-	4	C	1	2	Ga/-/-	Hedge on adjoining property affords screening. Trees on adjoining properties are afforded a high retention value
40*	*Ulmus glabra* (Wych Elm)	M	520	590	9	14	3	C	1	2	Pa, K/-/-	Council owned asset – street tree

Tree No	Tree Species	Age Class	DBH (mm)	DRB (mm)	Tree Height (M)	Crown Width (M)	Crown Condition	Crown Class	STARS	ULE	Root Zone/ Defects/ Services	Comments
41*	*Ulmus procera* (English Elm)	M	380	460	9	10	3	D	1	2	Pa, K/-/-	Council owned asset – street tree
42*	*Ulmus procera* (English Elm)	Y	90	120	5	2	4	D	1	2	Pa, K/-/-	Council owned asset – street tree
43*	*Ulmus procera* (English Elm)	M	310 & 420	590	9	12	3	D	1	2	Pa, K/-/-	Council owned asset – street tree
44*	*Syagrus romanzoffianum* (Cocos Palm)	M	-	-	9	2.5	4	D	1	2	Pa/-/-	Tree on neighbouring property

Trees in Green assessed with a high landscape value coupled with a medium to long ULE are allocated a high priority for retention.
Trees in Blue are less critical for retention, their retention should be a priority with removal considered when design options have been exhausted & adversely affecting the proposal.
Trees in Pink are of low retention value, nor require special works or design modifications to be implemented.
Tree in Orange are considered hazardous, in irreversible decline or environmental weed species and recommended for removal irrespective of development.
* Indicates trees or hedges close to the boundary on neighbouring properties or street trees

APPENDIX B

Notes on tree inventory schedule

Tree No: Relates to number on site diagram.

Species: Coded to tree species schedule

Age Class:

Y	Young- recently planted
S	Semi mature- <20% of life expectancy
M	Mature- 20-80% of life expectancy
O	Over mature- >80% of life expectancy

Height: In metres

Crown Diameter: In metres

Crown Class:

D	Dominant	Crown extends above general canopy; not restricted by other trees.
C	Co-dominant	Crown forms the bulk of the general Canopy but crowded by other trees.
I	Intermediate	Crown extends into dominant/ codominant canopy but quite crowded on all sides.
S	Suppressed	Crown development restricted from Overgrowing trees.

Crown Condition: Overall vitality

0	Dead
1	Severe decline (<20% canopy density; major dead wood)
2	Declining (20-60% canopy density; twig and branch dieback)
3	Average/ low vigour (60-90% canopy density; twig dieback)
4	Good (90-100% canopy density; little or no dieback or other problems)
5	Excellent (100% canopy density; no deadwood or other problems)

Root Zone:

C	Compaction
D	Damaged/wounded roots
E	Exposed roots
Ga	Tree in garden bed
Gi	Girdled roots
Gr	Grass
K	Kerb close to tree
L+	Raised soil level
L-	Lowered soil level
M	Mulched
Pa	Paving/concrete/bitumen
Pr	Roots pruned
O	Other

Defects:

B	Borers
C	Cavity
D	Decay
F	Previous failures
I	Inclusions
L	Lopped
M	Mistletoe/parasites
S	Splits/Cracks
T	Termites
O	Other

Services adjacent structures:

Bs	Bus stop
Bu	Building within 3 metres
Hvo	High voltage open wire construction
Hvb	High voltage bundled (ABC)
Lvo	Low voltage open wire construction
Lvb	Low voltage bundled (ABC)
Na	No services above
Nb	No services below
Si	Signage
Sl	Street light
T	Transmission lines
U	Underground services
O	Other

STARS: Significance of a Tree Assessment Rating System (copyright Institute of Australian Consulting Arborists 2010)

ULE: Useful Life Expectancy adapted from Barrell J (2001)

1	Long ULE	Trees that appear to be retainable at the time of assessment for more than 40 years
2	Medium ULE	Trees that appear to be retainable at the time of assessment for more than 15-40 years
3	Short ULE	Trees that appear to be retainable at the time of assessment for more than 5-15 years
4	Remove	Trees that should be removed within the next 5 years
5	Small, young or regularly pruned	Small trees less than 5 Metres in height or young trees less than 15 years old but over 5 metres in height.

APPENDIX C
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.

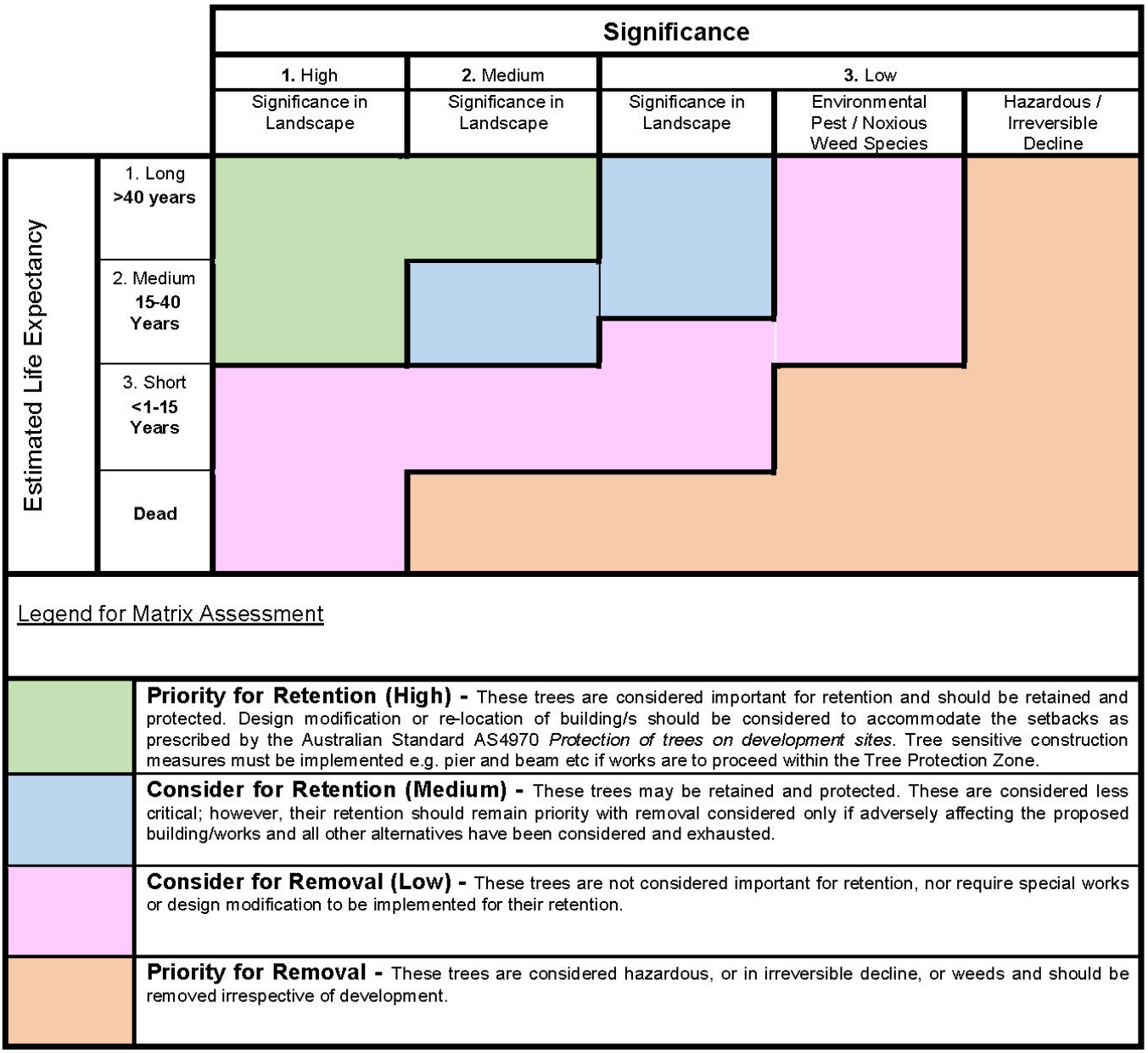
Hazardous/Irreversible Decline

- 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 6.0 Tree Retention Value - Priority Matrix



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 *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.
	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

APPENDIX D
Photographic documentation

Figure 2. Tree 8 forms a hedge of 16 x *Callistemon viminalis*

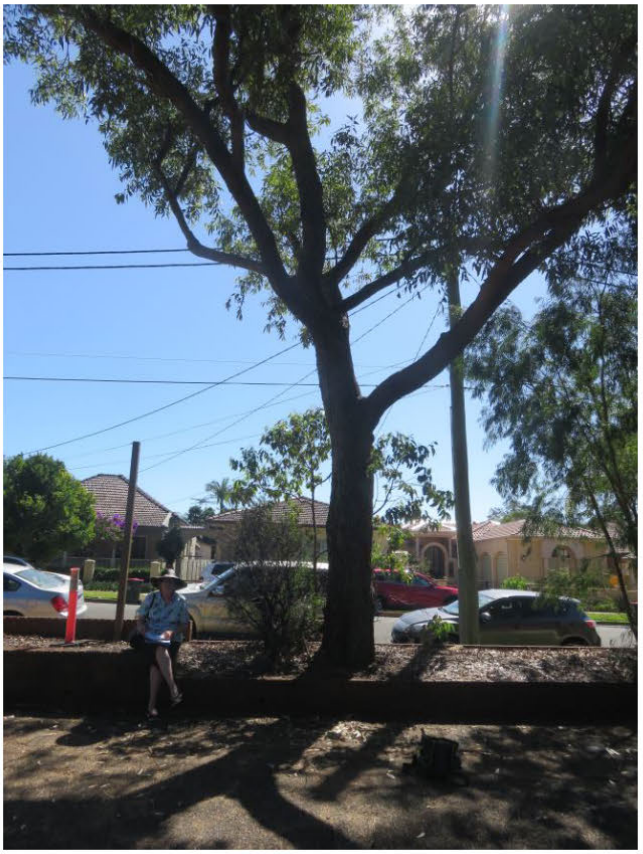


Figure 3. Tree 20 major encroachment of the TPZ and SRZ due to removal of low retaining walls, pedestrian access to Crabbes Ave and underground parking.

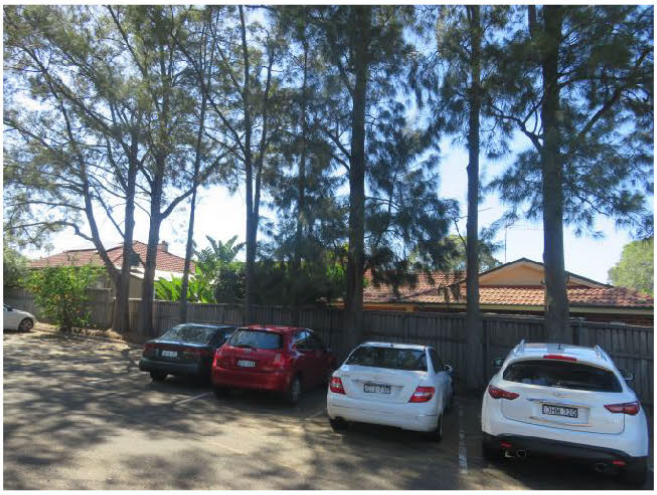


Figure 2. Trees 25 – 32 removal of bitumen, kerb & ripping of subsoil proposed within TPZ

Figure 3. Buttress of Tree 25 overhangs the kerb proposed for demolition.

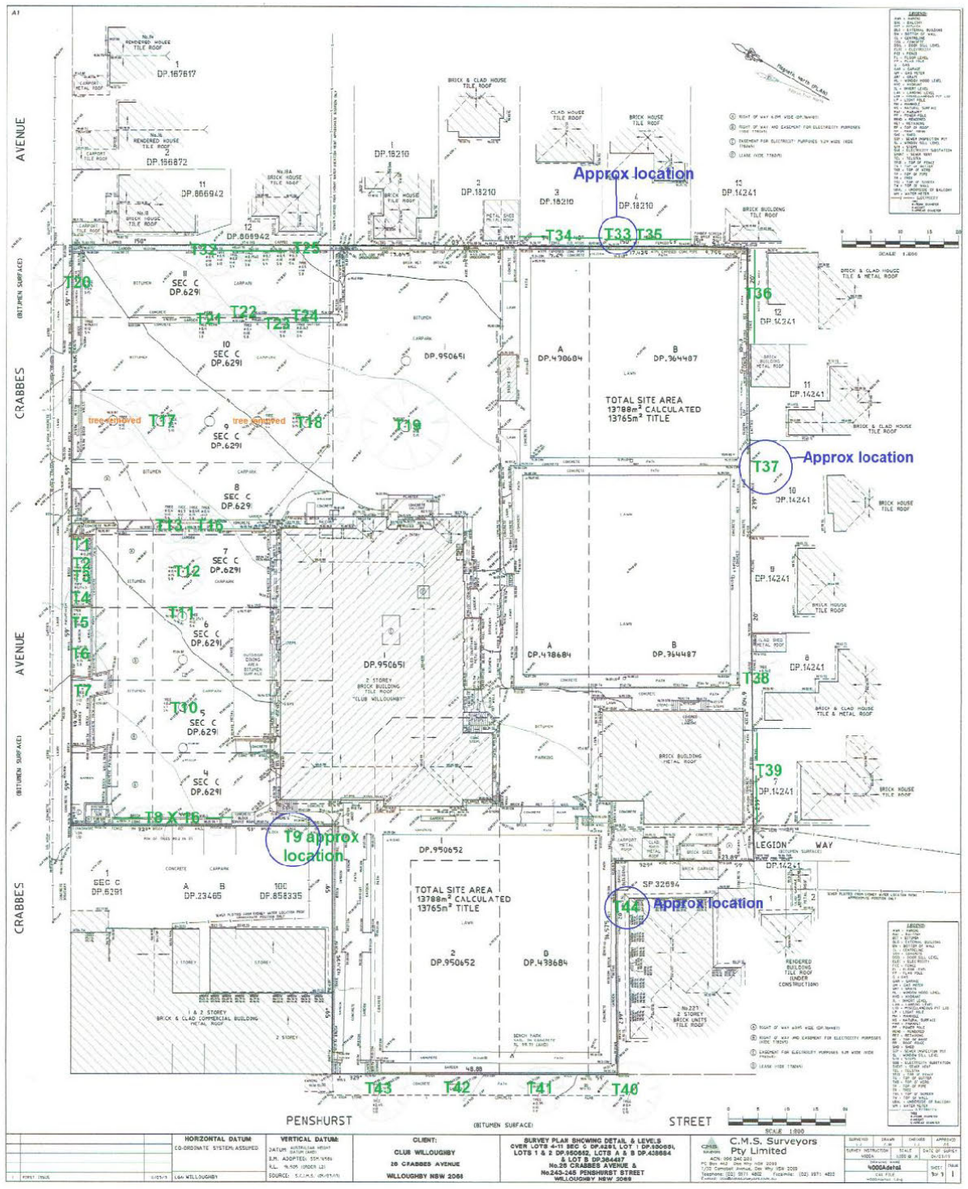
Figure 4. Neighbouring hedge Tree 36, stormwater drainage falls within the footprint of two specimens.

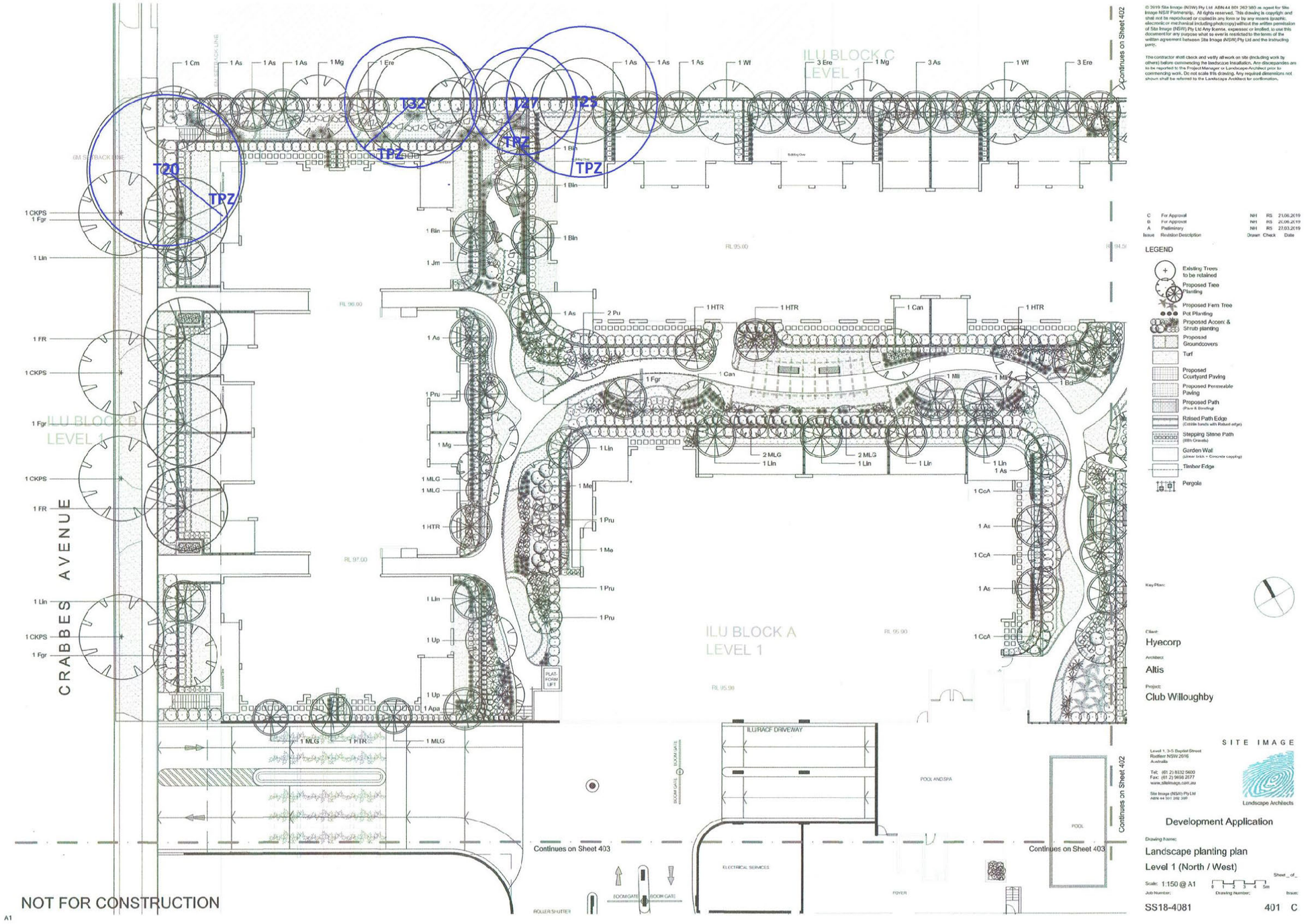
APPENDIX E
Examples of Trunk and Tree Protection Fencing

Figure 5. Example of trunk protection

Figure 6. Example of Tree Protection Fencing & mulching requirements

APPENDIX F
Survey and Landscape Plans





The contractor shall check and verify all work on site (including work by others) before commencing the landscape installation. Any discrepancies are to be reported to the Project Manager or Landscape Architect prior to commencing work. Do not scale this drawing. Any required dimensions not shown shall be referred to the Landscape Architect for confirmation.

Issue	Revision Description	Drawn	Check	Date
C	For Approval	NH	RS	21.06.2019
B	For Approval	NH	RS	20.06.2019
A	Preliminary	NH	RS	27.03.2019

LEGEND

- Existing Trees to be retained
- Proposed Tree Planting
- Proposed Fern Tree
- Pot Planting
- Proposed Accent & Shrub planting
- Proposed Groundcovers
- Turf
- Proposed Courtyard Paving
- Proposed Permeable Paving
- Proposed Path (Pave & Binding)
- Raised Path Edge (Cobble bands with Raised edge)
- Stepping Stone Path (With Gravels)
- Garden Wall (Linear brick + Concrete capping)
- Timber Edge
- Pergola

Key Plan:

Client: Hyecorp

Architect: Altis

Project: Club Willoughby

SITE IMAGE

Level 1, 3-5 Baptist Street
Redfern NSW 2016
Australia
Tel: (61 2) 8332 5600
Fax: (61 2) 9698 2677
www.siteimage.com.au
Site Image (NSW) Pty Ltd
ABN 44 801 282 389

Landscape Architects

Development Application

Drawing Name:
Landscape planting plan
Level 1 (North / West)

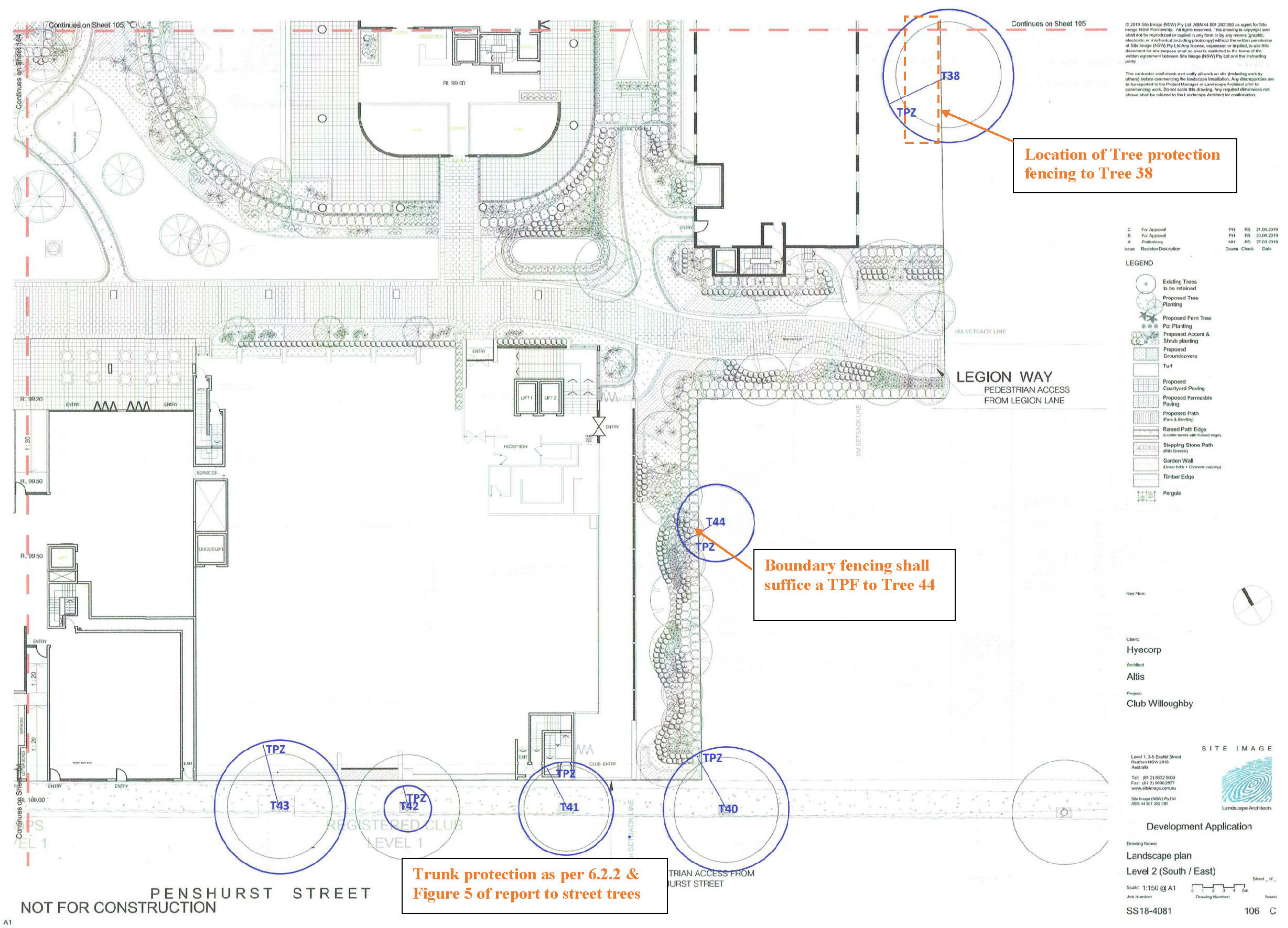
Scale: 1:150 @ A1 (0 1 2 3 4 5m)

Sheet _ of _

Job Number: SS18-4081

Drawing Number: 401

Issue: C


Continues on Sheet 105
T38
TPZ
Location of Tree protection fencing to Tree 38
LEGION WAY
PEDESTRIAN ACCESS FROM LEGION LANE
LEGEND
Existing Trees to be retained
Proposed Tree Planting
Proposed Fern Tree
Pot Planting
Proposed Accent & Shrub planting
Proposed Groundcovers
Turf
Proposed Courtyard Paving
Proposed Permeable Paving
Proposed Path
Raised Path Edge
Stepping Stone Path
Garden Wall
Timber Edge
Pergola
T44
TPZ
Boundary fencing shall suffice a TPF to Tree 44
Client: Hyecorp
Architect: Altis
Project: Club Willoughby
SITE IMAGE
Landscape Architects
Development Application
Drawing Name: Landscape plan
Level 2 (South / East)
Scale: 1:150 @ A1
SS18-4081
106 C
TPZ
T43
T42
T41
T40
REGISTERED CLUB LEVEL 1
PENSHURST STREET
NOT FOR CONSTRUCTION
Trunk protection as per 6.2.2 & Figure 5 of report to street trees