

Arboricultural Assessment Report



Prepared 6th August 2014

Site Location

26 Albion St.,
Waverley NSW 2024

Client

St Catherine's School Waverley

DISCLAIMER

The author and Tree & Landscape Consultants take no responsibility for actions taken and their consequences, contrary to those expert and professional instructions given as recommendations pertaining to safety by way of exercising our responsibility to our client and the public as our duty of care commitment, to mitigate or prevent hazards from arising, from a failure moment in full or part, from a structurally deficient or unsound tree or a tree likely to be rendered thus by its retention and subsequent modification/s to its growing environment either above or below ground contrary to our advice.

Peter Richards

Tree & Landscape Consultants

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Arboricultural Assessment Report:

St Catherine's School Waverley
26 Albion St.,
Waverley NSW 2024

1. INTRODUCTION

This report has been prepared by Tree & Landscape Consultants for St Catherine's School Waverley. The site was inspected by the author and the subject trees and their general growing environment evaluated on the 11th April, 21st May and 4th August 2014. The site is to be subject to a Development Application and this report and any works recommended, that require approval from the consenting authority is provided to form part of that development application and its consent conditions where appropriate.

This report assesses 29 trees the location of which are indicated in Appendix F and details their current health and condition and determines from the assessment, recommendations for their retention or removal. The numbering system utilised within this assessment has in part been drawn upon from tree numbering utilised within previous documentation and preliminary plans prepared by Earthscape that were submitted with the request for DGRs with the exception of trees 33,34,35,36 & 37.

2.0 AIMS & OBJECTIVES

Aims

Detail the condition of the trees on the site or on adjoining sites where such trees may be affected by the proposed works, by assessment of individual specimens or stands, and indicate remedial works or protection measures for their retention in a safe and healthy condition, or a condition not less than that at the time of initial inspection for this report, or in a reduced but sustainable condition due to the impact of the development but ameliorated through tree protection measures able to be applied, and will consider the location and condition of the trees in relation to the proposed building works, or recommend removal and replacement where appropriate.

Provide as an outcome of the assessment, the following: a description of the trees, observations made, discussion of the effects the location of the proposed building works may have on the trees, and make recommendations required for remedial or other works to the trees, if and where appropriate.

Determine from the assessment a description of the works or measures required to ameliorate the impact upon the trees to be retained, by the proposed building works or future impacts the trees may have upon the new building works if and where appropriate, or the benefits of removal and replacement if appropriate for the medium to long term safety and amenity of the site.

Objectives

Assess the condition of the subject trees.

Determine impact of development on the subject trees.

Provide recommendations for removal or management of the subject trees.

3. METHODOLOGY

- 3.1 The method of assessment of tree/s is applied from the ongoing knowledge and development of the author and considers but is not confined to:
- Tree health and subsequent stability, both long and short term
 - Sustainable Retention Index Value (S.R.I.V.)© (IACA 2009)
 - Amenity values
 - Significance
- 3.2 This assessment is undertaken using a standard tree assessment criteria for each tree based on the values above and is implemented as a result of at least one comprehensive and detailed site inspection.
- 3.3 In this report the dimensions of the tree recorded by the author for the trunk *diameter at breast height* (DBH) measurement is calculated at 1.4m above ground from the base of the tree. Where a tree is trunkless or branches at or near ground such as a mallee formed tree, an average diameter is determined by recording the radial extent of the stem mass at its narrowest and widest dimensions, adding the two dimensions together and dividing them by 2 to record an average.
- 3.4 Crown spreads are expressed as length by breadth measurements to accurately record their dimensions. Where appropriate, *crown spread orientation* is described along the length of the crown spread e.g. North/South, or as *radial* if the crown is distributed at an approximately even radius from the trunk e.g. 6x6m.
- 3.5 The Australian Standard AS 4970-2009 "Protection of trees on development sites, where applicable is applied to trees to be retained in this report as a point of reference and guide for the recommended minimum clearances from the centre of tree trunks to development works and is applied as a generalised benchmark and the distances may be increased or decreased by the author as a result of other factors providing mitigating circumstances or constraints as indicated by but not restricted to the following:
- *Tolerance of individual species to disturbance,*
 - *Geology e.g. physical barriers in soil, floaters, bedrock to surface*
 - *Topography e.g. slope, drainage,*
 - *Soil e.g. depth, drainage, fertility, structure,*
 - *Microclimate e.g. due to landform, exposure to dominant wind,*
 - *Engineering e.g. techniques to ameliorate impact on trees such as structural soil, lateral boring,*
 - *Construction e.g. techniques to ameliorate impact on trees such as pier and beam, bridge footings, suspended slabs*
 - *Arboriculture e.g. exploration trenches to map location of roots,*
 - *Physical limitations - existing modifications to the environment and any impact to tree/s by development e.g. property boundaries, road reserves, previous impact by excavation in other directions, soil level changes by cutting or filling, existing landscaping works within close proximity, modified drainage patterns.*

4. TREE ASSESSMENTS

Table 1

| Tree No. | Genus & species Common Name | Age S-Sapling Y-Young M-Mature O-Overmature | Condition D-Dead P-Poor F-Fair G-Good | Pest & Diseases N = No or Y = Yes (If yes see comments) | Branch Bark Included N = No or Y = Yes (If yes see comments) | Canopy Orientation A-Asymmetrical Sy-Symmetrical N,S,E,W-Orientation | DBH (mm) @ 1.4 metres from ground | Height/Spread (M) | Vigour L-Low G-Good A-Abnormal | Trunk Lean X-Straight or Slightly Leaning A-Acaulescent M-Moderate S-Severe C-Critical | SRIV Age,Vigour,Condition/ Index Rating (See Appendix A) |
|---|--|---|---|---|--|---|--------------------------------------|-------------------|---|---|---|
| 1 | Ficus rubiginosa <i>Port Jackson Fig</i> | O | P | N | N | A/S | 500 | 12 12x12 | G | S-South | OGVF4 |
| Comments: Indigenous evergreen tree. Tree is in decline supporting reduced foliage volume but still of good vigour. The crown of the tree has been previously severely modified resulting in the removal of half of its crown through severance of a superior leader to the north to accommodate the adjoining pool when constructed. | | | | | | | | | | | |
| 2 | Cupaniopsis anacardioides <i>Tuckeroo</i> | M | F | N | N | Sy | 300 | 6 4x4 | G | X | MGVF9 |
| Comments: Indigenous evergreen tree of good vigour. Smaller specimen appearing free of insect predation or disease. | | | | | | | | | | | |
| 3 | Banksia integrifolia <i>Coast Banksia</i> | M | F | N | N | Sy | 50 Ave | 4 3x3 | G | A | MGVF9 |
| Comments: Indigenous evergreen tree of good vigour. Smaller specimen appearing free of insect predation or disease. | | | | | | | | | | | |
| 5 | Ficus rubiginosa <i>Port Jackson Fig</i> | O | P | N | N | Sy | 900 | 12 14x14 | L | X | MLVP0 |
| Comments: Indigenous evergreen tree of low vigour. Tree in advanced decline. | | | | | | | | | | | |
| 6 | Magnolia grandiflora <i>Bull Bay Magnolia</i> | M | P | N | N | Sy | 500 Ave | 15 17x16 | G | A | MGVP6 |
| Comments: Exotic evergreen tree of good vigour. Multi leader specimen supporting large basal cavities. Branching on its eastern aspects have been previously braced to help support lower order branching. | | | | | | | | | | | |
| 8 | Cinnamomum camphora <i>Camphor laurel</i> | M | P | N | N | Sy | 1000 | 18 12x12 | G | X | MGVP6 |
| Comments: Exotic evergreen tree of good vigour. Short trunk specimen with foliage appearing free of insect predation or disease. | | | | | | | | | | | |
| 9 | Cinnamomum camphora <i>Camphor laurel</i> | M | P | N | N | Sy | 800 | 18 12x12 | G | X | MGVP6 |
| Comments: Exotic evergreen tree of good vigour. Short trunk specimen with foliage appearing free of insect predation or disease. | | | | | | | | | | | |
| 10 | Cinnamomum camphora <i>Camphor laurel</i> | M | P | N | N | Sy | 700 | 18 12x12 | G | X | MGVP6 |
| Comments: Exotic evergreen tree of good vigour. Short trunk specimen with foliage appearing free of insect predation or disease. | | | | | | | | | | | |
| 11 | Cinnamomum camphora <i>Camphor laurel</i> | M | P | N | N | A/E | 600 Ave | 18 12x12 | G | X | MGVP6 |
| Comments: Exotic evergreen tree of good vigour. Dual leader specimen with foliage appearing free of insect predation or disease. | | | | | | | | | | | |
| 12 | Archontophoenix alexandrae <i>Alexandra Palm</i> | M | F | N | N | Sy | 400 Ave | 17 4x4 | G | X | MGVF9 |
| Comments: Indigenous evergreen tree of good vigour. Trunk extends to 15 metres from ground before formation of the crown shaft. | | | | | | | | | | | |

Table 1 cont.

| | Genus & species Common Name | Age S-Sapling Y-Young M-Mature O-Overmature | Condition D-Dead P-Poor F-Fair G-Good | Pest & Diseases N = No or Y = Yes (If yes see comments) | Branch Bark Included N = No or Y = Yes (If yes see comments) | Canopy Orientation A-Asymmetrical Sy-Symmetrical N,S,E,W-Orientation | DBH (mm) @ 1.4 metres from ground | Height/Spread (m) | Vigour L-Low G-Good A-Abnormal | Trunk Lean X-Straight or Slightly Leaning A-Acaulescent M-Moderate S-Severe C-Critical | SRIV Age, Vigour, Condition/ Index Rating (See Appendix A) |
|---|---|---|---|---|--|---|--------------------------------------|-------------------|---|---|---|
| 13 | Cinnamomum camphora <i>Camphor laurel</i> | M | P | N | N | A/E | 600 Ave | 15 12x12 | G | X | MGVP6 |
| Comments: Exotic evergreen tree of good vigour. Smaller suppressed specimen. | | | | | | | | | | | |
| 14 | Cinnamomum camphora <i>Camphor laurel</i> | M | P | N | N | Sy | 800 | 18 12x12 | G | X | MGVP6 |
| Comments: Exotic evergreen tree of good vigour. Short trunk specimen with foliage appearing free of insect predation or disease. | | | | | | | | | | | |
| 15 | Picconia excelsa <i>Palo Blanco</i> | M | P | N | N | Sy | 300 Ave | 11 6x4 | G | A | MGVP6 |
| Comments: Exotic tree poor in condition. Multi leader specimen extending from near ground with foliage appearing free of insect predation or disease. Central leader has previously failed with long stub still remaining. Fluting and decay of wood is evident leader to the west extending down to the short trunk. | | | | | | | | | | | |
| 22 | Melaleuca leucadendra <i>Cajuput</i> | M | F | N | N | Sy | 300 | 12 4x4 | G | X | MGVF9 |
| Comments: Indigenous evergreen tree of good vigour. Trunk enters the ground within space provided within the pavement and foliage and crown co-dominant and somewhat narrow due to competition with neighbouring street trees. | | | | | | | | | | | |
| 23 | Melaleuca leucadendra <i>Cajuput</i> | M | F | N | N | Sy | 500 | 12 4x4 | G | X | MGVF9 |
| Comments: Indigenous evergreen tree of good vigour. Trunk enters the ground within space provided within the pavement and foliage and crown co-dominant and somewhat narrow due to competition with neighbouring street trees. | | | | | | | | | | | |
| 24 | Melaleuca leucadendra <i>Cajuput</i> | M | F | N | N | Sy | 350 | 12 4x4 | G | X | MGVF9 |
| Comments: Indigenous evergreen tree of good vigour. Trunk enters the ground within space provided within the pavement and foliage and crown co-dominant and somewhat narrow due to competition with neighbouring street trees. | | | | | | | | | | | |
| 25 | Melaleuca quinquenervia <i>Broad-leafed Paperbark</i> | M | F | N | N | Sy | 350 | 12 4x4 | G | X | MGVF9 |
| Comments: Indigenous evergreen tree of good vigour. Trunk enters the ground within space provided within the pavement and foliage and crown co-dominant and somewhat narrow due to competition with neighbouring street trees. | | | | | | | | | | | |
| 26 | Melaleuca leucadendra <i>Cajuput</i> | M | F | N | N | Sy | 500 | 12 4x4 | G | X | MGVF9 |
| Comments: Indigenous evergreen tree of good vigour. Trunk enters the ground within space provided within the pavement and foliage and crown co-dominant and somewhat narrow due to competition with neighbouring street trees. | | | | | | | | | | | |
| 27 | Melaleuca leucadendra <i>Cajuput</i> | M | F | N | N | Sy | 400 | 12 4x4 | G | X | MGVF9 |
| Comments: Indigenous evergreen tree of good vigour. Trunk enters the ground within space provided within the pavement and foliage and crown co-dominant and somewhat narrow due to competition with neighbouring street trees. | | | | | | | | | | | |
| 28 | Melaleuca quinquenervia <i>Broad-leafed Paperbark</i> | M | F | N | N | Sy | 350 | 12 4x4 | G | X | MGVF9 |
| Comments: Indigenous evergreen tree of good vigour. Trunk enters the ground within space provided within the pavement and foliage and crown co-dominant and somewhat narrow due to competition with neighbouring street trees. | | | | | | | | | | | |
| 29 | Melaleuca quinquenervia <i>Broad-leafed Paperbark</i> | M | F | N | N | Sy | 450 | 12 4x4 | G | X | MGVF9 |
| Comments: Indigenous evergreen tree of good vigour. Trunk enters the ground within space provided within the pavement and foliage and crown co-dominant and somewhat narrow due to competition with neighbouring street trees. | | | | | | | | | | | |
| 30 | Ficus rubiginosa <i>Port Jackson Fig</i> | M | F | N | N | Sy | 1000 | 18 13x13 | G | X | MGVF9 |
| Comments: Indigenous evergreen tree appearing structurally sound and free of insect predation or disease. | | | | | | | | | | | |
| 31 | Ficus rubiginosa <i>Port Jackson Fig</i> | M | F | N | N | Sy | 1000 | 18 13x13 | G | X | MGVF9 |
| Comments: Indigenous evergreen tree appearing structurally sound and free of insect predation or disease. | | | | | | | | | | | |

Table 1 cont.

| | Genus & species Common Name | Age S-Sapling Y-Young M-Mature O-Overmature | Condition D-Dead P-Poor F-Fair G-Good | Pest & Diseases N = No or Y = Yes (If yes see comments) | Branch Bark Included N = No or Y = Yes (If yes see comments) | Canopy Orientation A-Asymmetrical Sy-Symmetrical N,S,E,W-Orientation | DBH (mm) @ 1.4 metres from ground | Height/Spread (m) | Vigour L-Low G-Good A-Abnormal | Trunk Lean X-Straight or Slightly Leaning A-Acaulescent M-Moderate S-Severe C-Critical | SRIV Age, Vigour, Condition/ Index Rating (See Appendix A) |
|---|---|---|---|---|--|---|--------------------------------------|-------------------|---|---|---|
| 32 | Cedrus deodara <i>Deodar Cedar</i> | M | F | N | N | Sy | 500 | 13 8x8 | G | X | MGVF9 |
| Comments: Exotic evergreen tree of good vigour. Habit excurrent with foliage appearing free of insect predation or disease. | | | | | | | | | | | |
| 33 | Acmena smiyhii "Minor" <i>Dwarf Lilly Pilly</i> | M | F | N | N | A/W | 250 | 4 6x6 | G | X | MGVF9 |
| Comments: Indigenous evergreen tree. Crown supported by a short trunk dividing at 1.8 metres from ground. Foliage generally appeared free of insect predation or disease with crown asymmetrical to the west due to competition from adjoining vegetation. The trunk enters the ground cleanly with minimal soil heaving occurring. | | | | | | | | | | | |
| 34 | Howea forsteriana <i>Kentia Palm</i> | M | F | N | N | Sy | 150 | 8 3x3 | G | X | MGVF9 |
| Comments: Indigenous evergreen tree of good vigour. Crown appearing free of insect predation or disease. | | | | | | | | | | | |
| 35 | Phoenix reclinata <i>Senegal Date Palm</i> | M | F | N | N | Sy | 150 | 8 3x3 | G | X | MGVF9 |
| Comments: Exotic evergreen clumping palm tree of good vigour. Tree a smaller specimen with foliage free of insect predation or disease. | | | | | | | | | | | |
| 36 | Cyathea cooperi <i>Tree Fern</i> | M | F | N | N | Sy | 150 | 3 3x3 | G | X | MGVF9 |
| Comments: Smaller indigenous evergreen fern of good vigour. | | | | | | | | | | | |
| 37 | Callistemon viminalis <i>Bottlebrush</i> | M | P | N | N | A/N | 250 | 13 4x14 | L | X | MLVP2 |
| Comments: Indigenous evergreen tree of low vigour. Crown thinning and leggy in growth habit due to competition with surrounding vegetation. | | | | | | | | | | | |

Table 2 Setbacks for tree protection zones

This table only applies to trees being retained and potentially impacted upon by the proposed works to be included within a Tree Protection Zone. Tree Protection Zone fencing locations where required as measured from the centre of each tree and the recommended distances for the side closest to the building construction works e.g. excavation. (see explanatory notes below).

| A | B | C | D | E | F | G |
|----------|---|---|---|--|--|---|
| Tree No. | A=Trunk Diameter in millimetres at 1.4m above ground, B=Trunk Diameter in millimetres above root buttress . | Age of tree Y = Young M = Mature O = Over-mature (senescent) | Tree Vigour Good Vigour= GV Or Low Vigour= LV | Australian Standard AS 4970-2009 "Protection of trees on development sites (See appendix) Calculated Structural Root Zone (SRZ) in metres being Radius=(Dx50)0.42 x0.64 | Distance of Tree Protection Zone (TPZ) , in metres. Australian Standard AS 4970-2009 "Protection of trees on development sites" TPZ=DBH x 12 | Recommended distance of tree protection fence /zone on the side closest to building /construction in metres. (See explanatory notes below & report recommendations) |
| 6 | A=500(Ave) B=1400 | M | GV | 3.9 | 9.8 | 8.82(1) |
| 26 | A=500 B=520 | M | GV | 2.6 | 6 | 1(8) |
| 27 | A=400 B=420 | M | GV | 2.3 | 4.8 | 1(8) |
| 28 | A=350 B=370 | M | GV | 2.2 | 4.2 | 1(8) |
| 29 | A=450 B=470 | M | GV | 2.5 | 5.4 | 1(8) |
| 30 | A=1000 B=1020 | M | GV | 3.6 | 12 | 10.8 (1) |
| 31 | A=1000 B=1020 | M | GV | 3.6 | 12 | Not Affected |
| 32 | A=500 B=520 | M | GV | 2.6 | 6 | Not Affected |
| 33 | A=250 B=270 | M | GV | 2 | 3 | 2.7(1) |

Explanatory notes for Table 2.0.

This table is based upon Australian Standard AS 4970-2009 "Protection of trees on development sites." and identifies SRZ & TPZ near to trees to be retained when the age, and vigour of each tree is considered. However, if the prescribed setback from the trunk of the tree for the location of the Tree Protection Zone, is unable to accommodate the location of building works nearby in accordance with "Protection of trees on development sites section 3.3 of that Standard provides the following:

3.3.4 TPZ encroachment considerations When determining the potential impacts of encroachment into the TPZ, the project arborist should consider the following:(a) Location and distribution of the roots.(b) The potential loss of root mass resulting from the encroachment: number and size of roots.(c) Tree species and tolerance to root disturbance.(d) Age, vigour and size of the tree. (e) Lean and stability of the tree. (f) Soil characteristics and volume, topography and drainage. (g) The presence of existing or past structures or obstacles affecting root growth.(h) Design factors.

- * Average diameter.
- 1 Special conditions apply to protect the roots of trees generally, see recommendations
- 2 Additional protective fencing and works as detailed in appendix D & E.
- 3 Acceptable due to the good relative tolerance of the species to development impacts
- 4 Range of set backs for the trees at each end of a linear stand.
- 5 Acceptable as fence located at a substantial distance beyond dripline, or may also include the location of a smaller tree in proximity to a larger tree to be retained and the smaller tree being protected well within the protective fencing for that larger tree.
- 6 Acceptable due to additional special protection works, see appendix E & recommendations for this tree.
- 7 Acceptable as pre-existing site conditions were conducive to having restricted the development of root growth in this direction.
- 8 Street tree with protective fencing of minimal width to allow for pedestrian access along road reserve.
- 9 Acceptable as tree transplanted reducing the area of the root zone.
- 10 Acceptable as not effected by development.
- 11 Palm species or young tree not expected to have established a substantially expansive root system and able to re-establish or modify growth to be sustainable due to age and normal vigour.
- 12 Set back prescribed by the consent authority.
- 13 Acceptable as tree growing on a lean and encroachment on compression wood side where root growth is of reduced structural importance.
- 14 Acceptable as root mapping has indicated extent of structural woody roots with a diameter of 40mm or more.
- 15 Acceptable as pre-existing conditions would have aided in the deflection of roots away from the proposed development site.

5. Discussion

The development proposes to construct a Research, Performing Arts, Aquatic Centre and the introduction of area for a bus turning circle and reconfiguration of parking and hard stand area which enables the retention of trees numbered 6, 26, 27, 28, 29, 30, 31, 32 & 33. Of the remaining trees, numbers 1, 2, 3, 5, 8, 9, 10, 11, 12, 13, 14, 15, 34, 35, 36 & 37 are located directly within or adjacent to the proposed changes to the land and will require removal with the design in its current format.

The preliminary construction management plan prepared by ADCO identified numerous options for stage 1 works part of which in order to facilitate safe construction requires removal of the four most eastern trees on Macpherson Street numbered 22, 23, 24 & 25. These trees should be replaced with the same tree species and quantities following completion of the development.

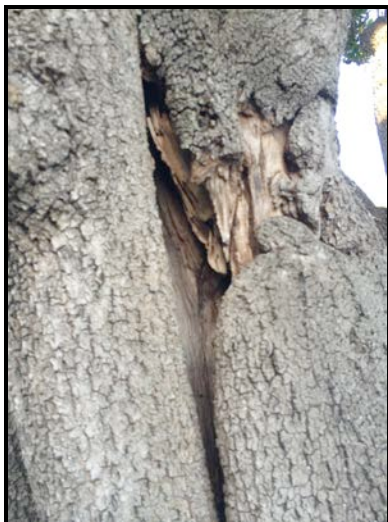
The following points are provided in regards to trees identified for removal internal to the site:

- **Tree 1:** *The crown of the tree has been previously badly managed through lopping near to its base severely modifying its natural habit to accommodate the existing pool located to the north of the tree. The pruning wound created from this inappropriate management has not occluded and the wound face is showing the initial signs of decay. The remainder of the tree leans severely to the south and modification to its root plate on its northern aspects would have occurred to accommodate the foundations and lower areas of the existing pool raising concerns over failure in full as the tree further ages or if subject to inclement weather patterns. The tree is declining and is not considered a specimen suitable for retention and would be better removed and replaced to provide for a long-term landscape element for the immediate area. The location of adjoining street trees and the provision of new street trees following completion of building works reduces any perceived impacts upon the amenity of the immediate area through the removal of this tree.*
- **Trees 2 & 3:** *These trees are of smaller specimens, and could be readily replaced following completion of building works with minimal impact upon the amenity of the immediate area.*
- **Tree 5:** *This tree is obviously in advanced senescence and requires removal to ensure safety for the school.*
- **Trees 8-14:** *These trees are located within and adjacent to the proposed building envelopes and are not retainable with the design in its current format.*
- **Tree 15:** *The central branch of the tree has previously failed and will need to be cut back to the main trunk if retained in situ or elsewhere to make the tree safe. There is also the inward and downward spread of decay in another leader or branch adjoining which will also need to be cut back to an adjoining main branch to make it safe. These works will result in the removal of upwards of a third of the trees crown area. Stored energy is everywhere in the tree so removal of the branches to make the tree safe combined with root severance to enable transplanting if undertaken will reduce the trees ability to sustain itself. The tree is considered to be in late maturity and is not considered a specimen suitable for retention or a viable prospect for transplantation.*
- **Tree 34:** *The tree is approximately 8 metres in height and is screened to a large degree by adjoining more dominant trees present internal to the site. These trees screen tree 34 from the south and north of the site significantly reducing any perceived impacts upon the amenity of the immediate area through removal of the tree.*

- **Trees 35 & 36:** These clump of palm and a fern are of smaller dimensions, and could be readily replaced following completion of building works with minimal impact upon the amenity of the immediate area. The palm and fern are screened from the south and north of the site by dominant larger trees and from the west through the retention of tree 33 reducing any perceived impacts upon the amenity of the immediate area through removal of the trees.
- **Tree 37:** The tree is approximately 13 metres in height and is screened to a large degree by adjoining more dominant trees present internal to the site. These trees and school buildings screen tree 37 from the south and north of the site reducing any perceived impacts upon the amenity of the immediate area through removal of the tree.



Screening by more dominant trees to the north & South of tree 34,35,36 & 37



T15 - Decayed leader western aspect.



T1- Previously lopped leader northern aspect

The following points are provided in regards to trees identified for retention:

- **Tree 6:** The design has been arrived at with specific attention to the retention of this tree. Tree protection is to be erected 9 metres from the trunk centre adjacent to the proposed development footprint. Pruning of 1 x 3rd order and 8 x 4th and 5th order leaders at the crown extremities will be required from the crown's eastern aspect to provide clearance and to avoid accidental damage occurring during construction works. The tree has been previously heavily wire braced on this aspect of the tree and these works will also benefit through the reduction of weight on this aspect of the tree. See recommendations.

- **Trees 26, 27, 28, 29:** *The trees are to be retained and the trunks and lower branches are to be armored with timber lengths to avoid accidental damage occurring during construction works. See recommendations.*
- **Trees 30, 31 & 32:** *These trees are mostly clear of the proposed works with the exception of tree 30 which will require initial hand excavation on its southern aspects prior to bulk earthworks occurring to ensure fracturing of any roots that may be present doesn't occur. See recommendations.*
- **Tree 33:** *The design has been arrived at with specific attention to the retention of this tree. All excavation works for the turning circle and hard stand area are located outside of the tree prescribed Tree Protection Zone (TPZ) and outside of the tree crown projection to the east eliminating the need for any pruning or modification of such.*

6. RECOMMENDATIONS

- a. That trees 6, 26, 27, 28, 29, 30, 31,32 and 33 identified in table 2 be retained and protected. Tree protection zones are to be established for trees 6 and 30 at setbacks identified in table 2 column G from trunk centres in accordance with appendix E prior to commencement of any site works.
- b. A Tree protection zone is to be established within the development site boundary only for tree 33 at a setback of 2.7 metres (radius) from the trunk centre in accordance with appendix E prior to commencement of any site works.
- c. Further protection for trees 26, 27, 28, 29 located along the public walkway, is to be achieved by wrapping 2 layers of hessian or carpet underfelt around the trunks and branches for a minimum of 2m or as lower branches permit, then wire or rope secures 75x50x2000 mm hardwood battens together around the trunks for the duration of site works.
- d. Initial excavation works for the basement from trees 6, 30 and 33 to be retained is to be undertaken by hand and any roots encountered are to be cut cleanly with a final cut to undamaged woody tissue. This will prevent tearing damage to the roots from excavation equipment which can extend beyond the point of excavation back towards the trees.
- e. Specific tree protection measures for tree 6 are as follows:

Install three water-monitoring probes well in advance of site works commencing to ascertain soil moisture levels that the tree receives.

Install and regulate temporary irrigation to emulate ground water the tree is receiving.

Download and analyze data on a monthly basis for the duration of the project with reports to be provided to the client or assigned representative within a week of the inspection being undertaken and adjust water flows as required.

Spray the tree crown with an Anti-Transpirant to reduce moisture loss prior to excavation for site works commencing.

Hand trench along the perimeters of the proposed cutting point for the basement to depths of 1 metre and clean cut any roots that may be present with final cuts to be undertaken undamaged woody tissue.

That pruning of lower order branches at the crown extremities be pruned in accordance with the Australian Standard AS 4373- 2007- "Pruning of Amenity Trees" primarily to avoid accidental damage occurring during construction works and to reduce weight of the crown bracing on its eastern aspects.

All new construction surfaces facing the east and southern aspects of the tree should be non reflective to avoid sunscald and wounding of branches and burning of foliage.

Removal of any structures beneath the crown such as the fountain walling and existing concrete slabs are to be undertaken by hand to avoid soil compaction and damage to tree root system.

That the inner side of the proposed tree protection zone fencing be lined with a geo-fabric type material to help in stopping the movement of phytotoxic particles during site works.

- f. That crown cleaning be undertaken upon trees to be retained (see table 2) prior to commencement of any site works to remove any dead or diseased wood. All pruning works are to be undertaken in accordance with AS 4373- 2007- Pruning of Amenity Trees.
- g. All proposed new ground re-surfacing in proximity to trees to be retained (see table 2) should be of a porous nature to provide beneficial growing conditions and the transfer of air between tree roots, the soil and the atmosphere.
- h. All services where possible are to be located outside the area of the dripline from trees to be retained (see table 2). Any services to be located within the area of the dripline of the trees or within the Tree Protection Zones indicated within table 2 are to be installed by the use of lateral or thrust boring equipment or some other type of Trenchless Technology considered appropriate by the Consulting Arboriculturist. Tunneling for such services should not occur less than 600mm in depth below existing ground level. See also Appendix D section 1.2.6.
- i. That trees 1, 2, 3, 5, 8, 9, 10, 11, 12, 13, 14, 15, 22, 23, 24,25,34,35,36 & 37 be removed and replaced with trees shrubs and ground covers following completion of hard landscape works in accordance with Landscape Documentation.
- j. That the replacement tree species to be planted, be advanced specimens with stems gradually tapering, with crowns symmetrical and roots established and proportional to the crown but not pot bound, having been propagated to the standards of Specifying Trees a Guide to assessment of tree quality (2nd edition) by Ross Clark 2003.



Peter Richards
Tree & Landscape Consultants

Appendix A

Matrix - Sustainable Retention Index Value (S.R.I.V.)©

Developed by IACA – Institute of Australian Consulting Arboriculturists www.iaca.org.au (2009)

To be used with the values defined in the Glossary.
An Index value as indicated where ten (10) is the highest value.

| Age Class | Vigour Class and Condition Class | | | | | |
|-----------------|---|--|--|---|---|---|
| | Good Vigour & Good Condition (GVG) | Good Vigour & Fair Condition (GVF) | Good Vigour & Poor Condition (GVP) | Low Vigour & Good Condition (LVG) | Low Vigour & Fair Condition (LVF) | Low Vigour & Poor Condition (LVP) |
| | Able to be retained if sufficient space available above and below ground for future growth. No remedial work or improvement to growing environment required. May be subject to high vigour. Retention potential - Medium – Long Term. | Able to be retained if sufficient space available above and below ground for future growth. Remedial work may be required or improvement to growing environment may assist. Retention potential - Medium Term. Potential for longer with remediation or favourable environmental conditions. | Able to be retained if sufficient space available above and below ground for future growth. Remedial work unlikely to assist condition, improvement to growing environment may assist. Retention potential - Short Term. Potential for longer with remediation or favourable environmental conditions. | May be able to be retained if sufficient space available above and below ground for future growth. No remedial work required, but improvement to growing environment may assist vigour. Retention potential - Short Term. Potential for longer with remediation or favourable environmental conditions. | May be able to be retained if sufficient space available above and below ground for future growth. Remedial work or improvement to growing environment may assist condition and vigour. Retention potential - Short Term. Potential for longer with remediation or favourable environmental conditions. | Unlikely to be able to be retained if sufficient space available above and below ground for future growth. Remedial work or improvement to growing environment unlikely to assist condition or vigour. Retention potential - Likely to be removed immediately or retained for Short Term. Potential for longer with remediation or favourable environmental conditions. |
| Young (Y) | Index Value 9 Retention potential - Long Term. Likely to provide minimal contribution to local amenity if height <5m. High potential for future growth and adaptability. Retain, move or replace. | Index Value 8 Retention potential - Short – Medium Term. Potential for longer with improved growing conditions. Likely to provide minimal contribution to local amenity if height <5m. Medium-high potential for future growth and adaptability. Retain, move or replace. | Index Value 5 Retention potential - Short Term. Potential for longer with improved growing conditions. Likely to provide minimal contribution to local amenity if height <5m. Low-medium potential for future growth and adaptability. Retain, move or replace. | Index Value 4 Retention potential - Short Term. Potential for longer with improved growing conditions. Likely to provide minimal contribution to local amenity if height <5m. Medium potential for future growth and adaptability. Retain, move or replace. | Index Value 3 Retention potential - Short Term. Potential for longer with improved growing conditions. Likely to provide minimal contribution to local amenity if height <5m. Low-medium potential for future growth and adaptability. Retain, move or replace. | Index Value 1 Retention potential - Likely to be removed immediately or retained for Short Term. Likely to provide minimal contribution to local amenity if height <5m. Low potential for future growth and adaptability. |
| Mature (M) | Index Value 10 Retention potential - Medium - Long Term. | Index Value 9 Retention potential - Medium Term. Potential for longer with improved growing conditions. | Index Value 6 Retention potential - Short Term. Potential for longer with improved growing conditions. | Index Value 5 Retention potential - Short Term. Potential for longer with improved growing conditions. | Index Value 4 Retention potential - Short Term. Potential for longer with improved growing conditions. | Index Value 2 Retention potential - Likely to be removed immediately or retained for Short Term. |
| Over-mature (O) | Index Value 6 Retention potential - Medium - Long Term. | Index Value 5 Retention potential - Medium Term. | Index Value 4 Retention potential - Short Term. | Index Value 3 Retention potential - Short Term. Potential for longer with improved growing conditions. | Index Value 2 Retention potential - Short Term. | Index Value 0 Retention potential - Likely to be removed immediately or retained for Short Term. |

Appendix B

Definitions & Terminology

From
Dictionary for Managing Trees in Urban Environments
Institute of Australian Consulting Arboriculturists (IACA) 2009.

Condition of trees

Condition A tree's *crown form* and growth habit, as modified by its *environment* (aspect, suppression by other trees, soils), the *stability* and *viability* of the *root plate*, trunk and structural branches (first (1st) and possibly second (2nd) order branches), including structural defects such as wounds, cavities or hollows, *crooked* trunk or weak trunk/branch junctions and the effects of predation by pests and diseases. These may not be directly connected with *vigour* and it is possible for a tree to be of *normal vigour* but in *poor condition*. Condition can be categorized as *Good Condition*, *Fair Condition*, *Poor Condition* and *Dead*.

Good Condition Tree is of good habit, with *crown form* not severely restricted for space and light, physically free from the adverse effects of *predation* by pests and diseases, obvious instability or structural weaknesses, fungal, bacterial or insect infestation and is expected to continue to live in much the same condition as at the time of inspection provided conditions around it for its basic survival do not alter greatly. This may be independent from, or contributed to by *vigour*.

Fair Condition Tree is of good habit or *misshapen*, a form not severely restricted for space and light, has some physical indication of *decline* due to the early effects of *predation* by pests and diseases, fungal, bacterial, or insect infestation, or has suffered physical injury to itself that may be contributing to instability or structural weaknesses, or is faltering due to the modification of the *environment* essential for its basic survival. Such a tree may recover with remedial works where appropriate, or without intervention may stabilise or improve over time, or in response to the implementation of beneficial changes to its local environment. This may be independent from, or contributed to by *vigour*.

Poor Condition Tree is of good habit or *misshapen*, a form that may be severely restricted for space and light, exhibits symptoms of advanced and *irreversible decline* such as fungal, or bacterial infestation, major die-back in the branch and *foliage crown*, *structural deterioration* from insect damage e.g. termite infestation, or storm damage or lightning strike, ring barking from borer activity in the trunk, root damage or instability of the tree, or damage from physical wounding impacts or abrasion, or from altered local environmental conditions and has been unable to adapt to such changes and may decline further to death regardless of remedial works or other modifications to the local *environment* that would normally be sufficient to provide for its basic survival if in *good* to *fair* condition. Deterioration physically, often characterised by a gradual and continuous reduction in *vigour* but may be independent of a change in *vigour*, but characterised by a proportionate increase in susceptibility to, and *predation* by pests and diseases against which the tree cannot be sustained. Such conditions may also be evident in trees of advanced senescence due to normal phenological processes, without modifications to the growing environment or physical damage having been inflicted upon the tree. This may be independent from, or contributed to by *vigour*.

Dead Tree is no longer capable of performing any of the following processes or is exhibiting any of the following symptoms;

Processes

Photosynthesis via its foliage crown (as indicated by the presence of moist, green or other coloured leaves);

Osmosis (the ability of the root system to take up water);

Turgidity (the ability of the plant to sustain moisture pressure in its cells);

Epicormic shoots or *epicormic strands* in Eucalypts (the production of new shoots as a response to stress, generated from latent or adventitious buds or from a *lignotuber*);

Symptoms

Permanent leaf loss;

Permanent wilting (the loss of turgidity which is marked by desiccation of stems leaves and roots);

Abscission of the *epidermis* (bark desiccates and peels off to the beginning of the sapwood).

Removed No longer present, or tree not able to be located or having been cut down and retained on a site, or having been taken away from a site prior to site inspection.

Description of Tree Dimensions

Height The distance measured vertically between the horizontal plane at the lowest point at the base of a tree, which is immediately above ground, and the horizontal plane immediately above the uppermost point of a tree.

Spread The furthest expanse of the crown when measured horizontally from one side of the tree to the other, generally through the centre of the trunk. Where the crown is not circular a measurement should be an average of the narrowest and widest diameters and this is dependent upon crown form and to a lesser extent its symmetry.

Crown Cover Percent of the homogenous distribution of foliage across the entire crown based upon that expected for a specimen of that species in good condition and of normal vigour, depending on form in situ, e.g. this may be influenced by crown die-back, proximity to other trees or structures, moisture stress, or overshadowing.

Vigour

Vigour Ability of a tree to sustain its life processes. This is independent of the *condition* of a tree but may impact upon it. Vigour can appear to alter rapidly with change of seasons (seasonality) e.g. *dormant*, deciduous or semi-deciduous trees. Vigour can be categorized as *Normal Vigour*, *High Vigour*, *Low Vigour* and *Dormant Tree Vigour*.

Good Vigour Ability of a tree to maintain and sustain its life processes. This may be evident by the typical growth of leaves, crown cover and crown density, branches, roots and trunk and resistance to predation. This is independent of the condition of a tree but may impact upon it, and especially the ability of a tree to sustain itself against predation.

High Vigour *Accelerated growth* of a tree due to incidental or deliberate artificial changes to its growing *environment* that are seemingly beneficial, but may result in *premature aging* or failure if the favourable conditions cease, or promote *prolonged senescence* if the favourable conditions remain, e.g. water from a leaking pipe; water and nutrients from a leaking or disrupted sewer pipe; nutrients from animal waste, a tree growing next to a chicken coop, or a stock feed lot, or a regularly used stockyard; a tree subject to a stringent watering and fertilising program; or some trees may achieve an extended lifespan from continuous *pollarding* practices over the life of the tree.

Low Vigour Reduced ability of a tree to sustain its life processes. This may be evident by the atypical growth of leaves, reduced crown cover and reduced crown density, branches, roots and trunk, and a deterioration of their functions with reduced resistance

to predation. This is independent of the condition of a tree but may impact upon it, and especially the ability of a tree to sustain itself against predation.

Dormant Tree Vigour Determined by existing turgidity in lowest order branches in the outer extremity of the crown, with good bud set and formation, and where the last extension growth is distinct from those most recently preceding it, evident by bud scale scars. Normal vigour during dormancy is achieved when such growth is evident on a majority of branches throughout the crown.

Poor Vigour See low vigour

Good Vigour See Normal Vigour

Age of Trees

Age of Trees Most trees have a stable biomass for the major proportion of their life. The estimation of the age of a tree is based on the knowledge of the expected lifespan of the taxa in situ divided into three distinct stages of measurable biomass, when the exact age of the tree from its date of cultivation or planting is unknown. These increments are Young, Mature and Overmature.

Young Tree aged less than 20% of life expectancy.

Mature Tree aged 20-80% of life expectancy.

Over-mature Tree aged greater than 80% of life expectancy tending to senescent with or without reduced vigour, and declining gradually or rapidly but irreversibly to death.

Sapling A young tree, early in its development with small dimensions.

Senescent Advanced old age, over-mature.

General Terms

Significant Important, weighty or more than ordinary.

Significant Tree A tree considered important, weighty or more than ordinary. Example: due to prominence of location, or in situ, or contribution as a component of the overall landscape for *amenity* or aesthetic qualities, or *curtilage* to structures, or importance due to uniqueness of taxa for species, subspecies, variety, form, or as an historical or cultural planting, or for age, or substantial dimensions, or habit, or as remnant vegetation, or habitat potential, or a rare or threatened species, or uncommon in cultivation, or of aboriginal cultural importance, or is a commemorative planting.

Substantial A tree with large dimensions or proportions in relation to its place in the landscape.

Excurrent Tree where the crown is comprised of one (1) dominant first order structural branch which is usually an extension of the trunk, erect, straight and continuous, tapering gradually, with the main *axis* clear from base to apex, e.g. *Araucaria heterophylla* - Norfolk Island Pine. Note: some tree species of *typical* excurrent habit may be altered to deliquescent by physical damage of the *apical meristem*, or from top lopping, or from the propagation of inferior quality stock. However, *formative pruning* may be able to correct a *crown* to excurrent if undertaken when a tree is *young*.

Sustainable Retention Index Value (SRIV) A visual method of rating the viability of urban trees for development sites and management, based on general tree and landscape assessment criteria. SRIV© is for the professional manager of urban trees to consider the tree in situ with an assumed knowledge of the taxa and its growing environment and is based on the physical attributes of the tree and its response to its environment considering its age class, vigour class, condition class and its sustainable retention with regard to the safety of people or damage to property and the ability to retain the tree with remedial work or beneficial modifications to its growing environment or removal and replacement. (IACA 2005)

Crown Spread Orientation Direction of the *axis* of *crown spread* which can be categorized as *Orientation Radial* and *Orientation Non-radial*.

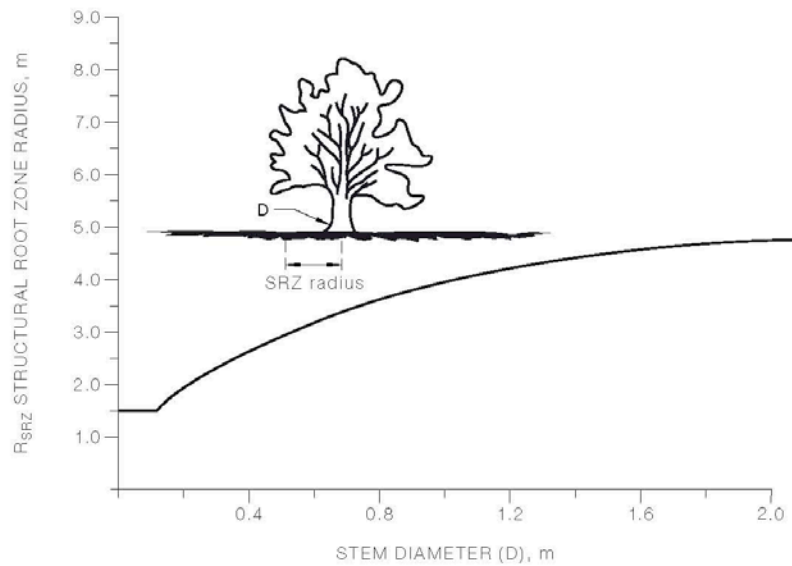
Diameter at Breast Height (DBH) Measurement of trunk width calculated at a given distance above ground from the base of the tree often measured at 1.4 m. The trunk of a tree is usually not a circle when viewed in cross section, due to the presence of *reaction wood* or *adaptive wood*, therefore an average diameter is determined with a *diameter tape* or by recording the trunk along its narrowest and widest axes, adding the two dimensions together and dividing them by 2 to record an average and allowing the orientation of the longest axis of the trunk to also be recorded. Where a tree is growing on a lean the distance along the top of the trunk is measured to 1.4m and the diameter then recorded from that point perpendicular to the edge of the trunk. Where a *leaning* trunk is *crooked* a vertical distance of 1.4m is measured from the ground. Where a tree branches from a trunk that is less than 1.4m above ground, the trunk diameter is recorded perpendicular to the length of the *trunk* from the point immediately below the base of the flange of the *branch collar* extending the furthest down the trunk, and the distance of this point above ground recorded as *trunk* length. Where a tree is located on sloping ground the DBH should be measured at half way along the side of the tree to average out the angle of slope. Where a tree is *acaulescent* or *trunkless* branching at or near ground an average diameter is determined by recording the radial extent of the trunk at or near ground and noting where the measurement was recorded e.g. at ground.

Structural Root Zone (SRZ) The minimal area around the base of a tree, generally circular, required for its *stability* in the ground. The section of *root plate* within this area and subsequent soil cohesion necessary to hold the tree upright against *wind throw*, therefore the entire depth of the *root zone* must be included.

Appendix C **Extract from Australian Standard AS 4970-2009** **“Protection of trees on development sites** **“Calculating the Structural Root Zone”**

13

AS 4970—2009



The curve can be expressed by the following formula:
 $R_{SRZ} = (D \times 50)^{0.42} \times 0.64$

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 D

TREE PROTECTION GUIDELINES

1.1 GENERAL NOTES

- 1.1.1 The application of measures for the protection of trees on development sites is determined by the species characteristics, and the existing physical constraints of the growing environment on site both above and below ground.
- 1.1.2 This report considers where applicable, Australian Standard AS 4970-2009 "Protection of trees on development sites." as a guide for the management of trees on development sites.
- 1.1.3 This report applies the ***Tree Protection Zone - Standard Procedure*** as developed and continually improved by the Consultant Arboriculturist for the effective protection of trees on development sites over time. (See Appendix E) Additional or alternative conditions are applied where it is deemed appropriate by the author for the protection of trees. Such additional or alternative conditions may be founded upon professional judgement based on:
- the experience of the Consulting Arboriculturist
 - scientific research
 - new technology
 - industry best practice
 - consideration of the individual tree species and its relative tolerance to development impacts
 - the individual or cumulative factors present or proposed to impact upon the growing environment essential for the trees' survival

1.2 PRECAUTIONS TO PROTECT TREES

1.2.1 *Demolition of landscape structures*

The demolition of walls, driveways, paths etc. near trees to be retained should be undertaken manually using hand tools. Use of light machinery can occur by utilising the driveway or a paved area as a stable platform to prevent soil compaction. The volume of space previously occupied by the driveway or paved area must be replaced with local top soil from the site or otherwise a loamy sand, to replace the mass on the root plate which may be critical to the ballast and centre of mass for the stability of the tree. If the tree becomes unstable immediately contact the Consultant Arboriculturist.

1.2.2 *Demolition of existing buildings*

The demolition of the buildings should be undertaken with access restricted to the driveway and the building platform for each of the existing buildings, or to areas of the land where no trees are growing within 6m of any tree to be retained. Where access or space for a safe working environment is restricted, or where the area of the 6m set back must be compromised, a 100mm layer of Eucalyptus wood mulch must be laid over the area of encroachment. Where vehicular access is required across the mulch layer further root protection should be provided by laying a temporary pathway over the mulch. The temporary pathway should be constructed of a grated steel material capable of supporting the vehicles used during demolition e.g. similar to ramps used to load vehicles onto the backs of trucks. Trunks of trees are to be protected from vehicular damage as per appendix E section 4 of this report.

1.2.3 *Removal of trees near to trees to be retained*

Removal of a tree within 6m of a tree to be retained should be undertaken only by cutting down such a tree without damaging the trees to be retained, and by grinding out its stump. Where possible the structural roots of 20mm diameter or greater of the tree to be cut down should not be removed, to minimise soil disturbance and to reduce the impact on the roots of any tree to be retained nearby. Where structural roots are to be removed this should be

undertaken manually by the use of non-motorized hand tools after the stump has been ground out when such roots are often easier to locate from the site of the stump from which they have been severed.

1.2.4 Structural Soil to accommodate compacted subgrade and root growth

To further protect woody roots with a diameter of 40mm or greater outside the area of the tree protection zone (see table 2), structural soil as a fill material or a subgrade should be used where appropriate and as detailed in the report recommendations. Structural soil addresses the issue of how to increase soil rooting volume whilst maintaining structural support for pavement. Structural soil maximises rock to rock contact utilising durable rock. Pore spaces are on average 8mm in size of which approximately 60% is taken up by the filler soil - the horticultural component, depending on the product utilised. The product is used for new tree planting in pavements, courtyards, carparks and kerbsides, planter boxes and raising levels around existing trees providing increased available soil volume to trees in pavements, structural properties for pavement support, increased root depth and high permeability for both air and water.

1.2.5 Root location and protection where structures are to be positioned near a retained tree

A: If walls, driveways or other structures are to be constructed near a protected tree or within a tree protection zone (see table 2 column G), careful excavation is to be undertaken manually by using hand tools or light machinery to determine the location of structural woody roots with a diameter of 40mm or greater, without damaging them. These roots are to be protected from physical damage by utilising pier & beam type footings to reduce excessive disturbance of existing soil profile supporting tree roots. Placement of piers are to be positioned so as to clear any structural root by at least 100mm to allow for future radial expansion of the tree root within the soil profile. Any roots 40mm or less may be clean cut with final cuts to undamaged woody tissue.

B: Where structural woody roots outside of the Tree Protection Zone or as otherwise indicated are to be pruned they are to be excavated manually first by using hand tools to adequately expose the root. Once located those roots to be severed are to be cut cleanly with a final cut to undamaged woody tissue. This will prevent tearing damage to the roots from excavation equipment which can extend beyond the point of excavation back towards the tree. Severed roots are to be treated with a root growth hormone stimulant.

1.2.6 Location of Services

If a utility service is to be located within the area of the dripline of a protected tree or within the Tree Protection Zone, the Australian Standard AS 4970-2009 "Protection of trees on development sites" provides the following:

"4.5.5. If underground services must be routed within the TPZ, they should be installed by directional drilling or in manually excavated trenches. The directional drilling bore should be at least 600mm deep. The project arborist should assess the likely impacts of boring and bore pits on retained trees. For manual excavation of trenches the project arborist should advise on roots to be retained and should monitor the works. Manual excavation may include the use of pneumatic and hydraulic tools."

1.2.7 Precautions in respect of temporary work

For Precautions in respect of temporary work, Australian Standard AS 4970-2009 "Protection of trees on development sites." provides the following:

4.5.6 Scaffolding

Where scaffolding is required it should be erected outside the TPZ. Where it is essential for scaffolding to be erected within the TPZ, branch removal should be minimized. This can be achieved by designing scaffolding to avoid branches or tying back branches. Where pruning is unavoidable it must be specified by the project arborist in accordance with AS 4373. NOTE: Pruning works may require approval by determining authority. Ground below

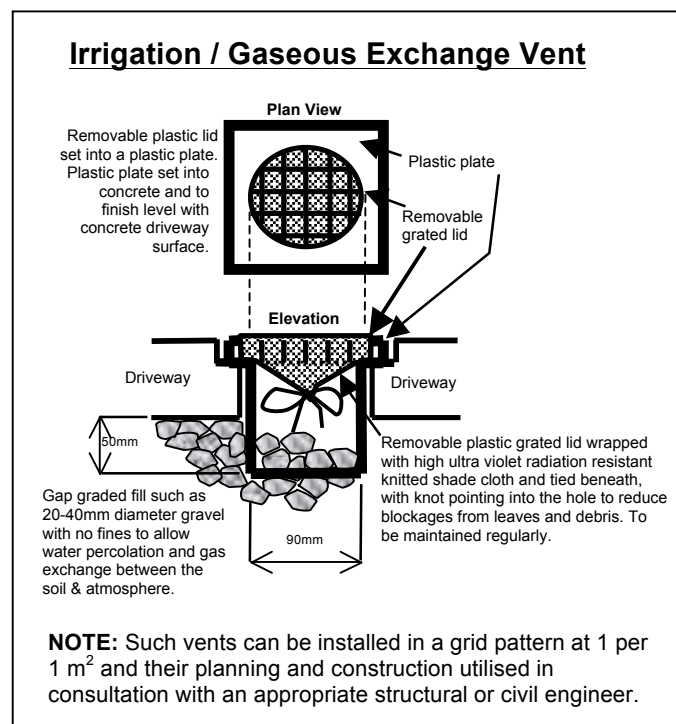
the scaffolding should be protected by boarding (e.g. scaffold board or plywood sheeting) as shown in Figure 5. Where access is required, a board walk or other surface material should be installed to minimize soil compaction. Boarding should be placed over a layer of mulch and impervious sheeting to prevent soil contamination. The boarding should be left in place until the scaffolding is removed. NOTE: Excavation required for the insertion of support posts for tree protection fencing should not involve the severance of any roots greater than 20 mm in diameter, without the prior approval of the project arborist.

“4.5.3 Ground protection

If temporary access for machinery is required within the TPZ ground protection measures will be required. The purpose of ground protection is to prevent root damage and soil compaction within the TPZ. Measures may include a permeable membrane such as geotextile fabric beneath a layer of mulch or crushed rock below rumble boards. These measures may be applied to root zones beyond the TPZ.”

1.2.9 Water / Gaseous Exchange Vents

Watering / Gaseous exchange vents are to be installed in the area of the driveway that passes within the dripline of the tree or the prescribed Tree Protection Zone area and the number and location are to be determined by a Consultant Arboriculturist and the driveway design approved by a Certified Engineer. Exposed edges of the path are to be concealed with the finished level beside the path equivalent to the top of the path by minimal filling with a sandy soil and turf, or mulch, or a garden bed with minimal cultivation, or other landscape treatments as appropriate.



1.2.10 Pruning/Removal Guidelines

- Any pruning recommended in this report is to be to the Australian Standard® AS4373 'Pruning of amenity trees', and conducted in accordance with the NSW Work Cover Authority Code of Practice for the Amenity Tree Industry, 1998

- All pruning or removal works are to be in accordance with the appropriate Tree Management Policy where applicable, or Tree Management Order (TMO), or Tree Preservation Order (TPO), or applicable consent conditions.
- Tree maintenance work is specialised and in order to be undertaken safely and to ensure the works carried out are not detrimental to the survival of the tree or surrounding vegetation, all works should be undertaken by a qualified Arboriculturist with appropriate competencies recognised within the Australian Qualification Framework, with a minimum of 5 years of continual experience within the industry of operational amenity arboriculture, and covered by appropriate and current types of insurance to undertake such works.
- Any pruning near electricity wires should be undertaken in accordance with relative Electrical Safety Rules and be performed by persons individually authorised by Energy Australia

Appendix E

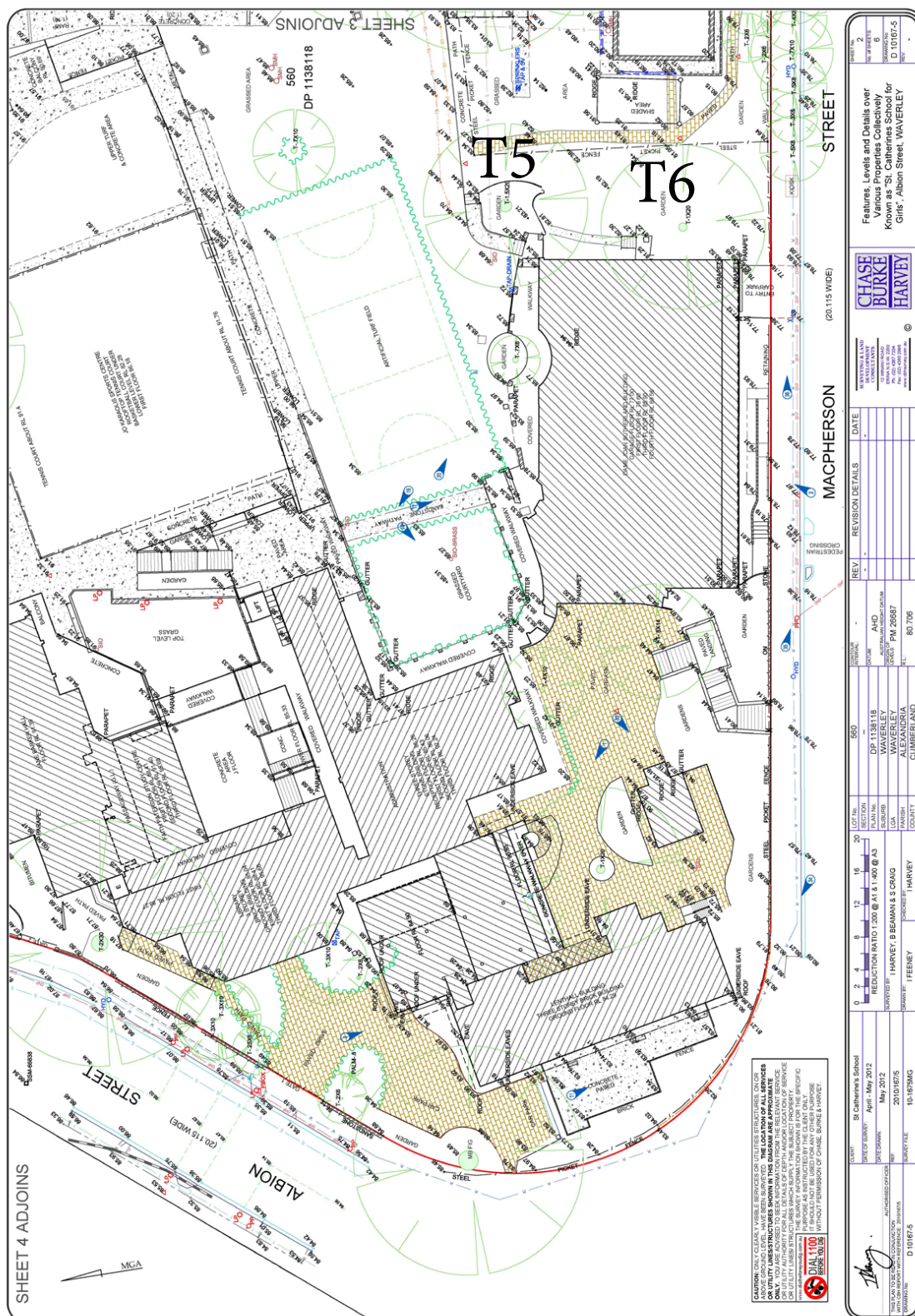
TREE PROTECTION ZONE STANDARD PROCEDURE

1. Each tree to be retained is to have its dripline fenced off, except where otherwise indicated, to create a Tree Protection Zone, and this may include one enclosure to protect a single or multiple tree/s, or multiple enclosures separated over the site. The area contained is the Tree Protection Zone, and is to exclude any activity, except where otherwise stated. The Tree Protection Zone is to exclude: modification of existing soil levels, storage of materials, site sheds and machinery; preparation of building materials e.g. concrete, or chemical treatments; the movement of pedestrian or vehicular traffic; or the temporary or permanent location of services, or the works required for their installation, e.g. trenches, holes or canals. The above list is not meant to be exhaustive, and is intended as a guide to the types of activities that are excluded from within the Tree Protection Zone, except where otherwise stated.
2. The Protective fencing where required may delineate the **TPZ** and should be located as determined by the project arborist in accordance with AS4970 *Protection of trees on development sites*, Section 4, 4.3. *"Fencing should be erected before any machinery or materials are brought onto the site and before the commencement of works including demolition. Once erected, protective fencing must not be removed or altered without approval by the project arborist. The TPZ must be secured to restrict access. AS4687 Temporary fencing and hoardings specifies applicable fencing requirements. Shade cloth or similar should be attached to reduce the transport of dust, other particulate matter and liquids into the protected area. Fence posts and supports should have a diameter greater than 20 mm and be located clear of roots. Existing perimeter fencing and other structures may be suitable as part of the protective fencing."*
3. Tree Protection signage is to be attached to each **Tree Protection Zone** and displayed from within the development site in accordance with AS4970 2009 *Protection of trees on development sites*, Section 4.4 and lettering to comply with AS1319.
4. Where a tree is to be retained and a **Tree Protection Zone** cannot be adequately established due to restricted access e.g. tree located along side an access way, the trunk and branches in the lower crown will be protected by wrapping 2 layers of hessian or carpet underfelt around the trunk and branches for a minimum of 2 m or as lower branches permit, then wire or rope secures 75x50x2000 mm hardwood battens together around the trunk (do not nail or screw to the trunk or branches). The number of battens to be used is as required to encircle the trunk and the planks are to extend to the base of the tree (AS4970 2009 *Protection of trees on development sites*, Figure 4 .
5. If a tree is growing down slope from an excavation, a silt fence located along the contours of the site in the area immediately above the **Tree Protection Zone** fencing may need to be installed and regularly maintained to prevent burial and asphyxiation of the roots of the tree. To allow for the maintenance of both fences, the silt fence must be constructed separately to the tree protection fence and the 2 fences must be constructed independently of each other and standalone. To reduce competition with the tree the area within the **Tree Protection Zone** is to be kept free of weeds. These are best removed by the application of foliar herbicide with Glyphosate as the active constituent. This is the preferred method rather than removal by cultivation of the soil within the dripline, to minimise root disturbance to the tree. The removal of woody weeds such as Privet should use the cut and paint method of herbicide application. Weeds to be controlled within the **Tree Protection Zone**, for the duration of the project.

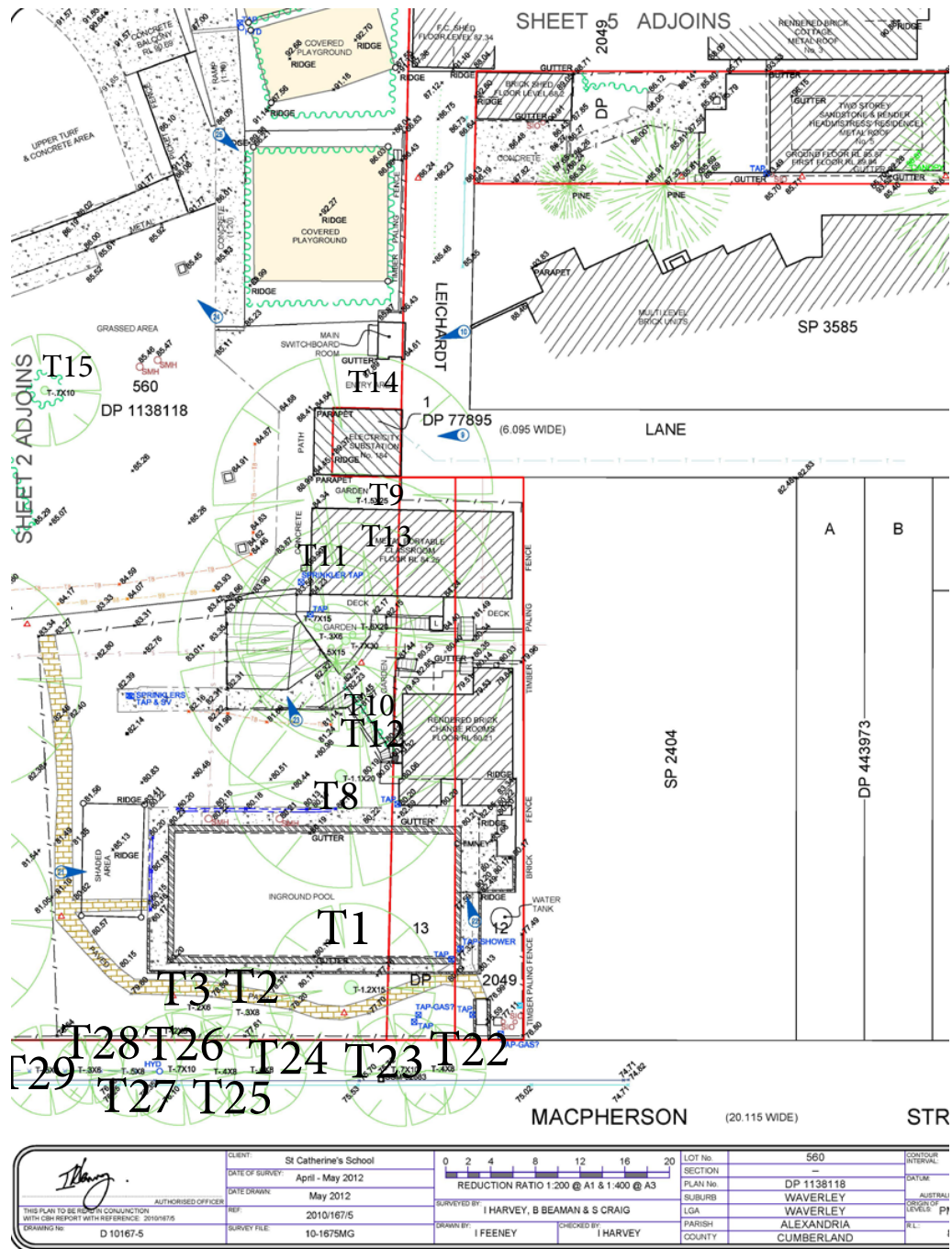
6. The area of the **Tree Protection Zone** to be mulched to a depth of 100 millimetres with organic material being 75% leaf litter and 25% wood, and this being composted material preferably from the same genus and species of tree as that to where the mulch is to be applied, i.e. species specific mulch. The depth of mulch and type as indicated, to be maintained for the duration of the project.
7. No services either temporary or permanent are to be located within the **Tree Protection Zone**. If services are to be located within the **Tree Protection Zone**, special details will need to be provided by a qualified Consulting Arboriculturist for the protection of the tree regarding the location of the service/s.
8. A tree will not be fertilised during its protection within the **Tree Protection Zone**, as this may hasten its decline if it were to decline. If a tree is to be fertilised this should be in consultation with a qualified Consulting Arboriculturist.
9. In the event of prolonged dry periods, or where a tree has been transplanted, or where excavation nearby, especially up slope, leads to drying out of soil profiles closest to the tree/s, the tree/s is to be deep root watered thoroughly at least twice a week. The need for such watering is determined readily by observing the dryness of the soil surface within the dripline of the tree by scraping back some mulch. Mulch to be reinstated afterwards. In the event of disrupted ground or surface water flows to the tree due to excavation, filling or construction, an irrigation system may be required to be installed within the **Tree Protection Zone**. If an irrigation system is to be installed, consideration must be given to volume, frequency, and drainage of water delivered, and this should be in consultation with a qualified Consulting Arboriculturist.

Appendix F

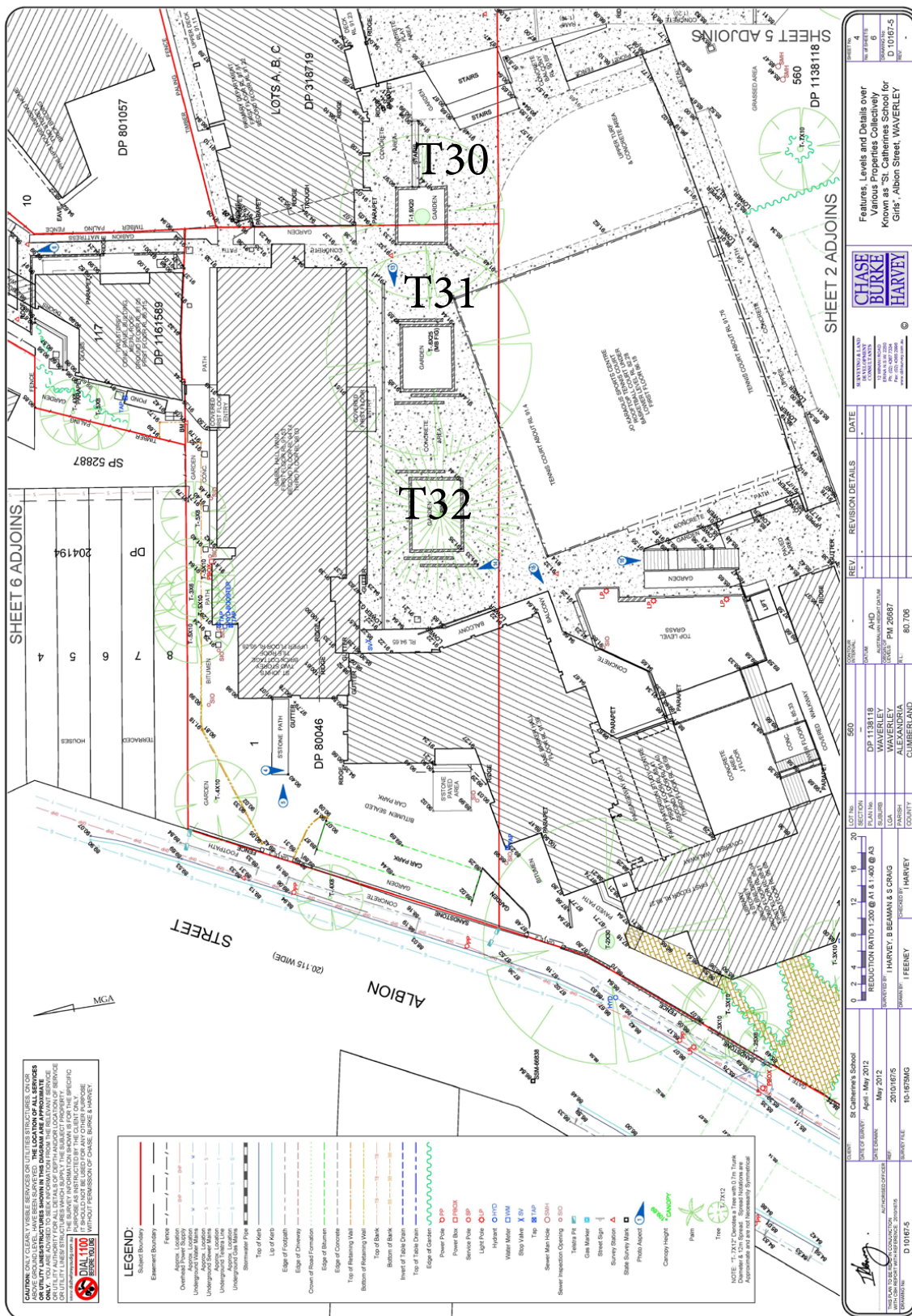
Tree Locations



Appendix F cont. Tree Locations

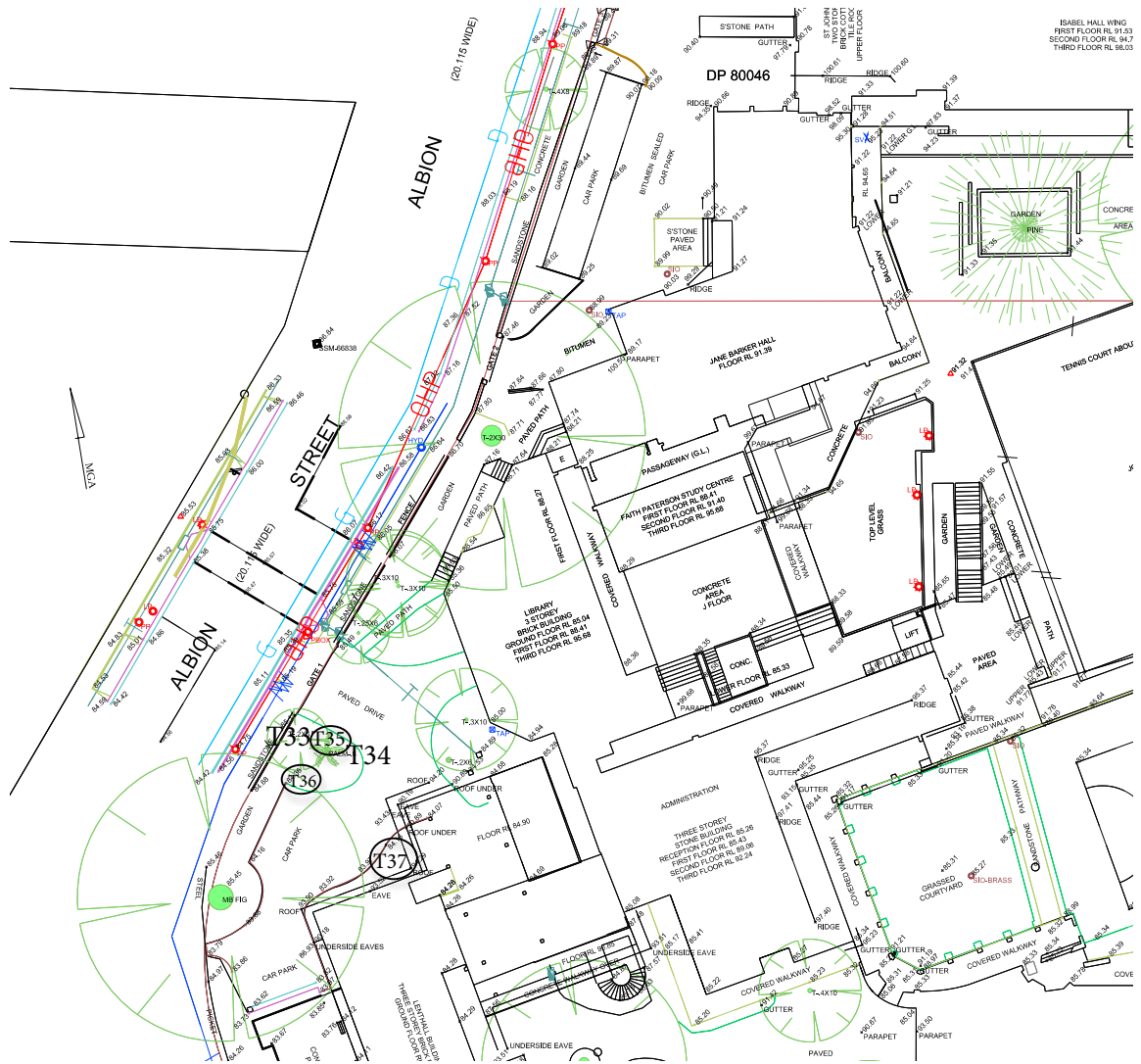


Tree Locations



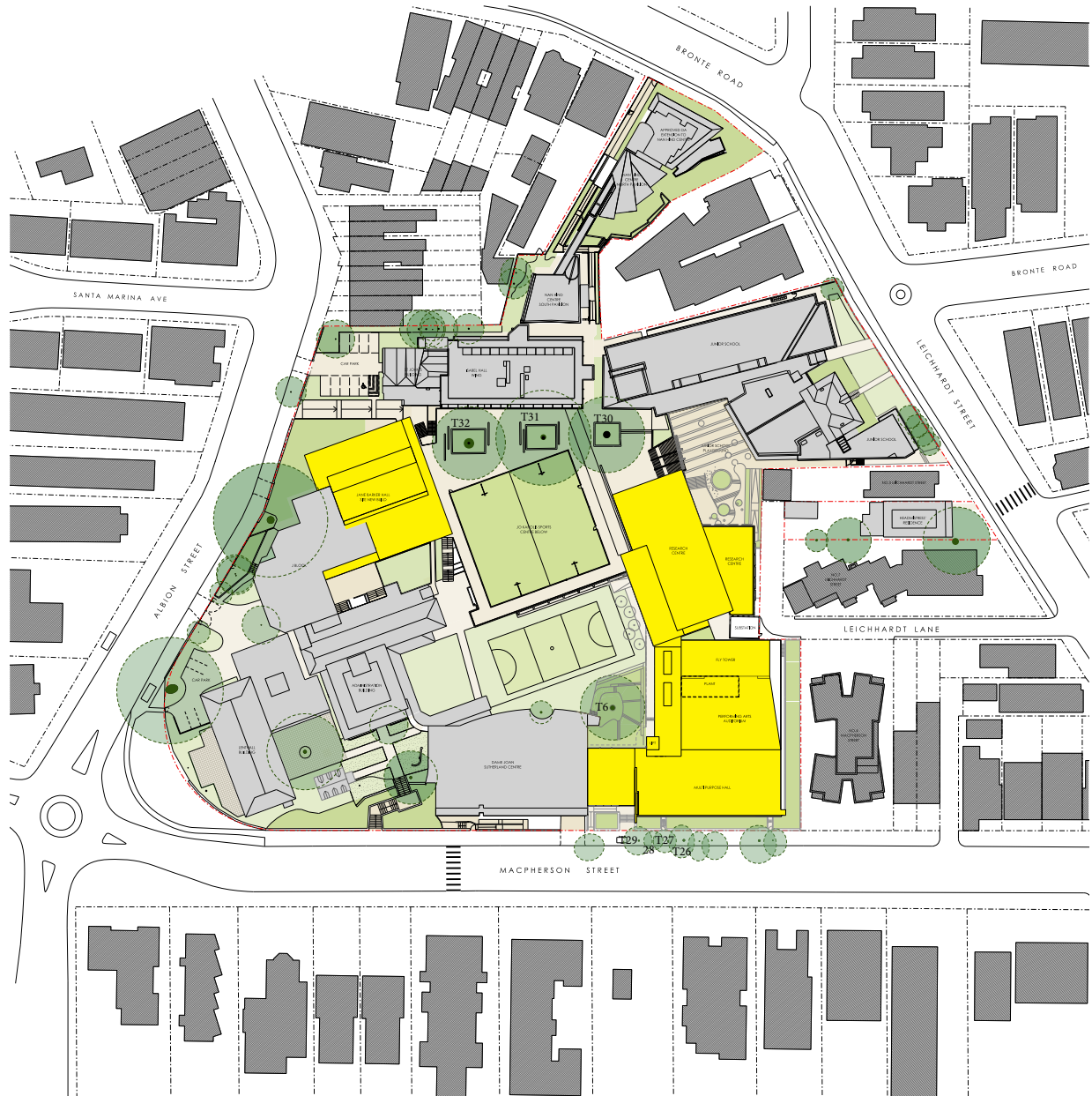
Appendix F cont.

Tree Locations



Appendix G

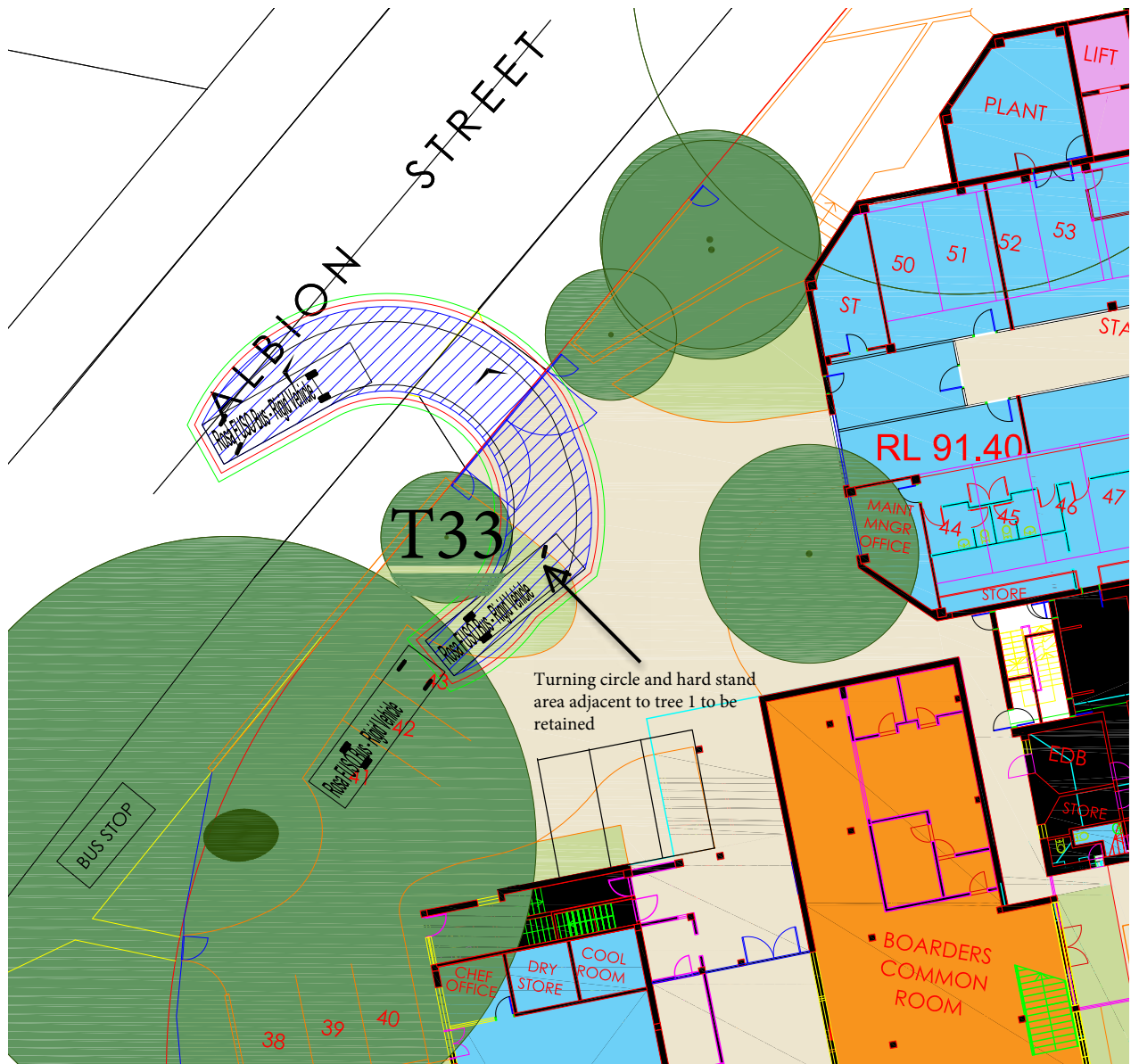
Master Plan/Turning Path Plan-Trees Numbered to be Retained



- LEGEND**
- EXISTING TO BE DEMOLISHED
 - APPROVED FUTURE DEVELOPMENT
 - PROPOSED FUTURE DEVELOPMENT
 - INTERNAL RENOVATION
 - EXISTING TREE
 - EXISTING TREE TO BE REMOVED

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