Arboricultural Impact Assessment

TALC
TREE AND LANDSCAPE CONSULTANTS

Prepared 8th August 2019

Site Location

72 Laycock Street
Bexley North NSW 2207

Client

Order of AHEPA NSW Inc

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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TREE & LANDSCAPE CONSULTANTS

Site Analysis, Arboricultural Assessments

INSTITUTE OF AUSTRALIAN CONSULTING ARBORICULTURISTS
MANAGING URBAN TREES ®

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Bexley North NSW 2207

Our reference: 4821

Arboricultural Impact Assessment:
72 Laycock Street
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1. INTRODUCTION

This report has been prepared by Tree & Landscape Consultants for AHEPA NSW. The site was inspected by the author and the subject trees and their general growing environment evaluated on the 4th June 2019.

The site is subject to a Development Application and this report and any works recommended herein, that require approval from the consenting authority are provided to form part of that development application and its consent conditions. The Tree Locations (Appendix C) and Tree Protection Plan (Appendix D) are to be included into and used in conjunction with the approval for *the site*.

The aims and objectives of this report are to detail and comply with the tree protection requirements specified in AS4970 (2009) *Protection of trees on development sites* to identify and assesses the condition of the subject tree/s; determine the impact of development on the subject tree/s; provide recommendations for retention or removal of the subject tree/s; provide specifications for protection of tree/s to be retained. The information in this report is intended to provided tree management and protection through all stages of development.

2. METHODOLOGY

2.1 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 – Rating System for Tree Significance - IACA (2009) ©

2.2 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.

2.3 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.

2.4 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.

2.5 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.*

2.6 *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

3. TREE ASSESSMENTS

3.1 Table 1- Tree Assessments

Tree No.	Genus & Species Common Name	Age Y = Young M = Mature O = Overmature	Condition G = Good F= Fair P= Poor D = Dead	Pest & Diseases	Branch Bark Included	Canopy Orientation Sy = Symmetrical N,S,E,W = North South East West	Trunk Diameter (1.4m above ground in mm)	Height (m)	Spread (m)	Tree Vigour L = Low G= Good A= Abnormal	Trunk Lean X = Straight or Slightly Leaning A = Acaulescent M = Moderate	SRIV (Age, Vigour, Condition, Index Rating)
1	**Chamaecyparis obtusa** Cypress	M	F	No	No	Sy	300	5	3	G	A	MGVF9
	Comments: Conifer with foliage appearing free of insect predation or disease.											
2	**Chamaecyparis obtusa** Cypress	M	F	No	No	Sy	300	4	3	G	A	MGVF9
	Comments: Conifer with foliage appearing free of insect predation or disease.											
3	**Chamaecyparis obtusa** Cypress	M	F	No	No	Sy	300	6	3	G	A	MGVF9
	Comments: Conifer with foliage appearing free of insect predation or disease.											
4	**Chamaecyparis obtusa** Cypress	M	F	No	No	Sy	300	5	3	G	A	MGVF9
	Comments: Conifer with foliage appearing free of insect predation or disease.											
5	**Callistemon viminalis** Bottlebrush	M	F	No	No	Sy	300	4	3	G	A	MGVF9
	Comments: Smaller tree appearing free of insect predation or disease.											
6	**Callistemon viminalis** Bottlebrush	M	F	No	No	Sy	300	4	3	G	A	MGVF9
	Comments: Smaller tree appearing free of insect predation or disease.											
7	**Callistemon viminalis** Bottlebrush	M	F	No	No	Sy	300	4	3	G	A	MGVF9
	Comments: Smaller tree appearing free of insect predation or disease.											
8	**Callistemon viminalis** Bottlebrush	M	F	No	No	Sy	300	4	3	G	A	MGVF9
	Comments: Smaller tree appearing free of insect predation or disease.											
9	**Callistemon viminalis** Bottlebrush	M	F	No	No	Sy	300	4	3	G	A	MGVF9
	Comments: Smaller tree appearing free of insect predation or disease.											
10	**Callistemon viminalis** Bottlebrush	M	F	No	No	Sy	300	5	3	G	A	MGVF9
	Comments: Bottlebrush appearing structurally sound.											
11	**Callistemon viminalis** Bottlebrush	M	F	No	No	Sy	300	5	3	G	A	MGVF9
	Comments: Bottlebrush appearing structurally sound.											
12	**Callistemon viminalis** Bottlebrush	M	F	No	No	Sy	300	7	3	G	A	MGVF9
	Comments: Dieback of lower order leaders evident.											
13	**Callistemon viminalis** Bottlebrush	M	F	No	No	Sy	250	7	3	G	A	MGVF9
	Comments: Dieback of lower order leaders evident.											
14	**Callistemon viminalis** Bottlebrush	M	F	No	No	Sy	200	7	2	G	A	MGVF9
	Comments: Dieback of lower order leaders evident.											
15	**Callistemon viminalis** Bottlebrush	M	F	No	No	Sy	300	5	1	G	A	MGVF9
	Comments: Dieback of lower order leaders evident.											
16	**Callistemon viminalis** Bottlebrush	M	F	No	No	Sy	300	5	1	G	A	MGVF9
	Comments: Dieback of lower order leaders evident.											
17	**Callistemon viminalis** Bottlebrush	O	P	No	No	Sy	300	5	1	L	A	OLVP0
	Comments: Extensive dieback evident.											
18	**Callistemon viminalis** Bottlebrush	M	F	No	No	Sy	200	5	3	G	A	MGVF9
	Comments: Tree appeared free of insect predation or disease.											
19	**Callistemon viminalis** Bottlebrush	M	F	No	No	Sy	250	5	3	G	A	MGVF9
	Comments: Tree appeared free of insect predation or disease.											
20	**Callistemon viminalis** Bottlebrush	M	F	No	No	Sy	300	4	3	G	A	MGVF9
	Comments: Tree appeared free of insect predation or disease.											
21	**Callistemon viminalis** Bottlebrush	M	F	No	No	Sy	300	5	3	G	A	MGVF9
	Comments: Tree appeared free of insect predation or disease.											
22	**Callistemon viminalis** Bottlebrush	M	F	No	No	Sy	300	5	3	G	A	MGVF9
	Comments: Tree appeared free of insect predation or disease.											
23	**Callistemon viminalis** Bottlebrush	M	F	No	No	Sy	300	5	3	G	A	MGVF9
	Comments: Tree appeared free of insect predation or disease.											
24	**Cupressus sempervirens** Cupressus	M	F	No	No	Sy	400	17	4	G	X	MGVF9
	Comments: Tree appeared free of insect predation or disease.											
25	**Cupressus sempervirens** Cupressus	M	F	No	No	Sy	400	17	4	G	X	MGVF9
	Comments: Tree appeared structurally sound separated from the development site by existing retaining wall											
26	**Cupressus sempervirens** Cupressus	M	F	No	No	Sy	400	17	4	G	X	MGVF9
	Comments: Tree appeared structurally sound separated from the development site by existing retaining wall											
27	**Cupressus sempervirens** Cupressus	M	F	No	No	Sy	400	17	4	G	X	MGVF9
	Comments: Tree appeared structurally sound separated from the development site by existing retaining wall											
28	**Cupressus sempervirens** Cupressus	M	F	No	No	Sy	400	17	4	G	X	MGVF9
	Comments: Tree appeared structurally sound separated from the development site by existing retaining wall											
29	**Cupressus sempervirens** Cupressus	M	F	No	No	Sy	400	17	4	G	X	MGVF9
	Comments: Tree appeared structurally sound separated from the development site by existing retaining wall											

Table 1 -cont.

Tree No.	Genus & Species Common Name	Age Y = Young M = Mature O = Overmature	Condition G = Good F= Fair P= Poor D = Dead	Pest & Diseases	Branch Bark Included	Canopy Orientation Sy = Symmetrical N,S,E,W = North South East West	Trunk Diameter (1.4m above ground in mm)	Height (m)	Spread (m)	Tree Vigour L = Low G= Good A= Abnormal	Trunk Lean X = Straight or Slightly Leaning A = Acaulescent M = Moderate	SRIV (Age, Vigour, Condition, Index Rating)
30	**Syagrus romanzoffiana**	M	F	No	No	Sy	400	12	3	G	X	MGVF9
	Cocos Palm	Comments: Palm appeared free of insect predation or disease.										
31	**Callistemon viminalis**	M	F	No	No	Sy	400	5	3	G	A	MGVF9
	Bottlebrush	Comments: Bottlebrush appearing structurally sound.										
32	**Callistemon viminalis**	M	F	No	No	Sy	400	5	3	G	A	MGVF9
	Bottlebrush	Comments: Bottlebrush appearing structurally sound.										
33	**Callistemon viminalis**	M	F	No	No	Sy	400	6	3	G	A	MGVF9
	Bottlebrush	Comments: Bottlebrush appearing structurally sound.										
34	**Callistemon viminalis**	M	P	No	No	Sy	400	6	3	G	A	MGVP6
	Bottlebrush	Comments: Bottlebrush appearing structurally sound.										
35	**Callistemon viminalis**	M	P	No	No	Sy	400	6	3	G	A	MGVP6
	Bottlebrush	Comments: Bottlebrush appearing structurally sound.										
36	**Callistemon viminalis**	M	F	No	No	Sy	400	6	3	G	A	MGVF9
	Bottlebrush	Comments: Bottlebrush appearing structurally sound.										
37	**Callistemon viminalis**	M	F	No	No	Sy	400	6	3	G	A	MGVF9
	Bottlebrush	Comments: Bottlebrush appearing structurally sound.										
38	**Callistemon viminalis**	M	F	No	No	Sy	400	6	3	G	A	MGVF9
	Bottlebrush	Comments: Bottlebrush appearing structurally sound.										
39	**Callistemon viminalis**	M	F	No	No	Sy	150	3	3	G	A	MGVF9
	Bottlebrush	Comments: Smaller insignificant specimen.										

Discussion

3.2 AS4970 (2009) section 3 requires a radial Tree Protection Zone (TPZ) setback of 12 x DBH from center of trunk (COT) but allows for a 10% reduction of area equal to a reduction of 30% of radius on one side only as per AS4970 (2009) section 3, 3.3.3 which requires the Project Arborist to demonstrate that where a retained tree is subject to a major encroachment (>10% of area of TPZ) it can be protected to remain viable.

3.3 Setback for Tree Protection Zones

A	B	C	D	E	F	G	H
Tree No.	**Trunk Diameter** (1.4m above root buttress in mm)	**Trunk Diameter** (above root buttress)	**Tree Vigour** L = Low G= Good A= Abnormal	**Age of Tree** Y = Young M = Mature O = Over-Mature (Senescent)	**Calculated Structural Root Zone (SRZ)** (radius in meters- Calculated Structural Root Zone (SRZ) in metres being Radius=(Dx50)0.42 x0.64)	**Distance of Tree Protection Zone (TPZ)** (radius in meters Australian Standard AS 4970-2009 "Protection of trees on development sites" TPZ=DBH x 12)	**Recommended Distance of Tree Protection Fence/Zone** (radius in meters- (See explanatory notes below & report recommendations))
1	300	320	G	M	2.1	3.6	2(1,7)
2	300	320	G	M	2.1	3.6	2(1,7)
3	300	320	G	M	2.1	3.6	2(1,7)
4	300	320	G	M	2.1	3.6	2(1,7)
5	300	320	G	M	2.1	3.6	3.24(1)
6	300	320	G	M	2.1	3.6	3.24(1)
7	300	320	G	M	2.1	3.6	3.24(1)
8	300	320	G	M	2.1	3.6	3.24(1)
9	300	320	G	M	2.1	3.6	3.24(1)
24	400	420	G	M	2.3	4.8	3.2(1,7)
25	400	420	G	M	2.3	4.8	3.2(1,7)
26	400	420	G	M	2.3	4.8	3.2(1,7)
27	400	420	G	M	2.3	4.8	3.2(1,7)
28	400	420	G	M	2.3	4.8	3.2(1,7)
29	400	420	G	M	2.3	4.8	3.2(1,7)
30	400	420	G	M	2.3	4.8	4.32(1)
31	400	420	G	M	2.3	4.8	4.32(1)
32	400	420	G	M	2.3	4.8	4.32(1)
33	400	420	G	M	2.3	4.8	4.32(1)
36	400	420	G	M	2.3	4.8	2.6(1,7,8)
37	400	420	G	M	2.3	4.8	2.6(1,7,8)
38	400	420	G	M	2.3	4.8	2.6(1,7,8)

Descriptors for modified setbacks in columns above.

1 Special conditions apply to protect the roots of trees generally, see Appendix D.
2 Additional protective fencing information is detailed in Appendices D.
3 Acceptable due to the good relative tolerance of the species to development impacts.
4 Range of setbacks for the trees at each end of a linear stand, see Appendix D.
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 D 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 works.
11 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 good 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 20 mm or more.

15 Acceptable as a specimen of palm taxa tolerant of encroachment.
16 Acceptable as excavation on down slope or across slope side of tree.
17 Acceptable as encroachment into growing area below ground minor, with one corner of building or excavation works extending to within the radius of the dripline.
18 Acceptable as encroachment by pier, including screw piles, with minimal disturbance.
19 Acceptable as encroachment above grade without excavation or sub-base compaction.
20 Acceptable as located within 0.5 m from edge of dripline.
21 Acceptable as encroachment with gap graded fill that can accommodate gaseous exchange between roots/soil and the atmosphere and ongoing root growth.
22 Minimum TPZ setback 2 m, AS4970 (2009) section 3, 3.2.
23 Maximum TPZ setback 15 m, AS4970 (2009) section 3, 3.2.
24 Tree is a palm, other monocot, cycad or tree fern TPZ is to be 1 m outside crown projection AS4970 (2009) section 3, 3.2.
25 Minimum Structural Root Zone (SRZ) for trees less than 0.15 m diameter is 1.5 m, AS4970 (2009) section 3, 3.5.
26 Acceptable due to compensation of TPZ encroachment with contiguous soil volume in other directions AS4970 (2009) section 3, 3.3.3.
27 Acceptable as encroachment for bulk earthworks by shoring with piles reducing over excavation e.g. benching or batters.

3.4 Discussion

Of the 39 trees assessed numbers 17,34, & 35 are poor in condition with the remaining trees being mostly fair in condition exhibiting good vigour. The most substantial size trees are numbered 24,25,26,27,28,29 & 30 located within the neighbouring land to the south. These trees are separated by existing retaining walls which would have contributed to the deflection of roots for trees 24-29. Tree 30 is a palm with minimal root spread as it is supported by a root ball of adventitious roots. The remaining trees are all generally of smaller dimensions.

Trees numbered 1, 2, 3, 4, 5, 6, 7, 8, 9, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 36, 37 & 38 are to be retained and trees numbered 10,11,12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23 ,34,35 & 39 are to be removed to accommodate the proposed changes to the land.

Trees numbered 1, 2, 3, 4, 5, 6, 7, 8, 9, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 36, 37 & 38 are to be retained subject to the following protection measures being introduced.

*3.5 Trunk Protection **(Trees- 31,32,33 ,36,37 & 38)***

Extract of AS4970-2009 is as follows:

> ***(Extract from AS4970-2009- 4.5.2 Trunk and branch protection)***
> *Where necessary, install protection to the trunk and branches of the trees. The materials and positioning of protection are to be specified by the project arborist. A minimum height of 2 m is recommended. Do not attach temporary powerlines, stays, guys and the like to the tree. Do not drive nails into the trunks or branches.*

Response: *Trunk protection will need to be established as per the AS4970-2009 for these trees. See also appendix D-Tree Protection Plan.*

*3.6 Tree Protection Zone Fencing **(Trees- 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 24, 25, 26, 27, 28, 29 & 30)***

> ***Extract from AS4970-2009 Section 4.3 PROTECTIVE FENCING***
> *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 should be secured to restrict access.AS 4687 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.*

Response: *Tree Protection Zone (TPZ) fencing of similar fencing to be erected within the*

development site boundaries to provide a physical barrier between the trees and the development works.

3.7 Ground Protection within TPZs- ***(Trees- 1, 2, 3, 4, 5, 6, 7, 8, 9, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 36, 37 & 38)***

Extract of AS4970-2009 is as follows:

(Extract from AS4970-2009- 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.

Response: *Any site movement required within prescribed TPZs is to be subject to ground protection as per AS4970. See also appendix D-Tree Protection Plan*

3.8 Scaffolding within TPZs- ***(Trees- 1,2,3,4, 24,25,26,27,28,29 & 30)***

Extract of AS4970-2009 is as follows:

(Extract from AS4970-2009- 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 s unavoidable it must be specified by the project arborist in accordance with AS 4373.

Response: *Any scaffolding required within prescribed TPZs is to be subject to protection as per AS4970 See also appendix D-Tree Protection Plan.*

3.9 Underground services within TPZs- ***(Trees- 1, 2, 3, 4, 5, 6, 7, 8, 9, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 36, 37 & 38)***

Extract of AS4970-2009 is as follows:

(Extract from AS4970-2009- 4.5.5 Installing Underground services).
All services should be routed outside the TPZ. 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 600 mm 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.

Response: *Any services required within prescribed TPZs should be installed as per AS4970 section 4.5.5 . through use of underground directional drilling.*

3.10 Root Protection - ***(Trees- 1,2,3,4, ,24,25,26,27,28,29 & 30)***

Extract of AS4970-2009 is as follows:

4.5.4 Root protection during works within the TPZ
Some approved works within the TPZ, such as regrading, installation of piers or landscaping may have the potential to damage roots. If the grade is to be raised the material should be coarser or more porous than the underlying material. Depth and compaction should be minimized. Manual excavation should be carried out under the supervision of the project arborist to identify roots critical to tree stability. Relocation or redesign of works may be required. Where the project arborist identifies roots to be pruned within or at the outer edge of

that, they should be pruned with a final cut to undamaged wood. Pruning cuts should be made with sharp tools such as secateurs, pruners, handsaws or chainsaws. Pruning wounds should not be treated with dressings or paints. It is not acceptable for roots within the TPZto be 'pruned' with machinery such as backhoes or excavators. Where roots within the TPZ are exposed by excavation, temporary root protection should be installed to prevent them drying out. This may include jute mesh or hessian sheeting as multiple layers over exposed roots and excavated soil profile, extending to the full depth of the root zone. Root protection sheeting should be pegged in place and kept moist during the period that the root zone is exposed. Other excavation works in proximity to trees, including landscape works such as paving, irrigation and planting can adversely affect root systems. Seek advice from the project arborist.

Response: *All initial excavation within prescribed TPZ should be undertaken utilising hand tools to depths of 700mm - below these depths mechanical means could be utilised. Any roots encountered should be clean cut with final cuts to undamaged woody tissue.*

4. RECOMMENDATIONS

a. That trees 10,11,12,13,14,15,16,17,18,19,20,21, 22, 34,35 & 39 be removed and replaced with replacement plantings within the property boundary as part of final landscape works.

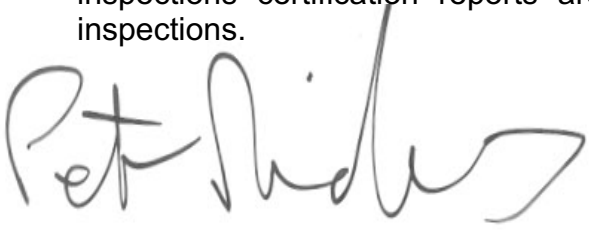
b. That trees 1, 2, 3, 4, 5, 6, 7, 8, 9, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 36, 37 & 38 be retained.

c. That protection for trees 1, 2, 3, 4, 5, 6, 7, 8, 9, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 36, 37 & 38 be in accordance with sections 3.5, 3.6, 3.7, 3.8, 3.9 & 3.10 of this report.

d. That an inspection schedule be introduced as part of construction works at key points as follows:

- Initial certification of the establishment of Tree Protection measures prior to the start of any site works adjacent to trees.
- Final inspection of the trees when all site works are completed.
- That bi-monthly inspections be undertaken and certification reports provided for the duration of site works indicating compliance with report recommendations and to outline any remedial requirements.

e. Following the above inspections or as otherwise directed following site inspections certification reports are to be provided within 2 weeks of the inspections.



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
Version 4, 2010

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.
(Y) Young	**YGVG - 9** **Index Value 9** Retention potential - Long Term. Likely to provide minimal contribution to local amenity if height <5 m. High potential for future growth and adaptability. Retain, move or replace.	**YGVF - 8** **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 <5 m. Medium-high potential for future growth and adaptability. Retain, move or replace.	**YGVP - 5** **Index Value 5** Retention potential - Short Term. Potential for longer with improved growing conditions. Likely to provide minimal contribution to local amenity if height <5 m. Low-medium potential for future growth and adaptability. Retain, move or replace.	**YLVG - 4** **Index Value 4** Retention potential - Short Term. Potential for longer with improved growing conditions. Likely to provide minimal contribution to local amenity if height <5 m. Medium potential for future growth and adaptability. Retain, move or replace.	**YLVF - 3** **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.	**YLVP - 1** **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 <5 m. Low potential for future growth and adaptability.
(M) Mature	**MGVG - 10** **Index Value 10** Retention potential - Medium - Long Term.	**MGVF - 9** **Index Value 9** Retention potential - Medium Term. Potential for longer with improved growing conditions.	**MGVP - 6** **Index Value 6** Retention potential - Short Term. Potential for longer with improved growing conditions.	**MLVG - 5** **Index Value 5** Retention potential - Short Term. Potential for longer with improved growing conditions.	**MLVF - 4** **Index Value 4** Retention potential - Short Term. Potential for longer with improved growing conditions.	**MLVP - 2** **Index Value 2** Retention potential - Likely to be removed immediately or retained for Short Term.
(O) Over-mature	**OGVG - 6** **Index Value 6** Retention potential - Medium - Long Term.	**OGVF - 5** **Index Value 5** Retention potential - Medium Term.	**OGVP - 4** **Index Value 4** Retention potential - Short Term.	**OLVG - 3** **Index Value 3** Retention potential - Short Term. Potential for longer with improved growing conditions.	**OLVF - 2** **Index Value 2** Retention potential - Short Term.	**OLVP - 0** **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*.

Normal 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

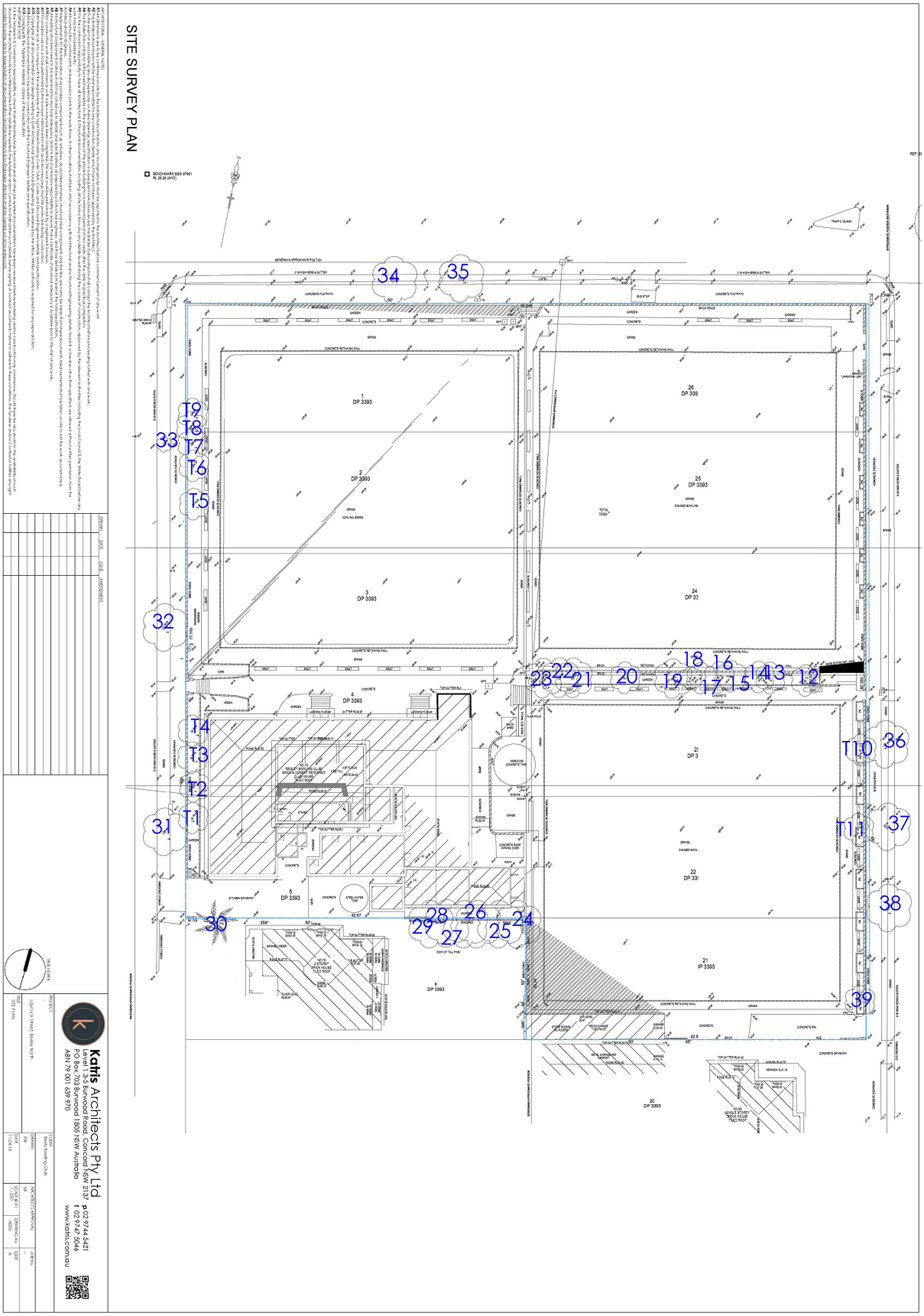
Age of Trees Most trees have a stable biomass for the major proportion of their life. The estimation of the age of a tree is based on the knowledge of the expected lifespan of the taxa in situ divided into three distinct stages of measurable biomass, when the exact age of the tree from its date of cultivation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

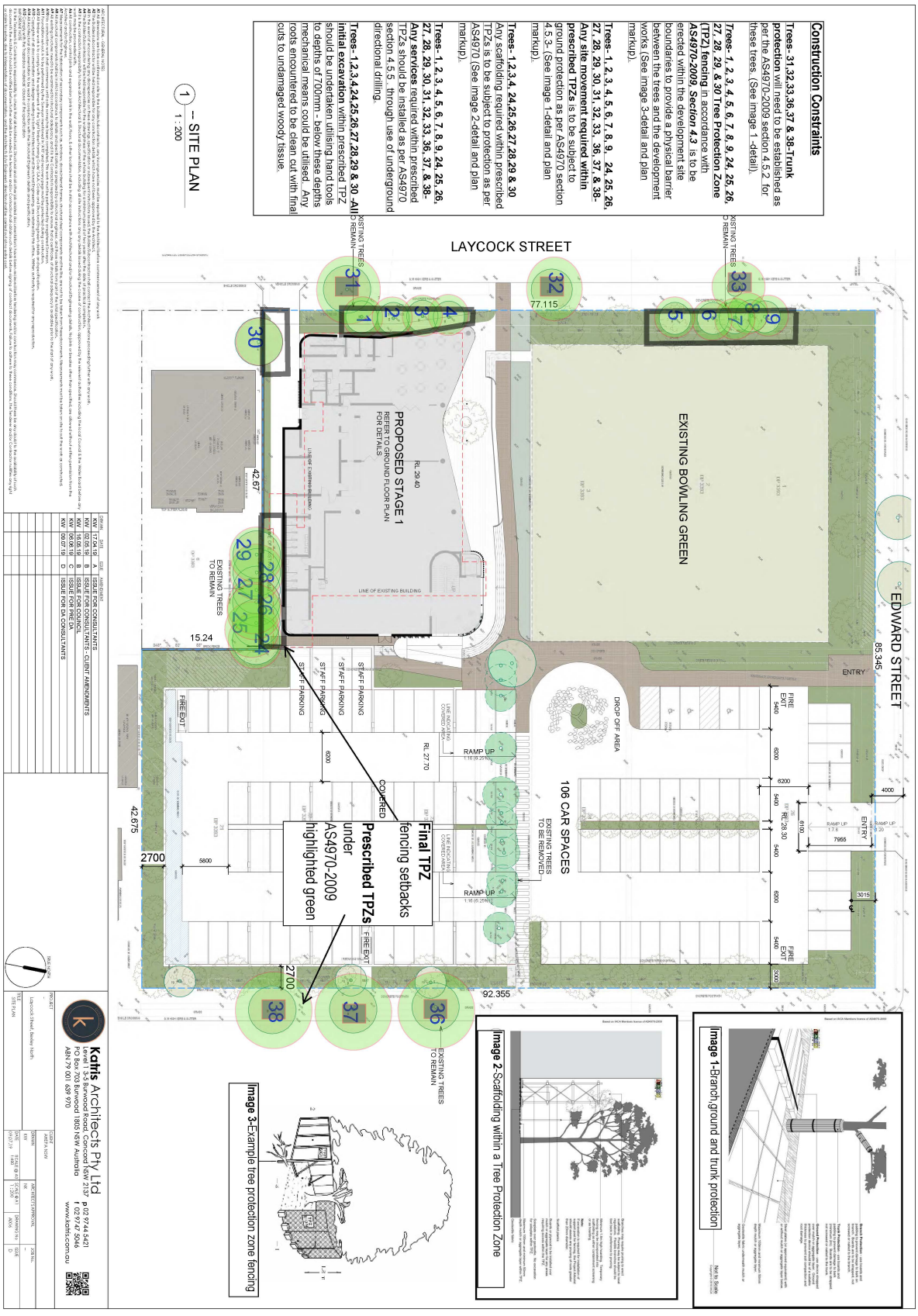
Appendix C

Survey Plan /Tree Locations



Appendix D

Tree Protection Plan



Appendix E

Extract from Australian Standard AS4970 2009 Protection of trees on development sites

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

3.1 Tree protection zone (TPZ)

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

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

3.2 Determining the TPZ

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

TPZ = DBH x 12

where

DBH = trunk diameter measured at 1.4 m above ground

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

Appendix F

Extract from Australian Standard AS4970 2009 Protection of trees on development sites

Section 3, Determining the protection zones of the selected trees

3.3.5 Structural root zone (SRZ)

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

Determining the SRZ

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

SRZ radius expressed by the curve is calculated by the following formula,

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

where

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

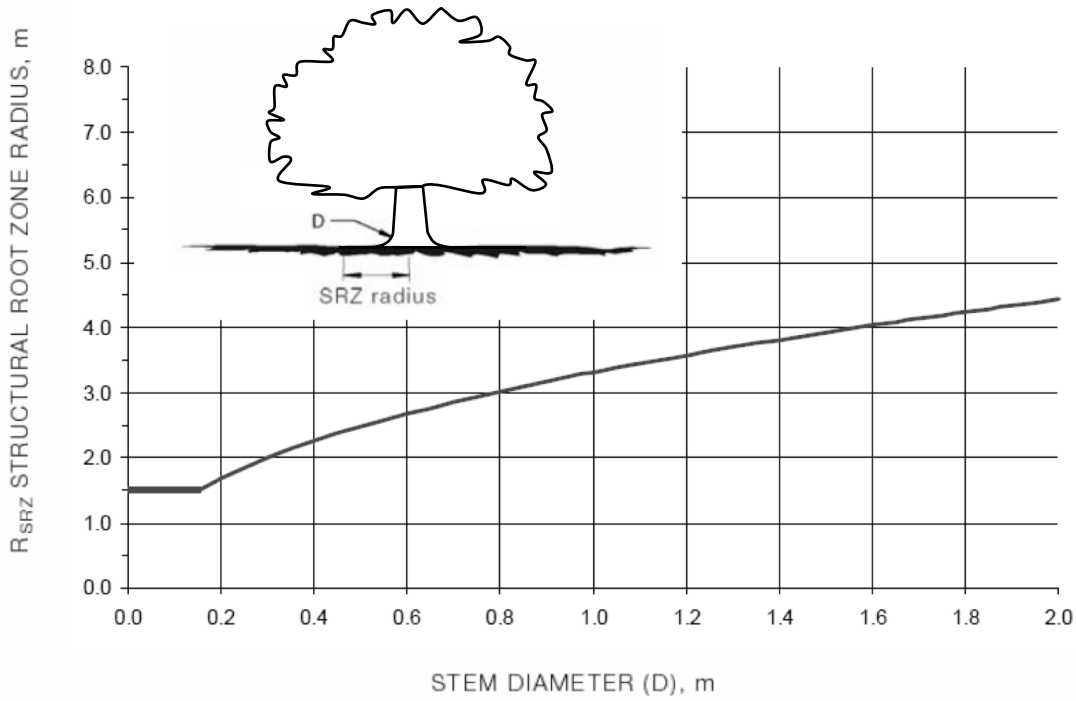


FIGURE 1 STRUCTURAL ROOT ZONE CALCULATION

(AS 4970 – 2009, Amendment No. 1 March 2010)

NOTES:

1 R_{SRZ} is the calculated structural root zone radius (SRZ radius).

2 D is the stem diameter measured immediately above root buttress.

3 The R_{SRZ} for trees less than 0.15 m diameter is 1.5 m.

4 The R_{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.

Appendix G
References

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