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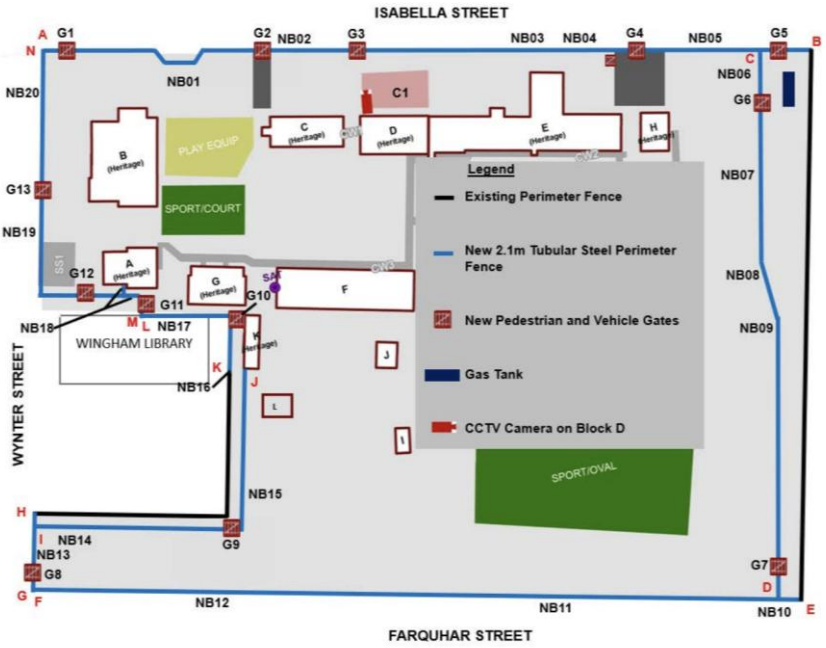
24th February 2025

ARBORIST REPORT

Arboricultural Impact Assessment (AIA)



Prepared for: Wingham Brush Public School
4 Isabella St, Wingham

Prepared by: Adam Beaman (dip. arb.)
Consulting Arborist for Valley Tree Services

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Client:	School Infrastructure NSW
Project:	Proposed new perimeter security fencing
Site address:	Wingham Brush Public School 4 Isabella St, Wingham NSW 2429
Site contact:	Blake Thomas | Cadet Support Officer, School Infrastructure NSW | 0492 429 449
Related documents:	*Overview of Works: Security Fence Installation and Repair (Scope Reference: 4575-2409-F1),* produced by School Infrastructure NSW, undated
Project arborist:	Adam Beaman (dip. arb. AQF Level 5 Consulting Arborist)

REVISION REGISTER				
Version	**Author**	**Employer**	**Date**	**Changes**
1	Adam Beaman	Valley Tree Services	24/02/25	-

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SUMMARY

Valley Tree Services were engaged by Blake Thomas of School Infrastructure NSW to produce an Arboricultural Impact Assessment report for the proposed new perimeter security fencing at Wingham Brush Public School at 4 Isabella St, Wingham.

A site inspection was undertaken on 28th of January 2025 and all site trees with potential to be impacted by the proposed development were assessed (Trees 1-9 and Groups A-E).

The proposed development has the potential to impact nine trees and five groups of trees (Trees 1-9 and Groups A-E).

Trees 1-6 and Groups A-E can likely be retained, depending on exact design and position of the new fence alignment.

Trees 7-9 will likely require removal to facilitate the fence construction.

Area D will have the fence installed back from the tree line and only minor pruning required.

It is likely that Trees 1, 2 & 4 and Groups A, D & E will require some minor to provide clearances from the security fencing upon completion, and it is likely that Trees 5 & 6 will require some major pruning.

All tree removals and pruning must be undertaken before any construction activities begin.

Once the design is finalised, it is recommended that a Tree Protection Plan is produced by the Project Arborist in accordance with the Australian Standard *AS4970-2009 protection of trees on development sites*.

Tree photos are provided in Appendix A.

Tree assessment details are provided in Appendix B.

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1 INTRODUCTION

1.1 SCOPE

- Valley Tree Services were engaged by Blake Thomas of School Infrastructure NSW to produce an Arboricultural Impact Assessment report for the proposed new perimeter security fencing at Wingham Brush Public School at 4 Isabella St, Wingham.
- Project Arborist Adam Beaman undertook a site inspection on 28th of January 2025 and all site trees with potential to be impacted by the proposed development were assessed (Trees 1-9 and Groups A-E).
- This report is to provide findings from the tree assessment, make recommendations for tree removal and retention, and provide specifications for the protection of retained trees before, during, and beyond the development of the site.

1.2 METHODOLOGY

The following methods were followed during the site inspection and individual tree assessments. For further details on the methodology, refer to Appendix E.

- *VTA – Visual Tree Assessment*[1] (developed by Matteck and Breloer).
  This is a basic, ground-based inspection of the tree canopy, trunk, root system and surroundings to estimate its overall health and identify defects and potential hazards.
- *TRAQ – Tree Risk Assessment Qualification*[2] (developed by the ISA).
  This is an industry-recognised method of risk assessment to determine the risk of specific tree or tree part causing personal harm, property damage, traffic obstruction, etc.
- *STARS – Significance of a Tree Assessment Rating System*[3] (developed by IACA).
  This is method of determining the retention value of a tree.

1.3 ASSUMPTIONS AND LIMITATIONS

- Exact analysis of soil composition and profile is not available, so the expected depth and direction of tree root systems will be estimated onsite based on observable site features, most likely soil type given the location and typical root morphology of subject tree species.
- In cases where more than 150mm excavation is required, the project arborist will first be consulted to implement any tree protection measures necessary.

[1] Mattheck, Bethge & Weber. 2015. *The Body Language of Trees: Encyclopedia of Visual Tree Assessment*.
[2] International Society of Arboriculture. 2017. *Tree Risk Assessment Manual*.
[3] IACA. 2010. *IACA Significance of a Tree, Assessment Rating System (STARS)*.

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1.4 PROJECT DESCRIPTION

The proposed development involves the construction of a new perimeter security fence at the site, with dimensions and clearances specified by the Department.

The proposed development has the potential to impact nine trees and five groups of trees (Trees 1-9 and Groups A-E). See Sections 2.2 & 3.3 for further information.

1.5 DISCLAIMER AND COPYRIGHT RELEASE

Care has been taken to obtain all information from reliable sources. The consultant can neither guarantee – nor be responsible for – the accuracy of information provided by others. Any sketches, diagrams, graphs, and photographs in this report, are not necessarily to scale and should not be construed as accurate measurements unless noted as such.

The consultant shall not be required to give testimony, or to attend court by reason of this report unless subsequent contractual arrangements are made including payment of an additional fee for such services. Valley Tree Services will not be liable for any damages that result from the loss of, alteration of, or failure to adhere to any part of this report by the client or a third party.

Neither all nor any part of this report, nor copies thereof, shall be conveyed by anyone, including the client, to the public through advertising, public relations, news, sales or other media, without the prior expressed written or verbal consent of Valley Tree Services.

The findings herein are valid for a maximum period of 24 months from the inspection date, due to the dynamic nature of trees and their surrounding environment. If the subject tree/s are affected by any significant change, such as a severe weather event, nearby development, removal of adjacent vegetation or sudden decline, a follow-up inspection will be required to identify any new issues.

Trees are inherently hazardous and will inevitably fail at some point in time. Much of the risk associated with this hazard can be mitigated by risk assessment and the implementation of control measures. However, structural weakness and tree failures are not always predictable, nor is the exact impact of a severe weather event. There is no such thing as a completely ‘safe’ tree.

Tree failures are more likely to occur during wet, windy weather; therefore, it is generally recommended that people stay under cover (or away from target areas) once the wind-speed exceeds 50km/hr. The *Beaufort Wind Scale* – published by the Bureau of Meteorology – describes how to predict wind-speed, based on the movements of nearby trees and surroundings. A copy of this tool has been included in the Appendix G.

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2 SITE DETAILS

The site is Wingham Brush Public School, located at 4 Isabella St, Wingham.

Nine trees and five groups of trees (Trees 1-9 and Groups A-E) were assessed for this report, with locations shown in Figure 1.

2.1 SITE MAP

Figure 1 – The site (outlined approximately in red), with approximate locations of Trees 1-9 and Groups A-E numbered. North at top. Taken from Google Maps.

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2.2 THE PROPOSED DEVELOPMENT

The proposed development involves the construction of a new perimeter security fence, which will mostly follow the alignment of the existing boundary fence.

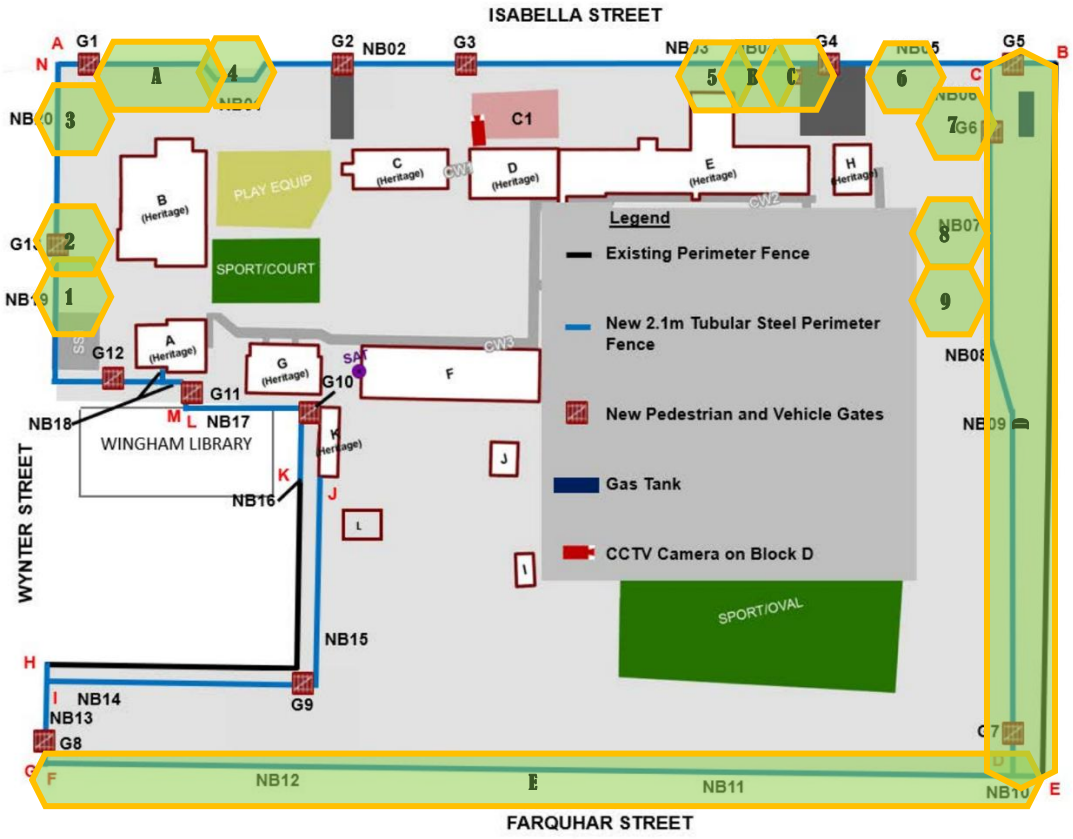

Figure 2 – An excerpt from *Overview of Works: Security Fence Installation and Repair (Scope Reference: 4575-2409-F1)*, produced by School Infrastructure NSW (undated), with approximate locations of Trees 1-9 and Groups A-E labelled.

2.3 ENVIRONMENTAL PROTECTIONS

Prescribed Vegetation

Trees 1-9 and trees in Groups B-E are protected under the *MidCoast Council Vegetation Management Policy*[4], in that they are (a) taller than 5m in heights, or (b) have a trunk circumference greater than 600mm at 1m high greater.

[4] Mid-Coast Council. 2024. *Vegetation Management Policy*.

Heritage

The site is listed as Heritage Item # I273 under the *Greater Taree Local Environmental Plan 2010*[5].

2.4 LEGISLATION AND STANDARDS

The following legislation and standards have relevance to the site and the proposed development:

- *Greater Taree Development Control Plan 2010*[6]
- *Greater Taree Local Environmental Plan 2010*[5]
- *State Environmental Planning Policy (Vegetation in Non-Rural Areas) 2017*[7]
- *State Environmental Planning Policy (Transport and Infrastructure) 2021*[8]
- Australian Standard *AS4373-2007 Pruning of amenity trees*[9]
- Australian Standard *AS4970-2009 Protection of trees on development sites*[10]

2.5 PROPERTY DETAILS

Consent Authority: MidCoast Council
Zoning: R1 (General Residential)
Lot/DP: 4/-/DP820546 & 1/20/DP759099

The site is zoned R1, meaning it is subject to the *State Environmental Planning Policy (Vegetation in Non-Rural Areas) 2017*[8]. As such, the Consent Authority for their management is MidCoast Council.

[5] NSW Legislation. 2025. *Greater Taree Local Environmental Plan 2010.*
[6] Mid-Coast Council. 2010. *Greater Taree Development Control Plan 2010.*
[7] NSW Legislation. 2025. *State Environmental Planning Policy (Vegetation in Non-Rural Areas) 2017.*
[8] NSW Legislation. 2025. *State Environmental Planning Policy (Transport and Infrastructure) 2021.*
[9] Standards Australia. 2007. *AS4373-2007 Pruning of amenity trees.*
[10] Standards Australia. 2009. *AS4970-2009 Protection of trees on development sites.*

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3 DISCUSSION AND OBSERVATIONS

3.1 DETERMINING TREE RETENTION VALUES

There are many industry-recognised methods of determining tree retention values, significance or monetary values, including:

- *SULE – Safe Useful Life Expectancy* (developed by British arborist Jeremy Barrell in 1993)
- *Tree AZ* – Also developed by Jeremy Barrell in 2000
- *SRIV* – Sustainable Retention Value Index (developed by IACA)
- *STARS* – Significance of a Tree Assessment Rating System (developed by IACA)
- *Burnley Method of Tree Valuation* (developed in Australia)
- *Thyer Tree Valuation Method* (developed in Australia)
- *City of Sydney Tree Valuation* (developed in Australia)
- *Tree Valuation Guide* (developed by the ISA)

In this case, the *STARS*[3] method was followed. See Appendix E for more details.

3.2 TPZ DATA

The following table records data used to calculate incursions and determine required tree protection measures. Measurements for DBH and DRF were only estimated by eye, and can be re-calculated more precisely, if necessary, for any trees that are retained.

Tree No.	DBH / DRF (m)	TPZ radius (m)	SRZ radius (m)	Impacts / Considerations
1	0.3 / 0.35	3.6	2.1	• Tree can likely be retained without significant impact, with appropriate tree protection • Excavations within TPZ require arborist supervision, using hydro-excavation to minimize damage to structural roots • Tree may require some minor pruning to provide clearances
2	0.45 / 0.35	5.4	2.1	• Tree can likely be retained without significant impact, with appropriate tree protection • Excavations within TPZ require arborist supervision, using hydro-excavation to minimize damage to structural roots • Tree may require some minor pruning to provide clearances
3	0.25 / 0.3	3.0	2.0	• Tree can likely be retained without significant impact, with appropriate tree protection • Excavations within TPZ require arborist supervision, using hydro-excavation to minimize damage to structural roots

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Tree No.	DBH / DRF (m)	TPZ radius (m)	SRZ radius (m)	Impacts / Considerations
A	-	3.0	2.5	• Trees can likely be retained without significant impact, with appropriate tree protection • Excavations within TPZ require arborist supervision, using hydro-excavation to minimize damage to structural roots • Trees may require pruning to provide clearances
4	0.4 / 0.5	4.8	2.5	• Tree can likely be retained without significant impact, with appropriate tree protection • Excavations within TPZ require arborist supervision, using hydro-excavation to minimize damage to structural roots • Tree may require some minor pruning to provide clearances
5	1.3 / 1.25	15.0	3.6	• Tree can likely be retained without significant impact, with appropriate tree protection • Excavations within TPZ require arborist supervision, using hydro-excavation to minimize damage to structural roots • Tree will require some major pruning to provide clearances
B	-	3.0	2.0	• Trees can likely be retained without significant impact, with appropriate tree protection • Excavations within TPZ require arborist supervision, using hydro-excavation to minimize damage to structural roots
C	-	4.0	2.5	• Trees can likely be retained without significant impact, with appropriate tree protection • Excavations within TPZ require arborist supervision, using hydro-excavation to minimize damage to structural roots
6	1.2 / 1.2	14.4	3.6	• Tree can likely be retained without significant impact, with appropriate tree protection • Excavations within TPZ require arborist supervision, using hydro-excavation to minimize damage to structural roots • Tree will require some major pruning to provide clearances
D	-	3.0	2.0	• Group of juvenile and semi-mature trees along western boundary • Excavations within TPZ require arborist supervision, using hydro-excavation to minimize damage to structural roots • Trees may require pruning to provide clearances
7	0.25 / 0.25	3.0	1.9	• Tree stands close to proposed alignment, will require removal to facilitate fence construction
8	0.35 / 0.4	4.2	2.3	• Tree stands close to proposed alignment, will require removal to facilitate fence construction
9	0.75 / 0.8	9.0	3.0	• Tree stands close to proposed alignment, will require removal to facilitate fence construction
E	-	6.0	3.0	• Group of mature trees outside southern boundary (Council-owned street trees on Farquar Street), can likely be retained without significant impact, with appropriate tree protection • Excavations within TPZ require arborist supervision, using hydro-excavation to minimize damage to structural roots • Trees may require pruning to provide clearances

3.3 ARBORIST CONSULTATION

It is important that the Project Arborist is consulted prior to the commencement of works in proximity to trees which are to be retained, to assess any likely impacts to any adjacent trees, and to implement appropriate tree protection measures. Recommended tree protection measures should remain in place for the duration of the project.

Once the design is finalised, it is recommended that a Tree Protection Plan is produced by the Project Arborist in accordance with *AS4970-2009*.

Refer to Appendix F for further details and requirements pursuant to *AS4970-2009*.

3.4 TREE REMOVALS

Trees 7-9 will require removal to facilitate the fence construction.

All tree removals must be undertaken before any construction activities begin.

3.5 TREE PRUNING – ROOTS AND BRANCHES

It is likely that Trees 1, 2 & 4 and Groups A, D & E will require some minor to provide clearances from the security fencing upon completion, and it is likely that Trees 5 & 6 will require some major pruning.

AS 4373-2007 Pruning of amenity trees[7] provides advice for branch pruning, as well as root pruning. Pruning activities must comply with Section 5 of *AS4373*. All tree pruning must be carried out in such a way that improves the aesthetic appearance of the trees and all cuts should be made at suitable branch collars.

In regard to the root pruning of the subject trees, Section 9 of *AS4373* provides the following information.

"*Roots are responsible for the uptake of nutrients and water and for anchoring and supporting the tree in the ground. The pruning of roots may place the tree under stress, allow entry of pathogens, including root-rotting fungi and may destabilize the tree. Specialist advice from a person with a minimum AQF Level 4 in arboriculture should be sought before any root pruning occurs. Where possible, the root to be pruned should be located and exposed using minimally destructive techniques such as hand-digging, compressed air or water-jetting, or non-destructive techniques such as ground penetrating radar. All cuts shall be clean cuts made with sharp tools such as secateurs, pruners, handsaws, chainsaws or specialized root pruning equipment. The effects of root pruning are not always predictable*."[7]

The Project Arborist should be consulted prior to any root pruning.

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3.6 MONITORING FUTURE TREE HEALTH AND RISK

Once the project is complete, any retained trees will need to be managed more proactively for the 2 years following practical completion. Upon practical completion, it is recommended that the Project Arborist undertakes a Tree Risk Assessment and provides pruning recommendations for the trees to be retained.

Furthermore, any health impacts sustained by retained trees adjacent to the new constructions should be observable within 6 months of practical completion, at which point a follow-up tree assessment by the Project Arborist is advised. In extreme cases, it can take several years for the full extent of health impacts to become apparent, so tree monitoring assessments should be carried out every 6 months for a minimum of 2 years after practical completion.

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4 FINDINGS AND CONCLUSIONS

- The proposed development has the potential to impact nine trees and five groups of trees (Trees 1-9 and Groups A-E).
- Trees 1-6 and Groups A-E can likely be retained, depending on exact design and position of the new fence alignment.
- Trees 7-9 will likely require removal to facilitate the fence construction.
- It is likely that multiple trees from Group D will need minor pruning for fence installation.
- It is likely that Trees 1, 2 & 4 and Groups A, D & E will require some minor to provide clearances from the security fencing upon completion, and it is likely that Trees 5 & 6 will require some major pruning.
- All tree removals and pruning must be undertaken before any construction activities begin.
- It is recommended that a Tree Protection Plan is produced by the Project Arborist in accordance with the Australian Standard *AS4970-2009 protection of trees on development sites*[8].
- It is recommended that tree monitoring assessments are carried out every 6 months for a minimum of 2 years after practical completion.

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5 REFERENCES

1. Mattheck, Bethge & Weber. 2015. *The Body Language of Trees: Encyclopedia of Visual Tree Assessment*.
Karlsruhe Institute of Technology. Karlsruhe, Germany. 1st edition.

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International Society of Arboriculture. Champaign, Illinois, USA. 2nd edition.

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

4. Mid-Coast Council. 2024. *Vegetation Management Policy.*
Accessed at https://www.midcoast.nsw.gov.au/Your-Council/About-MidCoast-Council/Plans-strategies-and-policies/Policies-Library/Vegetation-Management-Policy
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Accessed at https://legislation.nsw.gov.au/view/html/inforce/current/epi-2017-0454
Accessed on 24 February 2025.

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Accessed at https://legislation.nsw.gov.au/view/html/inforce/current/epi-2021-0732
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Standards Australia. Sydney, NSW, Australia.

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6 APPENDICES

6.1 APPENDIX A: INSPECTION IMAGES

Figure 3 – Trees 1-3, as viewed from the south.

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Figure 4 – Group A, as viewed from the west.

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Figure 5 – Tree 4, as viewed from the west.

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Figure 6 – Tree 5, as viewed from the west.

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Figure 7 – Group B, as viewed from the northeast.

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Figure 8 – Group C, as viewed from the northwest.

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Figure 9 – Tree 6, as viewed from the west.

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Figure 10 – Tree 7, as viewed from the north.

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Figure 11 – Trees 8 & 9, as viewed from the north.

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Figure 12 – Trees in Group D, looking south.

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Figure 13 – Trees in Group D, looking northeast.

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Figure 14 – Trees in Group E, looking west.

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6.2 APPENDIX B: TREE ASSESSMENT DETAILS

Measurements recorded in this section were estimated by eye and may not be entirely accurate, but are sufficient for the purpose of this report.

The following categories have been used in this table to describe the trees' health:

Good (G)	Tree features indicate high levels of health, vigour and vitality.
Fair (F)	Tree is showing signs of stress or some form of defect present; however, still appears structurally sound.
Poor (P)	Tree is either in a spiral of declining health or may be structurally unsound.
Dead (D)	Tree is either completely dead or has declined beyond the point of return.

The following categories have been used to describe the trees' age class, in accordance with IACA's SRIV method:

Young	Tree aged less than <20% of life expectancy, in situ.
Mature	Tree aged 20-80% of life expectancy, in situ.
Over-mature	Tree aged greater than >80% of life expectancy, in situ, or senescent with or without reduced vigour, and declining gradually or rapidly but irreversibly to death.

Definitions for Retention Values (using IACA's STARS method) are provided in Appendix G.

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Tree No.	Name	DBH / DRF (m)	Height (m)	Health (G/F/P/D)	Retention Value (H/M/L/R)	Observations
1	*Grevillea robusta* Silky Oak	0.3 / 0.35	10	G	M	• Locally indigenous species • Can likely be retained without significant impact • Will require excavations for new post holes within TPZ • May require some minor pruning to provide clearances
2	*Grevillea robusta* Silky Oak	0.45 / 0.35	9	G	M	• Locally indigenous species • Can likely be retained without significant impact • Will require excavations for new post holes within TPZ • May require some minor pruning to provide clearances
3	*Stenocarpus sinuatus* Firewheel Tree	0.25 / 0.3	7	F	M	• Locally indigenous species • Can likely be retained without significant impact • Will require excavations for new post holes within TPZ
A	*Lagerstroemia indica* Crepe Myrtle **Group of 3**	-	5-6	G	L	• Exotic species – group of 3 • Can likely be retained without significant impact • Will require excavations for new post holes within TPZs • May require some minor pruning to provide clearances
4	*Casuarina cunninghamiana* River She Oak	0.4 / 0.5	16	G	H	• Locally indigenous species • Can likely be retained without significant impact • Will require excavations for new post holes within TPZ • May require some minor pruning to provide clearances
5	*Cinnamomum camphora* Camphor Laurel	1.3 / 1.25	15	G	M	• Exotic environmental weed species • Can likely be retained without significant impact • Will require excavations for new post holes within TPZ • Will require some major pruning to provide clearances
B	*Callitris sp.* Cypress Pine **Group of 3**	-	9-12	F	L	• Locally indigenous species – group of 3 • Can likely be retained without significant impact • Will require excavations for new post holes within TPZs

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Tree No.	Name	DBH / DRF (m)	Height (m)	Health (G/F/P/D)	Retention Value (H/M/L/R)	Observations
C	*Callistemon salignus* Willow Bottlebrush **Group of 2**	-	6-8	F-G	M	• Locally indigenous species – group of 3 • Can likely be retained without significant impact • Will require excavations for new post holes within TPZs
6	*Cinnamomum camphora* Camphor Laurel	1.2 / 1.2	15	G	M	• Exotic environmental weed species • Can likely be retained without significant impact • Will require excavations for new post holes within TPZ • Will require some major pruning to provide clearances
D	**Group of several dozen trees**	-	5-20	F-G	L-M	• Mix of locally indigenous species along western boundary – group of several dozen • Will require excavations for new post holes within TPZs • Trees may require pruning to provide clearances
7	*Lophostemon confertus* Brush Box	0.25 / 0.25	15	F	M	• Locally indigenous species • Tree stands close to proposed alignment, will require removal to facilitate fence construction
8	*Lophostemon confertus* Brush Box	0.35 / 0.4	20	F-G	M	• Locally indigenous species • Tree stands close to proposed alignment, will require removal to facilitate fence construction
9	*Lophostemon confertus* Brush Box	0.75 / 0.8	20	G	H	• Locally indigenous species • Tree stands close to proposed alignment, will require removal to facilitate fence construction
E	**Group of several dozen trees**	-	5-25	**F-G**	L-M	• Mix of locally indigenous and Australian native species outside southern boundary – group of several dozen Council-owned street trees • Trees can likely be retained without significant impact • Will require excavations for new post holes within TPZs • Trees may require pruning to provide clearances

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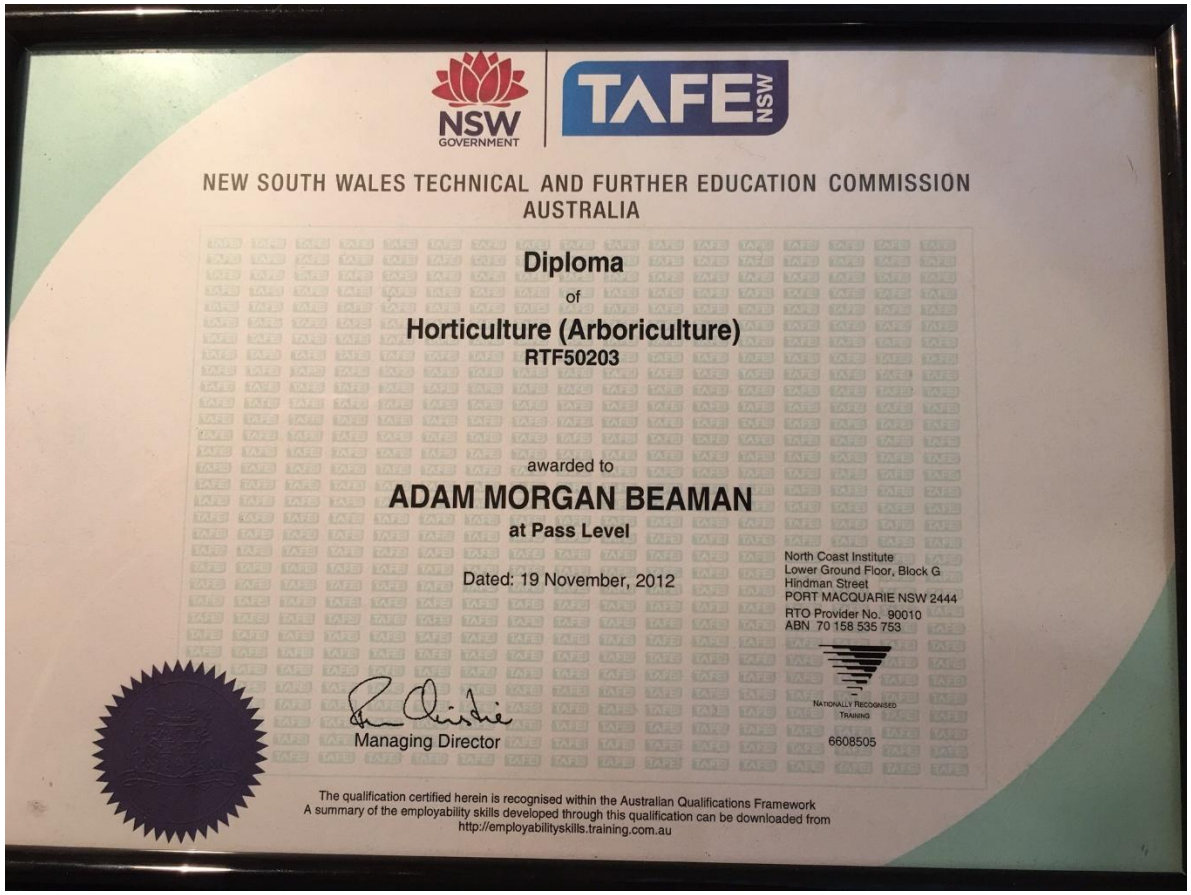
6.3 APPENDIX C: AUTHOR'S QUALIFICATIONS


NSW GOVERNMENT

TAFE NSW

NEW SOUTH WALES TECHNICAL AND FURTHER EDUCATION COMMISSION
AUSTRALIA

Diploma
of
Horticulture (Arboriculture)
RTF50203

awarded to
ADAM MORGAN BEAMAN
at Pass Level

Dated: 19 November, 2012

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The qualification certified herein is recognised within the Australian Qualifications Framework
A summary of the employability skills developed through this qualification can be downloaded from
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6.4 APPENDIX D: GLOSSARY OF ARBORICULTURAL TERMS

Abatement	Reduction in hazard, either by remedial tree works and/or removal of target(s)
Abnormal Lean	Abnormal departure of trunk from the vertical or near vertical position.
Amenity Value	The environmental and landscape benefits of a tree as opposed to its commercial value for timber. Many of these benefits are intangible or difficult to measure.
Arboriculture	The care, cultivation and management of individual trees or groups of trees in the landscape primarily for their amenity value.
Arborist	A specialist in the cultivation and care of trees and shrubs, including tree surgery, tree identification, the diagnosis, treatment, and prevention of tree diseases, and the control of pests.
Basal Flare	The rapid increase in diameter that occurs at the confluence of trunk and roots, associated with stem and root tissue.
Bifurcation	To divide or fork into two (2) parts, usually equal in size and occurring at a narrow angle.
Bleeding/Sap flow	Exudation of sap/resin from wounds and/or other injuries, may be accompanied by a foul odour.
Bole	The central stem of the tree. Another meaning for trunk.
Bow	The gradual curve of a branch or stem.
Bracket Fungi	Fruiting body of some spore producing, wood decay fungi, forming on the external surface of the stem or trunk.
Branch Attachment	The structural linkage of branch to stem.
Branch Collar	Wood which forms around branch attachments, frequently more pronounced below the branch.
Brash Wood	Type of reaction wood which is weaker than normal due to thin cell walls and decreased fibre content; presence increases the likelihood of failure.
Burl	More correctly identified as a Lignotuber (a mass of dormant, tightly arranged buds), it is a generally circular swelling on the main stem or branch; not considered a defect.
Buttress	Support of branch, stem or root; usually associated with exaggerated growth.
Buttress Root	A large woody root located at the base of the trunk (the root crown) which is important to the overall stability of the tree due to its contributions to basal flare.
Callus	Can be detected within weeks after cells on the edge of a wound die and is produced by the enlargement or increased division of cells adjacent to the edge of cell dieback. Often associated with wound wood development post pruning.

Cambium	A layer of delicate meristematic cells between the inner bark or phloem and the wood or xylem, which produces new phloem on the outside and new xylem on the inside in stems, roots, etc., originating all secondary growth in plants and forming the annual rings of wood.
Canker	A localised area of dead tissue on a stem or branch, caused by fungal or bacterial organisms, characterised by wound wood development on the periphery; may be perennial or annual.
Canopy	Parts of the tree above the trunk, including leaves, and lateral and scaffold branches.
Cavity	An open wound often characterised by the presence of decay and resulting in a hollow.
CODIT	An acronym for Compartmentalisation of Decay in Trees, this scientific theory was developed by the late Dr. Alex Shigo which now forms the basis of our knowledge of how trees respond to wounding, infection and decay.
Co-dominant Stems	Equal in size and relative importance, usually associated with either the trunks/stems or scaffold limbs/branches in the crown. Not necessarily a structural defect.
Compartmentalise	Physiological process which creates the chemical and mechanical boundaries that act to limit the spread of disease and decay organisms within trees (see also CODIT).
Compression Wood	Type of reaction wood produced on the underside of branches and leaning trunks.
Coppice	To cut a tree to ground level to stimulate regenerative growth.
Core Drill	A technique involving creating a series of vertical cores within a trees root zone which can be filled with a variety of materials to stimulate root initiation and growth. Often used on aging and/or stressed trees.
Crack	Breakage in the stem, involving bark, cambium and xylem.
Crown	Parts of the tree above the trunk, including leaves, and lateral and scaffold branches (see also Canopy).
Crown uplift	Pruning technique where lower limbs are removed, thereby raising the overall crown above the ground.
DBH	Diameter of the trunk, measured at breast height i.e. 1.4m from ground level.
Deadwood	Branch or stem bearing no live tissues. (Small dead wood <3cm, medium dead wood 3-10cm, large dead wood >10cm.)
Deadwooding	The act of removing deadwood from the canopy.
Decay	Process of degradation of woody tissues by fungi and bacteria through decomposition of cellulose and lignin.
Decurrent	Referring to crowns which are made up of system of co-dominant scaffold branches; lacking a central leader.

Defect	Any structural weakness or deformity.
Dieback	Death of shoots and branches, generally from tip to base.
Disease/Pathogens	A malfunction in, or destruction of tissues within a living organism, usually excluding mechanical damage; in trees, usually caused by pathogenic micro-organisms.
Dominant	In crown class, trees whose crowns extend above the general stand canopy and are not restricted by adjacent trees.
DRF	(Diameter at Root Flare) The diameter of the very lowest part of the trunk where root buttressing begins and often used to calculate a tree's structural root zone (SRZ).
End Weight	The concentration of excessive foliage toward the branch extremity.
Epicormic Growth	Shoots which result from adventitious or latent buds, generally initiated in times of distress and are generally poorly attached.
EWP	Elevated work platform.
Excessive Thinning	Having relatively little extent from one side of the canopy to the opposite. In relation to pruning; excessive pruning of lateral branches at their point of origin, usually associated with removal of large amounts of live tissue.
Exclude Site Use	Implement control measures to prevent people from entering an area that has the capacity to cause harm or damage i.e. due to hazardous trees.
Fasciation	Abnormal twig proliferation.
Flush Cut	Pruning technique where both branch and trunk tissue are removed behind the branch collar; considered poor practice.
Frass Bore Dust	Excrement and other debris left by word boring insects.
Fungal Fruiting Body	(see Bracket Fungi)
Gall	In branches and stems, an abnormal, localised growth, generally seen as a large knob of undifferentiated woody tissues.
Girdling Root	A root or roots which circles and constricts the stem or roots causing death of phloem and/or cambial tissue.
Hanger	A partially attached (but clearly broken) or unattached branch which remains lodged in the crown.
Hazard	A hazard is an action or item that has the capacity to cause harm or damage, which may be more or less serious.
Hydrophilic	Refers to materials/soils that attract and absorb water and bond on a molecular level.

Hydrophobic	Refers to materials/soils that repel water, such as a soil profile that is difficult to rehydrate.
Hygrophobic	Refers to materials/soils that attract and absorb water without forming a molecular bond. An example is Sodium Bentonite clay. The term is generally used to describe the ability of a material/soil to absorb humidity from the air.
Included bark	Pattern of development at branch junctions where bark is turned inward rather than pushed out (synonym -embedded bark); contrast with branch bark ridge. Also referred to as Embedded bark. Such a formation generally results in weakened attachment.
Infection	The establishment of parasitic micro-organism in the tissues of a tree.
Irrigation	The watering of land by artificial means to foster plant growth.
Kino	The resin which flows from Eucalypts and its relatives such as Corymbia sp. & Angophora sp.
Leader	The primary terminal shoot or trunk of a tree.
Lean/Leaning	Departure of trunk from the vertical or near vertical position.
Lerp	A type of Psyllid that commonly predates on many species of Eucalypts and its relatives.
Loading	Refers to the mechanical stresses imposed by the weight, orientation etc. of trees and branches in relation to the site, the architecture of the tree and the weather. The amount of loading upon a tree can be directly influenced by its level of exposure to the prevailing winds.
Lopping	The removal of the crown of a tree, or a major proportion of it. Incorrect pruning method of removing branches to stubs, resulting in poor form and weak branch unions.
Mycorrhiza	A mutual association between certain fungi and the roots of vascular plants often resulting in an increased efficiency in the absorption of mineral nutrients.
Mulch	Material laid down over the rooting area to help conserve soil moisture, supress weeds and regulate soil temperature.
Nutrition	The elements and compounds required to support healthy plant growth, of which at least 17 are known.
Parasitic plants	Vascular plants such as Mistletoes which infect host plants via the penetration of specialised roots called haustorium to gain access to the host's vascular system for water and mineral nutrients.
Pathogen	(See Disease/Pathogens)
Pests/Pest Insects	Pests such as Wood Borers, Termites, Leaf Beetles, Gumleaf Skeletoniser, Leafblister Sawfly, Lerps or Elm Leaf Beetle that cause tree decline. There are various methods of treatment to remove pests as well as prevent their return.

Phellinus sp.	A genus of bracket forming, wood decaying fungi which occurs in native and exotic species. Whilst the decay associated with this fungus is often localised it has a reputation for being quite destructive.
Phytotoxic	A substance which is toxic to plants.
Phloem	The part of a vascular bundle consisting of sieve tubes, companion cells, parenchyma, and fibres and forming the food-conducting tissue of a plant.
PICUS	(Sonic Tomograph) A specialised piece of diagnostic equipment generally used to determine the level of internal decay within a branch or trunk using sound waves.
Pollard	The removal of the tree canopy, back to the stem or primary branches. Pollarding may involve the removal of the entire canopy in one year or may be phased over several years.
Poor Pruning	Pruning techniques (such as lopping) which are undertaken without regard for the tree's natural biology and which can cause decline, decay and potentially lead to part or whole tree failure.
pH	(Potenz Hydrogenous) Is the measure of soluble Hydrogen ions in a solution which is used to measure its acidity or alkalinity. Effects nutrient availability to plants.
Previous Failures	Denotes a tree has previously had a leader or branches fail. Previous failures can result in wounding if a required action is not attended to (see wound).
Propagate	To reproduce a plant, sexually by means of seed or asexually by cuttings, grafting or divisions, so that it is genetically identical to the parent (true to type).
Pruning	The removal or cutting back of twigs or branches.
Psyllid	A common & diverse group of sap-sucking insects related to whiteflies, aphids & scales. They are regularly associated with native plants and most species appear to be host specific or confined to a group of closely related plants. Sustained infestations can lead to tree decline if untreated.
Reactive Growth	Production of woody tissue in response to altered mechanical loading; often in response to internal defect or decay and loss of strength.
Risk	The likelihood that a hazard will cause harm within a variable period of time.
Root Collar/Crown	The transitional area between the stem/s and roots.
Saprophyte	An organism which obtains its nutrition from dead or decaying organic matter. This term is often associated with fungi and with some groups of vascular plants such as Orchids.
Scaffold Limb	Primary structural branch of the crown.
Senescence	The stage of a tree's life cycle between maturity and death, whereby a tree will naturally decline over a number of years.

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Soil Compaction	Area of compacted soil covering the root system. Affected soil becomes less able to absorb rainfall and water, thus increasing runoff and erosion. Trees have difficulty growing in compacted soil because soil particles are pressed together leaving little space for oxygen and water, which are essential for root growth.
Soil Problems	Soil problems such as compaction, salinity, erosion can cause tree decline and potentially lead to tree failure.
Split	Breakage in stem, affecting bark, cambium and xylem.
Stress	In plant physiology, a condition under which one or more physiological functions are not operating within their optimum range, e.g. a lack of soil moisture, inadequate nutrition or extremes of temperature.
Structural Defect	Internal or external points of weakness which reduce the structural integrity of branches and/or stems or roots. Defects in roots may impact upon tree stability.
Structural Roots	Contribute significantly to the structural support, anchorage and stability of a tree, often found close to the base.
Sucker	A shoot which appears from an underground root.
Suppressed	In crown class, trees which have been over heavily shaded by others from above or the side and whose crown development is wholly or partially restricted.
Symbiosis	A mutual association between two (2) organisms whereby the presence of one (1) is beneficial to the other.
Target	Persons or property or other things of value which might be harmed by mechanical failure of the tree or by objects falling from it.
Thinning	Having relatively little extent from one side of the canopy to the other. In relation to pruning; excessive pruning of lateral branches at their point of origin, usually associated with removal of large amounts of live tissue.
TLE	Tree Life Expectancy (see useful life expectancy).
Topping	Synonymous with lopping it is the indiscriminate removal of the crown of a tree, or a major proportion of it. Incorrect pruning method of removing branches to stubs, resulting in poor form and weak branch unions.
ULE	Useful Life Expectancy refers to an expected period of years that a tree can be retained before its amenity values decline to a point where it may detract from the appearance of the landscape and/or becomes potentially hazardous to people and/or property.
Understorey	Vegetation beneath the main canopy.
VTA	An acronym for Visual Tree Assessment which is the process undertaken when systematically assessing trees for attributes such as their species, health, age, defects and pest or disease infestations.

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Wall 4	A chemical and anatomical barrier formed by the cambium present at the time of wounding, which inhibits the spread of decay into xylem tissue formed after the time of wounding.
Weak unions	A stem or branch union which is exhibiting signs of a potential structural weakness through its growth habit and/or as a result of peat and/or disease infestation.
Weed	A plant that is not valued where it is growing and is usually of vigorous growth; especially one that tends to overgrow or supress desirable plants.
Whorl	The particular arrangement of foliage or flower parts around a stem whereby they radiate from a single point.
Windthrow	The blowing over of a tree at its roots.
Wound	Any injury which induces a compartmentalisation response.
Wound Wood	Develops from callus tissue or from uninjured vascular cambium at the margins of injuries/wounds that have damaged or exposed the phloem, vascular cambium or sapwood.
Xylem	A compound tissue in vascular plants that helps provide support and that conducts water and nutrients upward from the roots, consisting of tracheids, vessels, parenchyma cells, and woody fibres.

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6.5 APPENDIX E: DETAILED METHODOLOGY

The purpose of the arboricultural assessment performed was to evaluate the general health and condition of trees onsite, identify elevated levels of risk from trees, and determine construction impacts that trees may sustain from the proposed construction. Industry best practice principles were used while conducting the assessments. The three methods utilised are described below.

1. VTA (Visual Tree Assessment) – method used for assessing overall tree health and structure

This assessment was conducted using the Visual Tree Assessment (VTA) methods described by Mattheck & Breloer (1994 & 1999), Matheny & Clark (1994), Lonsdale (1999) and Harris (1992 & 1999). Additional references to tree anatomy and structure are based on the concepts outlined by Shigo (1986 & 1991), and references to roots were based on the texts of Perry (1982). Specifications on protection of trees and tree roots during construction activities are taken from AS4970-2009.

"*The tree shows through its configuration what is wrong with it. This understanding is the basis for the visual assessment system known as VTA*." (Mattheck & Breloer). "*VTA is based on the axiom of uniform stress, which states that trees grow with such configuration that all stresses on their surfaces are distributed evenly. If this state is disturbed the trees repair themselves by forming locally thicker rings. These reparative structures are symptoms of defects*." (Mattheck & Breloer)

The VTA occurs in three phases:

1) Visual inspection for defect symptoms and vitality.
2) If a defect is suspected based on symptoms, its presence or absence must be confirmed by a thorough examination.
3) If a defect is confirmed and appears to be a cause for concern, it must be measured and the strength of the remaining part of the tree evaluated.

The site was physically assessed using non-invasive arboricultural techniques. Digital photos were taken where required, and measurements were generally estimated, unless exact measurements were requested in the brief.

Other factors that were considered during the VTA include:

- Significance and useful life expectancy, species attributes, apparent health, structural form, obvious past influences, location and recent nearby developments;
- Amenity value – i.e. the trees' overall contribution to its surrounding landscape and community, such as climate control, stormwater management and wildlife habitat;
- Cultural value – additional tree status, such as conservation, historical, commemorative, etc.;
- Trees causing property damage, posing safety issues, hindering construction or competing with other vegetation.

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2. TRAQ (Tree Risk Assessment Qualification) – method using for assigning risk ratings

TRAQ is a qualitative risk assessment method developed by the ISA (International Society of Arboriculture), as a tool for consulting arborists to use during tree risk assessments.

This risk assessment involves a 3-step process:

Step 1 – Identify the hazard (findings from VTA – Visual Tree Assessment).

- Identify the part predicted to fail and the mode of failure.
- Consider the type of target (should be stated in the job brief), either people, property/assets or disruption to traffic/services.

Step 2 – Use the "TRAQ Calculator" (included below) to calculate "Initial Risk Rating".

- Use Matrix 1 to determine likelihood.
- Use Matrix 2 to determine consequence.
- Use Matrix 3 to determine the Initial Risk Rating by multiplying the results of Matrix 1 and Matrix 2 together.
- The terms used in the TRAQ Calculator are defined on the next page.

Step 3 – Risk mitigation by applying control measures.

If the Initial Risk Rating is:

  - Low – the tree is normal, and no further action is required;
  - Moderate – implement control measures or remedial tree work within 6 months;
  - High – implement control measures or remedial tree work within 3 months to mitigate the risk, then use TRAQ Calculator again to assign a New Risk Rating
  - Extreme – (highly unlikely) cordon off area to prevent access, manage risk and take measures to isolate the target or remove the hazard/tree.
- Control measures may include barrier fencing, exclusion of playgrounds during winds over 60km/hr, pruning, fall-arrest bracing systems, etc.
- These measures need to be reasonably practicable, not just practical.
- Consider any un-intended hazards that may arise due to implementing the control measures.

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TRAQ Calculator

The TRAQ Calculator is a series of three matrix tables used to calculate a risk rating. A brief explanation of the terms used in this TRAQ calculator is included below. For a detailed definition, refer to the Tree Risk Assessment Manual.

Terms used in Matrix 1 (Likelihood)

Likelihood of Impact: The estimated chance of a target being struck by the expected part of failure. Consider where the target zone is for the expected part of failure (predominant wind direction, tree lean, etc…) and whether the occupancy rate is constant, frequent, occasional or rare for this target area. Also consider how this will change during a severe weather event, when failure is more likely to occur.

Likelihood of Failure: The estimated chance of a specific tree part (or whole tree) failing during the next 12-month period, due to a hazard/issue identified in the VTA process.

Terms used in Matrix 2 (Consequence)

Level of Impact: The estimated amount of damage or harm caused as a resulted of the expected tree part failing. Based on the size of part, height/orientation of fall, mass of tree part and dampening of branches/structures below, vines or adjacent vegetation.

Value of Target: The estimated value of the target, which will be different for each scenario being assessed. For example, harm to people (crowds or children vs politicians), damage to property/assets (old fence vs HV power lines) and disruption to traffic (low-use country road with available detour vs the main highway).

Terms used in Matrix 3 (Risk Rating)

Risk Rating: The final result which indicates the level of risk, calculated by multiplying Likelihood from Matrix 1 and Consequence from Matrix 2.

Likelihood: Value calculated by multiplying Likelihood of Impact and Likelihood of Failure.

Consequence: Value calculated by multiplying Level of Impact and Value of Target.

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Matrix 1: LIKELIHOOD	***Likelihood of Impact***				
Likelihood of Failure		Very Low	Low	Medium	High
	Improbable	Unlikely	Unlikely	Unlikely	Unlikely
	Possible	Unlikely	Unlikely	Unlikely	Somewhat Likely
	Probable	Unlikely	Unlikely	Somewhat Likely	Likely
	Imminent	Unlikely	Somewhat Likely	Likely	Very Likely

Matrix 2: CONSEQUENCE	***Level of Impact***				
Value of Target		Very Low	Low	Medium	High
	Very Low	Negligible	Negligible	Negligible	Minor
	Low	Negligible	Negligible	Minor	Significant
	Medium	Negligible	Minor	Significant	Significant
	High	Minor	Significant	Significant	Severe

Matrix 3: RISK RATING	***Consequence (from Matrix 2)***				
Likelihood (from Matrix 1)		Negligible	Minor	Significant	Severe
	Unlikely	Low	Low	Low	Low
	Somewhat Likely	Low	Low	Moderate	Moderate
	Likely	Low	Moderate	High	High
	Very Likely	Low	Moderate	High	Extreme

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3. STARS (Significance of a Tree Assessment Rating System) – method for determining retention values

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

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

Tree Significance - Assessment Criteria

1.High Significance in Landscape

- The tree is in good condition and good vigour;
- The tree has a form typical for the species;
- The tree is a remnant or is a planted locally indigenous specimen and/or is rare or uncommon in the local area or of botanical interest or of substantial age;
- The tree is listed as a Heritage Item, Threatened Species or part of an Endangered ecological community or listed on Councils significant Tree Register;
- The tree is visually prominent and visible from a considerable distance when viewed from most directions within the landscape due to its size and scale and makes a positive contribution to the local amenity;
- The tree supports social and cultural sentiments or spiritual associations, reflected by the broader population or community group or has commemorative values;
- The tree's growth is unrestricted by above and below ground influences, supporting its ability to reach dimensions typical for the taxa in situ - tree is appropriate to the site conditions.

2. Medium Significance in Landscape

- The tree is in fair-good condition and good or low vigour;
- The tree has form typical or atypical of the species;
- The tree is a planted locally indigenous or a common species with its taxa commonly planted in the local area
- The tree is visible from surrounding properties, although not visually prominent as partially obstructed by other vegetation or buildings when viewed from the street,
- The tree provides a fair contribution to the visual character and amenity of the local area,
- The tree's growth is moderately restricted by above or below ground influences, reducing its ability to reach dimensions typical for the taxa in situ.

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3. Low Significance in Landscape

- The tree is in fair-poor condition and good or low vigour;
- The tree has form atypical of the species;
- The tree is not visible or is partly visible from surrounding properties as obstructed by other vegetation or buildings,
- The tree provides a minor contribution or has a negative impact on the visual character and amenity of the local area,
- The tree is a young specimen which may or may not have reached dimension to be protected by local Tree Preservation orders or similar protection mechanisms and can easily be replaced with a suitable specimen,
- The tree's growth is severely restricted by above or below ground influences, unlikely to reach dimensions typical for the taxa in situ - tree is inappropriate to the site conditions,
- The tree is listed as exempt under the provisions of the local Council Tree Preservation Order or similar protection mechanisms,
- The tree has a wound or defect that has potential to become structurally unsound.

The tree is to have a minimum of three (3) criteria in a category to be classified in that group.

Environmental Pest / Noxious Weed Species

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

Hazardous / Irreversible Decline

- The tree is structurally unsound and/or unstable and is considered potentially dangerous,
- The tree is dead, or is in irreversible decline, or has the potential to fail or collapse in full or part in the immediate to short term.

Note: The assessment criteria are for individual trees only, however, can be applied to a monocultural stand in its entirety e.g. hedge.

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Tree Retention Value – Priority Matrix

		Significance				
		1. High	**2. Medium**	**3. Low**		
		Significance in Landscape	Significance in Landscape	Significance in Landscape	Environmental Pest / Noxious Weed Species	Hazardous / Irreversible Decline
Estimated Life Expectancy	**1. Long** >40 years					
	2. Medium 15-40 years					
	3. Short <1-15 years					
	4. Dead					

Legend for Priority Matrix

	Priority for Retention (High) - These trees are considered important for retention and should be retained and protected. Design modification or re-location of building/s should be considered to accommodate the setbacks as prescribed by the Australian Standard AS4970 Protection of trees on development sites. Tree sensitive construction measures must be implemented e.g. pier and beam etc if works are to proceed within the Tree Protection Zone.
	Consider for Retention (Medium) - These trees may be retained and protected. These are considered less critical; however, their retention should remain priority with removal considered only if adversely affecting the proposed building/works and all other alternatives have been considered and exhausted.
	Consider for Removal (Low) - These trees are not considered important for retention, nor require special works or design modification to be implemented for their retention.
	Priority for Removal - These trees are considered hazardous, or in irreversible decline, or weeds and should be removed irrespective of development.

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6.6 APPENDIX F: GENERAL TREE PROTECTION SPECIFICATIONS FROM AS4970

1. Appointment of Project Arborist

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

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

2. Compliance

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

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

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

3. Tree Removals

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

This has relevance for all trees to be removed – Trees 1-3, and potentially Trees 4-6 & 10-13.

4. Tree Protection Zones

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

- Modification of existing soil levels, excavations and trenching
- Mechanical removal of vegetation
- Movement of natural rock
- Storage of materials, plant or equipment or erection of site sheds

- Affixing of signage or hoarding to the trees
- Preparation of building materials, refuelling or disposal of waste materials and chemicals
- Lighting fires
- Movement of pedestrian or vehicular traffic
- Temporary or permanent location of services, or the works required for their installation
- Any other activities that may cause damage to the tree

This has relevance for all trees to be retained – Trees 7-9, and potentially Trees 4-6.

5. Tree Protection Fencing

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

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

This has relevance for all trees to be retained – Trees 7-9, and potentially Trees 4-6.

6. Site Management

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

This has relevance for all trees to be retained – Trees 7-9, and potentially Trees 4-6.

7. Scaffolding

Where possible, scaffolding shall not be located within the TPZ. Scaffolding shall not be in contact with the tree. As necessary, this shall be achieved by erecting scaffolding around branches. Branches shall be tied back and protected as deemed necessary by the Project Arborist.

8. Works within the Tree Protection Zones

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

If roots (>25mm Ø) are encountered during the demolition, excavation and construction works, these roots must be retained in an undamaged condition and advice sought from the

Project Arborist. Adjustment of final levels and design shall remain flexible to enable the retention of roots (>25mm Ø) where deemed necessary by the Project Arborist.

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

This has relevance for all trees to be retained – Trees 7-9, and potentially Trees 4-6.

9. Ground Protection

Where deemed necessary by the Project Arborist, machinery movements shall be restricted to areas of existing pavement or from areas of temporary ground protection such as ground mats or steel road plates.

This has relevance for all trees to be retained – Trees 7-9, and potentially Trees 4-6.

10. Trunk Protection

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

This has relevance for all trees to be retained – Trees 7-9, and potentially Trees 4-6.

11. Underground Services

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

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

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

This has relevance for all trees to be retained – Trees 7-9, and potentially Trees 4-6.

13. Excavations, Root Protection & Root Pruning

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

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

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

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

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

This has relevance for all trees to be retained – Trees 7-9, and potentially Trees 4-6.

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6.7 APPENDIX G: BEAUFORT WIND SCALE

Please note: Beaufort scale numbers and descriptive terms such as 'near gale', 'strong gale' and 'violent storm' are not normally used in Bureau of Meteorology communications or forecasts.

Beaufort Scale Number	Descriptive Term	Units in km/h	Description on Land
0	Calm	0	Smoke rises vertically
1-3	Light winds	19 km/h or less	Wind felt on face; leaves rustle; ordinary vanes moved by wind.
4	Moderate winds	20 - 29 km/h	Raises dust and loose paper; small branches are moved.
5	Fresh winds	30 - 39 km/h	Small trees in leaf begin to sway; crested wavelets form on inland waters
6	Strong winds	40 - 50 km/h	Large branches in motion; whistling heard in telephone wires; umbrellas used with difficulty.
7	Near gale	51 - 62 km/h	Whole trees in motion; inconvenience felt when walking against wind.
8	Gale	63 - 75 km/h	Twigs break off trees; progress generally impeded.
9	Strong gale	76 - 87 km/h	Slight structural damage occurs -roofing dislodged; larger branches break off.
10	Storm	88 - 102 km/h	Seldom experienced inland; trees uprooted; considerable structural damage.
11	Violent storm	103 -117 km/h	Very rarely experienced - widespread damage
12	Hurricane	118 km/h or more	Very rarely experienced - widespread damage