



Park Road, Wallacia Arboricultural Impact Assessment

Catholic Metropolitan Cemeteries Trust

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Template 2.8.1

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Abbreviations

Abbreviation	Description
AQF	Australian Qualifications Framework
AS	Australian Standards
DBH	Diameter at Breast Height
ELA	Eco Logical Australia
m	Metre
mm	Millimetre
NDE	Non-Destructive Excavation
NO	Number
NSW	New South Wales
SP	Species
SRZ	Structural Root Zone
TPZ	Tree Protection Zone
VTA	Visual Tree Assessment

1. Background

This Arboricultural Impact Assessment was prepared for Catholic Metropolitan Cemeteries Trust in relation to a proposed road widening at Wallacia. The address of the subject site is in Table 1 and mapped in Figure 1. The purpose of this report is to:

- identify the trees within the site that are likely to be affected by the proposed works
- undertake a visual tree assessment of the subject trees
- assess the current overall health and condition of the subject trees
- evaluate the retention value of the subject trees
- identify trees to be removed, retained or transplanted
- determine the likely impacts on trees to be retained
- recommend tree protection measures to minimise adverse impacts.

Features of the subject site are tabulated below.

Table 1: Development site

Criteria	Description
Street address	Park Road, Wallacia
Local Government Area	Penrith City Council
General land use	SP2 Infrastructure

The description of the proposed activity in Table 2 is based on information available at the time of preparing this report.

Table 2: Proposed activity

Activities that can impact trees	Description of proposed activities
Clearing vegetation	Yes – 21 trees are proposed for removal as they are highly affected by the proposed works
Pruning vegetation	No
Earthworks including regrading, excavation, and trenching	Yes – road widening works that consist of the construction of a new road pavement and pedestrian pathway along with the installation of batters, kerbs and a median island

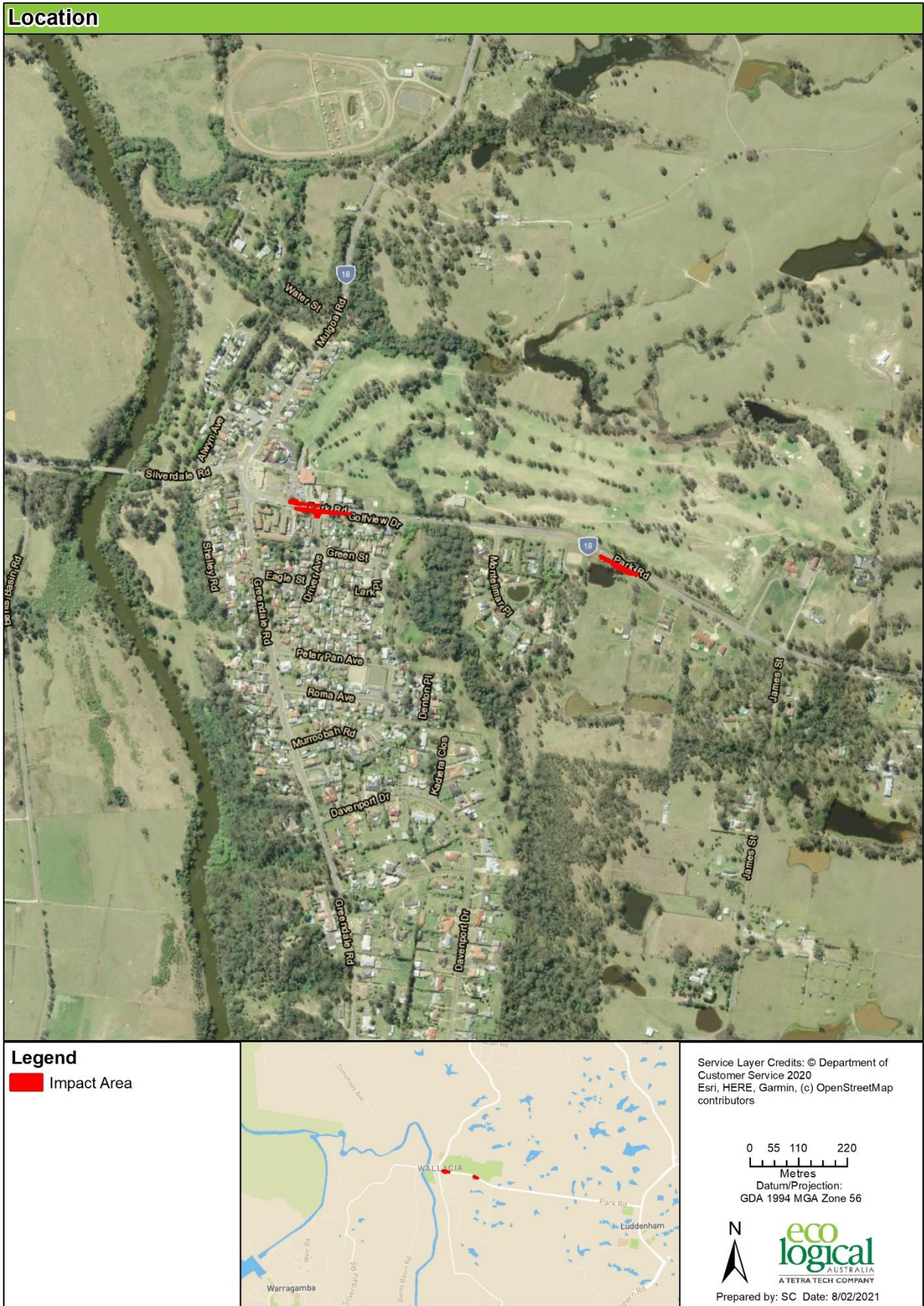


Figure 1: Location

2. Method

2.1 Definition of a tree

A tree is defined under the Australian Standard, *AS 4970-2009, Protection of Trees on Development Sites* as a long lived woody perennial plant greater than (or usually greater than) 3 m in height with one or relatively few main stems or trunks.

The Penrith City Council 2014 Development Control Plan defines a tree as:

'a living perennial plant that has a height of 3 m or more or a trunk circumference exceeding 300 mm at 400 mm above ground level, or individual trees, gardens or native vegetation listed as Significant Trees and Gardens' (Penrith City Council 2014).

2.2 Visual tree assessment

The subject trees were assessed in accordance with a stage one visual tree assessment (VTA) as formulated by Mattheck and Breloer (1994) and practices consistent with modern arboriculture.

A total of **36 subject trees** were inspected in February 2021 by AQF Level 5 Consulting Arborists, Sophie Diller and Michael Shaw.

The following limitations apply to this methodology:

- Trees were inspected from ground level, without the use of any invasive or diagnostic tools and testing.
- Trees were inspected within limits of site access.
- The location of the subject trees were recorded using hand-held GPS units. These placements have error in the accuracy of approximately 2 - 20 m.
- All tree location points were moved to the Warren Smith & Partners survey (2020) except for tree location points for Trees 2 and 3 as they were not recorded on the survey. These trees will be subject to errors associated with using hand-held GPS units as stated above.
- No aerial inspections or root mapping was undertaken.
- Tree heights, canopy spread and diameter at breast height (DBH) were estimated, unless otherwise stated.
- Tree identification was based on broad taxonomical features present and visible from ground level at the time of inspection.

2.3 Health

Tree health is determined by the percentage of foliage present. Trees are provided one of the following ratings:

- Deciduous: reduced foliage
- Excellent: 100% very vigorous
- Good: 80-100% foliage
- Average: 50-80% foliage
- Fair: 30-50% foliage

- Poor: <30% foliage
- Dead

2.4 Tree structure (Tree AZ)

The structure of a tree is determined in accordance with the formulated New Zealand (NZAA) and Australian associations (ISAAC, QAA, NAAA, Treenet and ENSPEC Pty Ltd) guidelines, Tree AZ: Detailed guidance on its use (Barrell Tree Consultancy 2010). Trees are provided one of the following ratings:

- Z1 Young or insignificant small trees, i.e. below the local size threshold for legal protection
- Z2 Too close to a building, i.e. exempt from legal protection because of proximity
- Z3 Species that cannot be protected for other reasons, i.e. scheduled noxious weeds, out of character in a setting of acknowledged importance
- Z4 Dead, dying, diseased or declining
- Z5 Severe damage and/or structural defects where a high risk of failure cannot be satisfactorily reduced by reasonable remedial care, i.e. cavities, decay, included bark, wounds, excessive imbalance, overgrown and vulnerable to adverse weather conditions
- Z6 Instability, i.e. poor anchorage, increased exposure
- Z7 Excessive, severe and intolerable inconvenience to the extent that a locally recognized court or tribunal would be likely to authorize removal, i.e. dominance, debris, interference
- Z8 Excessive, severe and intolerable damage to property to the extent that a locally recognized court or tribunal would be likely to authorize removal, i.e. severe structural damage to surfacing and buildings
- Z9 Severe damage and/or structural defects where a high risk of failure can be temporarily reduced by reasonable remedial care, i.e. cavities, decay, included bark, wounds, excessive imbalance, vulnerable to adverse weather conditions
- Z10 Poor condition or location with a low potential for recovery or improvement, i.e. dominated by adjacent trees or buildings, poor architectural framework
- Z11 Removal would benefit better adjacent trees, i.e. relieve physical interference, suppression,
- Z12 Unacceptably expensive to retain, i.e. severe defects requiring excessive levels of maintenance
- A1 No significant defects and could be retained with minimal remedial care
- A2 Minor defects that could be addressed by remedial care and/or work to adjacent trees
- A3 Special significance for historical, cultural, commemorative or rarity reasons that would warrant extraordinary efforts to retain for more than 10 years
- A4 Trees that may be worthy of legal protection for ecological reasons (Advisory requiring specialist assessment)

2.5 Retention value

The retention value or importance of a tree or group of trees, is determined in accordance with the Institute of Australian Consulting Arborists (IACA) Significance of a Tree Assessment Rating System (STARS©), which is summarised in Appendix A. The method considers the Useful Life Expectancy (ULE) and landscape significance of a tree. Trees are provided one of the following ratings:

- High - priority for retention. These trees are considered important and should be retained and protected. Design modification should be considered to accommodate the setbacks as prescribed by Australian Standard AS 4970–2009 Protection of trees on development sites.
- Medium - consider for retention. These trees are moderately important for retention. Their removal should only be considered if adversely affected by the proposed works and all other alternatives have been considered and exhausted.
- Low - consider for removal. 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.

2.6 Protection zones

2.6.1 Tree protection zone (TPZ)

The TPZ is a specific area above and below ground and at a distance from the trunk set aside for the protection of a tree's roots and crown to provide for the viability and stability of a tree to be retained where it is potentially subject to damage by the development. The TPZ (as defined by AS 4970-2009) requires restriction of access during the development process. Groups of trees with overlapping TPZs may be included within a single protection area. Tree sensitive measures must be implemented if works are to proceed within the TPZ.

2.6.2 Structural root zone (SRZ)

The SRZ is the area of the root system (as defined by AS 4970-2009) used for stability, mechanical support and anchorage of the tree. It is critical for the support and stability of trees. Severance of roots within the SRZ is not recommended as it may lead to the destabilisation and/or decline of the tree.

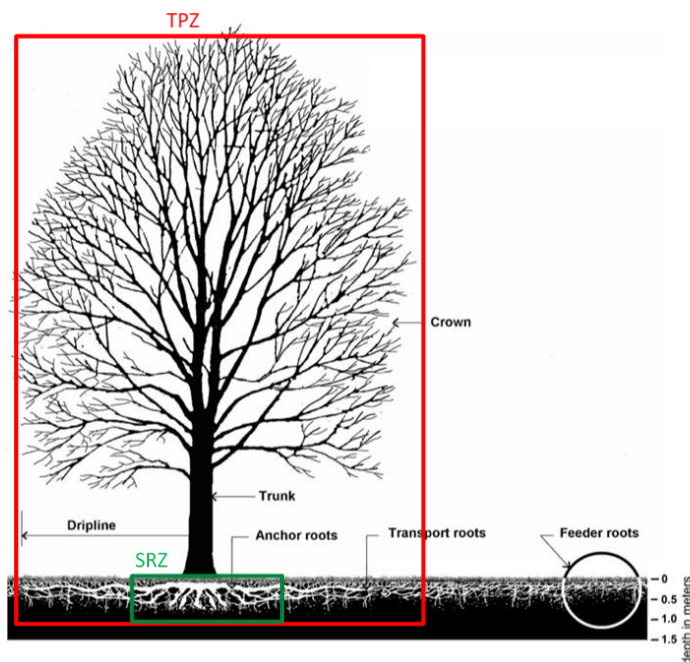


Figure 2: Representative tree structure and indicative TPZ and SRZ

2.7 Potential impacts

Trees may be impacted by physical or chemical damage to roots or above tree parts. Examples include impacts associated with site grading, soil compaction, excavation, stock piling within TPZ as well as changes in site hydrology, changes in soil level and site contamination. The extent of encroachment to the TPZ and SRZ determines the level of potential impact. AS 4970-2009 defines types of encroachment as follows and as illustrated in Appendix B:

- **Major encroachment** - If the proposed encroachment is greater than 10% of the TPZ or inside the SRZ, the project arborist must demonstrate that the tree(s) would remain viable. The location and distribution of roots may be determined through non-destructive excavation (NDE) methods such as hydro-vacuum excavation (sucker truck), Air Spade or manual extraction. The area lost to this encroachment should be compensated for elsewhere and contiguous with the TPZ.
- **Minor encroachment** – If the proposed encroachment is less than 10% of the TPZ, and outside of the SRZ, detailed root investigations should not be required. The area lost to this encroachment should be compensated for elsewhere and contiguous with the TPZ.

For the purposes of this Arboricultural Impact Assessment, impacts are defined as follows:

- **High impact:** The SRZ is directly affected or the proposed encroachment is greater than 20% of the TPZ. Trees may not remain viable if they are subject to high impact. These trees cannot be retained unless the proposal is changed.
- **Medium impact:** If the proposed encroachment is greater than 10% of the TPZ (but less than 20% of the TPZ) and outside of the SRZ, the project arborist may require detailed root investigation to demonstrate that the tree(s) would remain viable. These trees may be retained subject to further investigation and mitigation measures.
- **Low impact:** If the proposed encroachment is less than 10% (total area) of the TPZ, and outside of the SRZ, detailed root investigations should not be required. These trees can be retained.
- **No impact:** No likely or foreseeable encroachment within the TPZ. These trees can be retained.

Impacts are calculated using geographic information systems techniques.

3. Results and discussion

Results of the arboricultural assessment are summarised in Table 3. Detailed results are included in Appendices C and D. Tree protection guidelines are provided in Appendix E and the site plans are outlined in Appendix F. Site photos are provided in Appendix G.

Table 3: Summary of tree retention values and impacts

Retention value	High Impact	Medium Impact	Low Impact	No impact	Total
Priority for retention (High)	6	-	-	1	7
Consider for retention (Medium)	7	-	1	8	16
Consider for removal (Low)	8	-	2	3	13
Total	21	0	3	12	36

A total of **36 trees** were assessed within a 15 m buffer of the proposed road widening works. The proposed impacts and retention values of these trees are provided below.

TREES TO BE REMOVED (HIGH IMPACT)

A total of **21 trees** will be highly affected by the proposed works (>20% TPZ encroachment) and are proposed for removal. These trees cannot be retained within the current proposal. Tree retention values are as follows:

- **High retention:** a total of **six** high retention value trees (Trees 1, 2, 3, 6, 23 and 32) will be highly affected by the proposed works.
These trees are mature and remnant specimens of *Eucalyptus tereticornis* (Forest Red Gum). They have a high landscape significance because they have a form typical of the species, are remnant and visually prominent. They have suffered branch tip dieback and have been pruned next to the road, however they still have a useful life expectancy of 15-40 years. This gives them a high retention value.
- **Medium retention:** a total of **seven** medium retention value trees (Trees 20, 21, 22, 24, 27, 30 and 33) will be highly affected by the proposed works.
- **Low retention:** a total of **eight** low retention value trees (Trees 25, 26, 28, 29, 31, 34, 35 and 36) will be highly affected by the proposed works.

TREES TO BE RETAINED (LOW AND NO IMPACT)

A total of **15 trees** are proposed for retention. Details on these trees are outlined below.

- **Low Impact (<10% TPZ encroachment):** a total of **three** trees will be subject to low impact from the proposed works. These trees can be retained. Their retention values are as follows:
 - **Medium retention value: one** medium retention value tree (Tree 8)
 - **Low retention value: two** low retention value trees (Trees 4 and 7)
- **No Impact (0% TPZ encroachment):** a total of **12** trees will be subject to no impact from the proposed works. Their retention values are as follows:
 - **High retention value: one** high retention value tree (Tree 17)

- **Medium retention value: eight** medium retention value trees (Trees 9-15 and 19)
- **Low retention value: three** low retention value trees (Trees 5, 16 and 18)

OFFSETS

Any loss of trees should be offset with replacement planting in accordance with the relevant offset policy. It is understood that the broader development proposal includes biodiversity offsets and we recommend that these are updated with the final footprint, including the road widening.

4. Tree protection plan

- All tree pruning and removal is to be carried out by an arborist with a minimum AQF Level 3 qualification in Arboriculture.
- All tree work must be in accordance with Australian Standard *AS 4373-2007, Pruning of Amenity Trees* and the NSW WorkCover Code of Practice for the Amenity Tree Industry (1998).
- Permission must be granted from the relevant consent authority prior to removing or pruning of any of the subject trees. Approved tree works should not be carried out before the installation of tree protection measures.
- Any additional construction activities within the TPZ of the subject trees must be assessed and approved by the project arborist and must comply with *AS 4970-2009 - Protection of trees on development sites*.

Tree protection measures are summarised in Table 4 and further information is in Appendix E.

Table 4: Summary of tree protection measures

Type	More details	Comment
Signage	Appendix E1	Prominently sign posted with 300 mm x 450 mm boards stating, "NO ACCESS - TREE PROTECTION ZONE".
Tree protection fencing	Appendix E1	Protective cyclone chain wire link fence to be erected around the TPZ to protect and isolate retained trees from the construction works. Existing boundary fencing may be used.
Crown protection	Appendix E2	Where required, crown protection may include the installation of a physical barrier, pruning selected branches to establish clearance, or the tying/bracing of branches.
Trunk and branch protection	Appendix E3	When fencing is not practical or prior to any activities within the TPZ, trunk protection is required and consist of a layer geotextile fabric or similar followed by 1.8 m lengths of softwood timbers spaced evenly around the trunk and secured with a galvanised hoop strap.
Ground protection	Appendix E4	Install and maintain 100mm thick layer of mulch around tree in TPZ. For machine or vehicle access within TPZ geotextile fabric beneath crushed rock or rumble boards may be required.
Soil moisture		Soil moisture levels should be regularly monitored by the project arborist. Temporary irrigation or watering may be required within TPZ.
Root protection and investigation	Appendix E5	If incursions/excavation within the TPZ are unavoidable, root investigation may be needed to determine the extent and location of roots within the area of construction activity using non-destructive excavation (NDE) methods.
Underground services	Appendix E6	All underground services should be routed outside of the TPZ. If underground services need to be installed within the TPZ, they should be installed using horizontal directional drilling (HDD), non-destructive excavation (NDE) methods such as hydro-vacuum, Air Spade or manually excavated trenches.

5. Hold points, inspection and certification

An AQF Level 5 Consulting Arborist needs to be engaged to supervise work within the TPZ, provide advice regarding tree protection and monitor compliance. Once each stage is reached, the work will be inspected and certified by the project arborist and the next stage may commence. Alterations to this schedule may be required due to necessity, however, this shall be through consultation with the project arborist only.

A copy of this report must be available on-site prior to the commencement of works, and throughout the entirety of the project. Hold points have been specified in the schedule of works below to ensure trees are adequately protected during construction. It is the responsibility of the principal contractor to complete each of the tasks.

Pre-construction

Indicate clearly (with spray paint on trunks) trees marked for removal.

During construction

Monthly inspection of trees by the project arborist (or other timing as agreed with the project arborist). Notification to be given prior to the commencement of work within the TPZ, with supervision by the project arborist of any work undertaken in this zone.

Post-construction

Final inspection of trees by project arborist after all major construction has ceased and following the removal of tree protection measures.

6. References

6.1 General references

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Standards Australia 2007. *Australian Standard: Pruning of amenity trees, AS 4373 (2007)*, Standards Australia, Sydney.

Standards Australia 2009. *Australian Standard: Protection of trees on development sites, AS 4970 (2009)*. Standards Australia, Sydney.

6.2 Project specific references

Penrith City Council 2014. *Appendix F1 Definitions, Penrith Development Control Plan 2014*. Volume 2. Pg. 22

Warren Smith & Partners Pty Ltd 2020. *External Works Plan Sheet 1 & 4*. Dwg. no. C7.01 & C7.04. Job no. 5936001. Issue 3. Dated June 2020

Warren Smith & Partners Pty Ltd 2020. *Nepean Gardens Tree Removal Plan Sheet 1, 2 & 3*. Dwg. no. C2.11, C2.12 & C2.13. Job no. 5936001. Issue 1. Dated June 2020

Warren Smith & Partners Pty Ltd 2020. *Swept Paths – Sheet 1*. Dwg. no. C9.01. Job no. 5936001. Issue 2. Dated June 2020

Appendix A Tree retention assessment method

A1 Tree Significance Assessment Criteria - STARS©

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

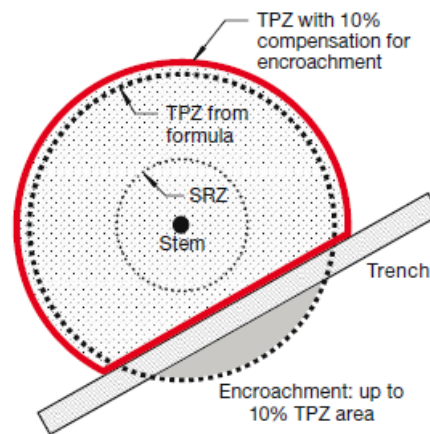
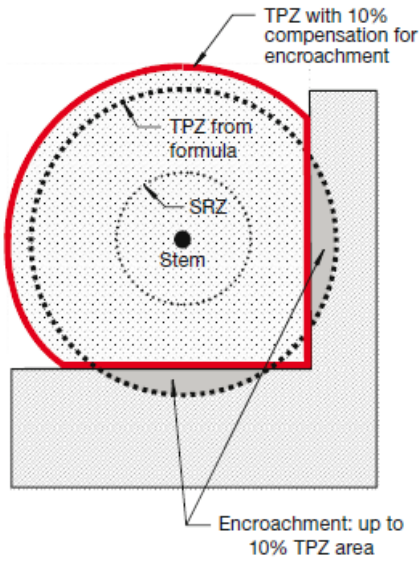
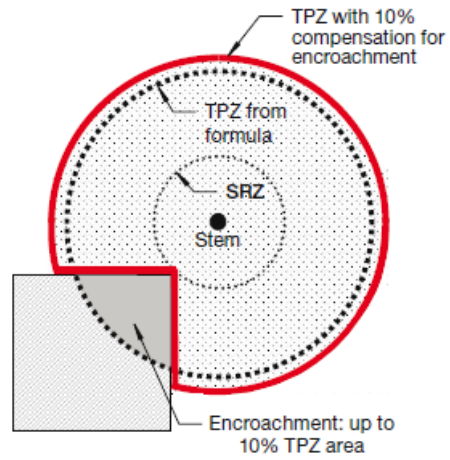
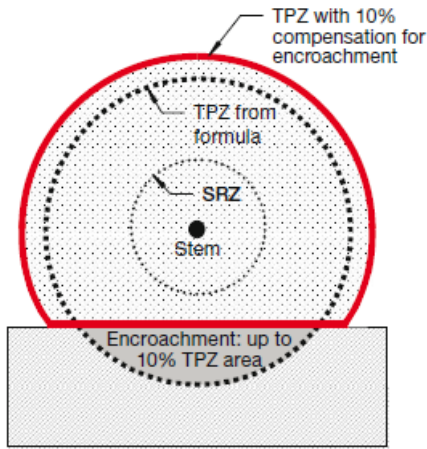
Low	Medium	High
<p>The tree is in fair-poor condition and good or low vigour.</p> <p>The tree has form atypical of the species</p> <p>The tree is not visible or is partly visible from the surrounding properties or obstructed by other vegetation or buildings</p> <p>The tree provides a minor contribution or has a negative impact on the visual character and amenity of the local area</p> <p>The tree is a young specimen which may or may not have reached dimensions to be protected by local Tree Preservation Orders or similar protection mechanisms and can easily be replaced with a suitable specimen</p> <p>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</p> <p>The tree is listed as exempt under the provisions of the local Council Tree Preservation Order or similar protection mechanisms</p> <p>The tree has a wound or defect that has the potential to become structurally unsound.</p> <p>Environmental Pest / Noxious Weed</p> <p>The tree is an environmental pest species due to its invasiveness or poisonous/allergenic properties. The tree is a declared noxious weed by legislation.</p> <p>Hazardous /Irreversible Decline</p> <p>The tree is structurally unsound and / or unstable and is considered potentially dangerous.</p> <p>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.</p>	<p>The tree is in fair to good condition and good or low vigour</p> <p>The tree has form typical or atypical of the species</p> <p>The tree is a planted locally indigenous or a common species with its taxa commonly planted in the local area</p> <p>The tree is visible from surrounding properties, although not visually prominent as partially obstructed by other vegetation or buildings when viewed from the street</p> <p>The tree provides a fair contribution to the visual character and amenity of the local area</p> <p>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</p>	<p>The tree is in good condition and good vigour</p> <p>The tree has a form typical for the species</p> <p>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.</p> <p>The tree is listed as a heritage item, threatened species or part of an endangered ecological community or listed on Council's significant tree register</p> <p>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.</p> <p>The tree supports social and cultural sentiments or spiritual associations, reflected by the broader population or community group or has commemorative values.</p> <p>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.</p>

A2 Matrix assessment - STARS©

		Tree significance				
		High	Medium	Low		
		Significance in Landscape	Significance in Landscape	Significance in Landscape	Environmental Pest/Noxious Weed Species	Hazardous/Irreversible Decline
Useful Life Expectancy	Long >40 years					
	Medium 15-40 years					
	Short <1-15 years					
	Dead					

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

Appendix B Encroachment into tree protection zones - AS 4970-2009



Appendix C Maps



Figure 3: Tree locations



Figure 4: Retention value



Figure 5: Arboricultural impact assessment

Appendix D Tabulated results of arboricultural assessment

Tree	Botanical name	Height (m)	Spread (m)	Health	Structure/ Tree AZ	ULE	DBH (mm)	TPZ (m)	SRZ (m)	Landscape significant	Retention value	Impact	Notes
1	<i>Eucalyptus tereticornis</i>	19	10	Fair	Good	Medium (15-40 years)	980	11.8	3.3	High	High	High Impact: >20%	branch tip dieback, thinning canopy
2	<i>Eucalyptus tereticornis</i>	18	8	Fair	Fair	Medium (15-40 years)	650	7.8	2.8	High	High	High Impact: >20%	pruned, lopped, branch tip dieback
3	<i>Eucalyptus tereticornis</i>	18	10	Good	Good	Long (>40 years)	600	7.2	2.7	High	High	High Impact: >20%	good vigour and form
4	<i>Syagrus romanzoffianum</i>	8	3	Fair	Fair	Medium (15-40 years)	260	3.1	1.9	Low	Low	Low Impact: <10%	pruned under wires, exempt
5	<i>Ligustrum sinense</i>	6	5	Good	Fair	Medium (15-40 years)	300	3.6	2.0	Low	Low	No Impact: 0%	weed
6	<i>Eucalyptus tereticornis</i>	17	10	Fair	Fair	Medium (15-40 years)	500	6.0	2.5	High	High	High Impact: >20%	asymmetrical, dieback, deadwood
7	<i>Angophora subvelutina</i>	17	7	Poor	Fair	Short (5-15 years)	650	7.8	2.8	Medium	Low	Low Impact: <10%	pruned under wires, dieback, stubs, epis, fungal bracket, over mature
8	<i>Grevillea robusta</i>	18	12	Good	Fair	Medium (15-40 years)	500	6.0	2.5	Medium	Medium	Low Impact: <10%	pruned under wires, multitrunked
9	<i>Araucaria columnaris</i>	15	6	Good	Good	Medium (15-40 years)	400	4.8	2.3	Medium	Medium	No Impact: 0%	good form and vigour
10	<i>Callistemon citrinus</i>	4	5	Good	Good	Medium (15-40 years)	300	3.6	2.0	Medium	Medium	No Impact: 0%	planted large shrub, part of hedge
11	<i>Callistemon citrinus</i>	4	5	Good	Fair	Medium (15-40 years)	300	3.6	2.0	Medium	Medium	No Impact: 0%	large shrub
12	<i>Callistemon salignus</i>	7	6	Fair	Fair	Medium (15-40 years)	350	4.2	2.1	Medium	Medium	No Impact: 0%	dieback, multitrunked
13	<i>Callistemon citrinus</i>	5	6	Fair	Fair	Medium (15-40 years)	300	3.6	2.0	Medium	Medium	No Impact: 0%	multitrunked, fair union, deadwood
14	<i>Callistemon citrinus</i>	5	5	Fair	Fair	Medium (15-40 years)	269	3.2	1.9	Medium	Medium	No Impact: 0%	multitrunked, dieback
15	<i>Callistemon citrinus</i>	6	7	Fair	Fair	Medium (15-40 years)	289	3.5	2.0	Medium	Medium	No Impact: 0%	multitrunked, fair union, deadwood, sooty mould
16	<i>Callistemon citrinus</i>	6	6	Fair	Fair	Short (5-15 years)	200	2.4	1.7	Medium	Low	No Impact: 0%	pruned, lopped, multitrunked, deadwood
17	<i>Lophostemon confertus</i>	17	7	Fair	Good	Long (>40 years)	480	5.8	2.4	Medium	High	No Impact: 0%	small deadwood, good form
18	<i>Callistemon citrinus</i>	4	4	Fair	Fair	Medium (15-40 years)	180	2.2	1.6	Low	Low	No Impact: 0%	multiple branches lopped
19	<i>Callistemon salignus</i>	7	4	Fair	Fair	Medium (15-40 years)	300	3.6	2.0	Medium	Medium	No Impact: 0%	multitrunked, sooty mould, thinning canopy
20	<i>Eucalyptus tereticornis</i>	16	10	Good	A1	Medium (15-40 years)	400	4.8	2.3	Medium	Medium	High Impact: >20%	Co dominant leaders from 2m
21	<i>Eucalyptus tereticornis</i>	15	8	Good	A1	Medium (15-40 years)	390	4.7	2.2	Medium	Medium	High Impact: >20%	Two trunks from base
22	<i>Eucalyptus tereticornis</i>	20	15	Good	A1	Medium (15-40 years)	560	6.7	2.6	Medium	Medium	High Impact: >20%	Two trunks from base. Unrecorded sapling 4 m east of this tree.
23	<i>Eucalyptus tereticornis</i>	25	20	Good	A1	Medium (15-40 years)	1050	12.6	3.4	High	High	High Impact: >20%	
24	<i>Eucalyptus tereticornis</i>	8	2	Good	A1	Long >40 years	100	2.0	1.5	Low	Medium	High Impact: >20%	
25	<i>Acacia sp</i>	8	2	Average	A1	Short (5-15 years)	100	2.0	1.5	Low	Low	High Impact: >20%	
26	<i>Ligustrum lucidum</i>	10	8	Good	Z3	Medium (15-40 years)	140	2.0	1.5	Low	Low	High Impact: >20%	Included co dominant leaders from base
27	<i>Cinnamomum camphora</i>	8	5	Good	Z3	Long (>40 years)	150	2.0	1.5	Low	Medium	High Impact: >20%	Low quality sucker regrowth. Several small individuals and one multi leader individual located close to each other.
28	<i>Eucalyptus tereticornis</i>	12	5	Average	A2	Medium (15-40 years)	200	2.4	1.7	Low	Low	High Impact: >20%	Suppressed by nearby dominant canopy
29	<i>Eucalyptus tereticornis</i>	12	8	Good	A2	Medium (15-40 years)	300	3.6	2.0	Low	Low	High Impact: >20%	Suppressed by nearby dominant canopy, Phototropism
30	<i>Eucalyptus tereticornis</i>	12	10	Good	A1	Medium (15-40 years)	350	4.2	2.1	Medium	Medium	High Impact: >20%	Co dominant leaders from,1.5 m
31	<i>Ligustrum lucidum</i>	8	8	Good	Z3	Medium (15-40 years)	200	2.4	1.7	Low	Low	High Impact: >20%	Multiple leaders from 1 m. DBH measurement taken below junction.
32	<i>Eucalyptus tereticornis</i>	22	15	Good	A1	Medium (15-40 years)	500	6.0	2.5	High	High	High Impact: >20%	Co dominant leaders from,3 m

Tree	Botanical name	Height (m)	Spread (m)	Health	Structure/ Tree AZ	ULE	DBH (mm)	TPZ (m)	SRZ (m)	Landscape significant	Retention value	Impact	Notes
33	<i>Eucalyptus teriticornis</i>	12	8	Good	A2	Medium (15-40 years)	350	4.2	2.1	Medium	Medium	High Impact: >20%	Co dominant leaders from 1.5 m. 4 x small Acacias nearby to the north. Unrecorded short-lived saplings.
34	<i>Eucalyptus teriticornis</i>	18	10	Average	Z4	Short (5-15 years)	500	6.0	2.5	Medium	Low	High Impact: >20%	Basal area to over 2 m is affected by borers. Tree displays phototrophic asymmetry and some dieback.
35	<i>Malus sp</i>	8	5	Good	A1	Medium (15-40 years)	250	3.0	1.8	Low	Low	High Impact: >20%	Located within blackberry thicket. DBH estimated.
36	<i>Grevillea robusta</i>	8	4	Good	A1	Medium (15-40 years)	100	2.0	1.5	Low	Low	High Impact: >20%	

Appendix E Tree protection guidelines

The following tree protection guidelines must be implemented during the construction period if no tree-specific recommendations are detailed.

E1 Tree protection fencing

The TPZ is a restricted area delineated by protective fencing or the use of an existing structure (such as a wall or fence).

Trees that are to be retained must have protective fencing erected around the TPZ (or as specified in the body of the report) to protect and isolate it from the construction works. Fencing must comply with the Australian Standard, AS 4687-2007, Temporary fencing and hoardings.

Tree protection fencing must be installed prior to site establishment and remain intact until completion of works. Once erected, protective fencing must not be removed or altered without the approval of the project arborist.

If the protective fencing requires temporary removal, trunk, branch and ground protection must be installed and must comply with AS 4970-2009, *Protection of Trees on Development Sites*.

Tree protection fencing shall be:

- Enclosed to the full extent of the TPZ (or as specified in the Recommendations and Tree Protection Plan).
- Cyclone chain wire link fence or similar, with lockable access gates.
- Certified and Inspected by the Project Arborist.
- Installed prior to any machinery or material are brought to site and before the commencement of works.
- Prominently sign posted with 300 mm x 450 mm boards stating, "NO ACCESS - TREE PROTECTION ZONE".

E2 Crown protection

Tree crowns/canopy may be injured or damaged by machinery such as; excavators, drilling rigs, trucks, cranes, plant and vehicles. Where crown protection is required, it will usually be located at least one meter outside the perimeter of the crown.

Crown protection may include the installation of a physical barrier, pruning selected branches to establish clearance, or the tying/bracing of branches.

E3 Trunk protection

Where provision of tree protection fencing is impractical or must be temporarily removed, trunk protection shall be installed for the nominated trees to avoid accidental mechanical damage.

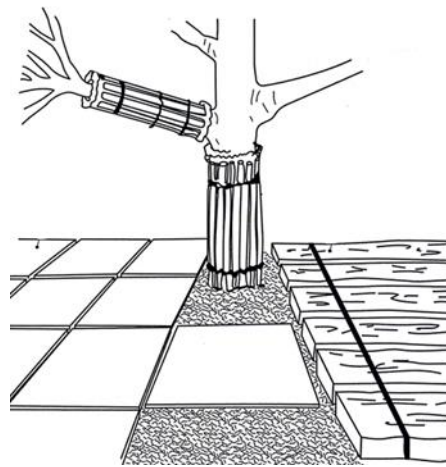
The removal of bark or branches allows the potential ingress of micro-organisms which may cause decay. Furthermore, the removal of bark restricts the trees' ability to distribute water, mineral ions (solutes), and glucose.

Trunk protection shall consist of a layer of either carpet underfelt, geotextile fabric or similar wrapped around the trunk, followed by 1.8 m lengths of softwood timbers aligned vertically and spaced evenly around the trunk (with an approx. 50 mm gap between the timbers).

The timbers must be secured using galvanised hoop strap (aluminium strapping). The timbers shall be wrapped around the trunk but not fixed to the tree, as this will cause injury/damage to the tree.



Tree protection fencing



Trunk protection fencing

E4 Ground protection

Tree roots are essential for the uptake/absorption of water, oxygen and mineral ions (solutes). It is essential to prevent the disturbance of the soil beneath the dripline and within the TPZ of trees that are to be retained. Soil compaction within the TPZ will adversely affect the ability of roots to function correctly.

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. Maintain a thick layer of mulch around all retained trees to a depth of 100 mm using coarse pine bark or wood chip material that complies with AS 4454. Where the existing landscape within the TPZ is to remain unaltered (e.g. garden beds or turf) mulch may not be required.

For heavy vehicle access within TPZ, ground protection may include a permeable membrane such as geotextile fabric beneath a layer of crushed rock or rumble boards.

If the grade is to be raised within the TPZ, the material should be coarser or more porous than the underlying material.

E5 Root protection and investigation

If incursions/excavation within the TPZ are unavoidable, root investigation may be needed to determine the extent and location of roots within the area of construction activity. The location and distribution of roots are found through non-destructive excavation (NDE) methods such as hydro-vacuum excavation (sucker truck), air spade and manual excavation. Root investigation does not guarantee the retention of the tree.

If the project arborist identifies conflicting roots that requiring pruning, they must be pruned with a sharp implement such as; secateurs, pruners, handsaws or a chainsaw back to undamaged tissue. The final cut must be a clean cut.

E6 Underground services

All underground services should be routed outside of the TPZ. If underground services need to be installed within the TPZ, they should be installed using horizontal directional drilling (HDD), non-destructive excavation (NDE) methods such as hydro-vacuum, Air Spade or manually excavated trenches. The horizontal drilling/boring must be at minimum depth of 600 mm below grade. Trenching for services is to be regarded as “excavation”. The project arborist should assess the likely impacts of boring and bore pits on retained trees.

Appendix F Site plan

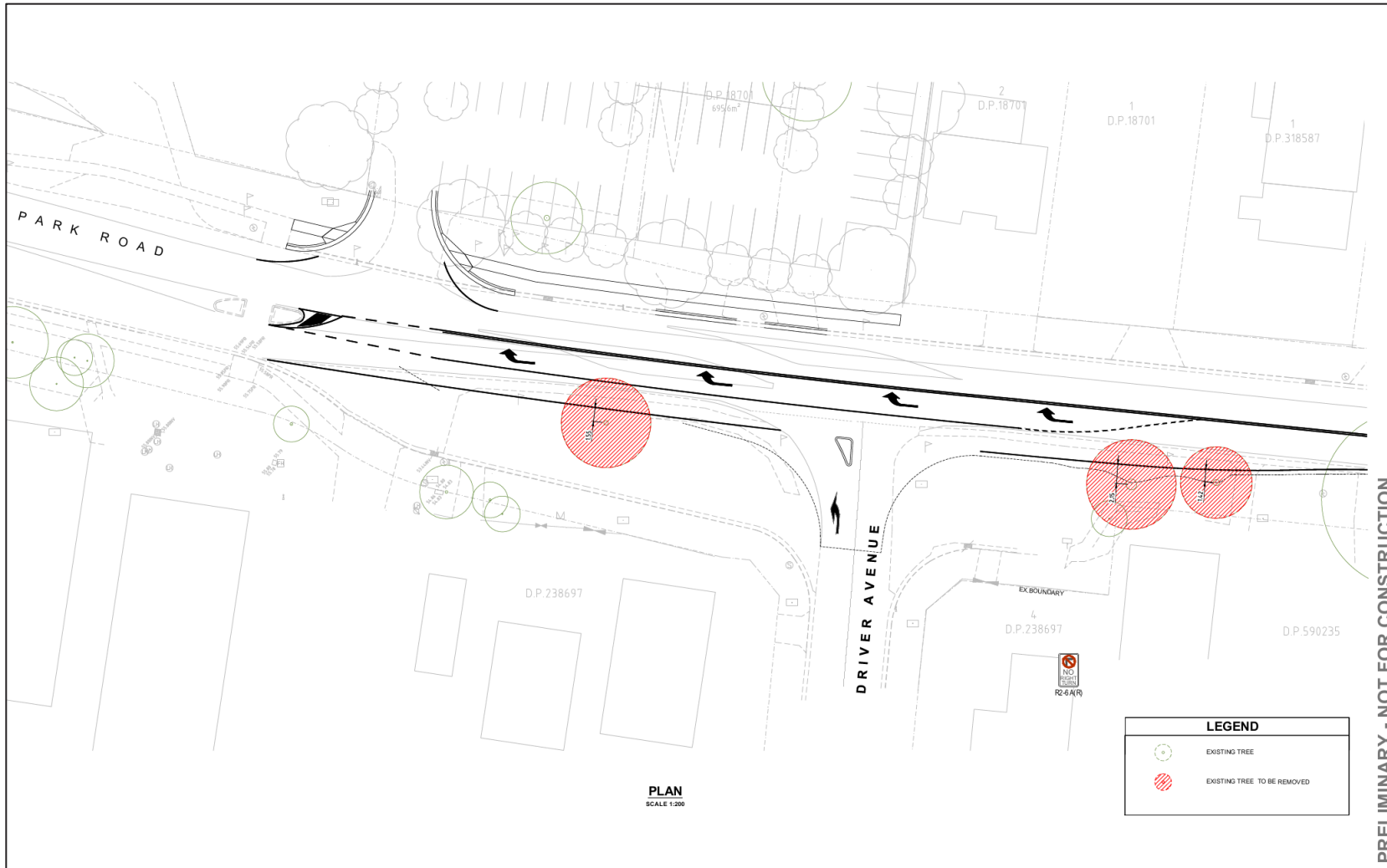


Figure 6: Tree removal plan sheet 1 (Warren Smith & Partners 2020)

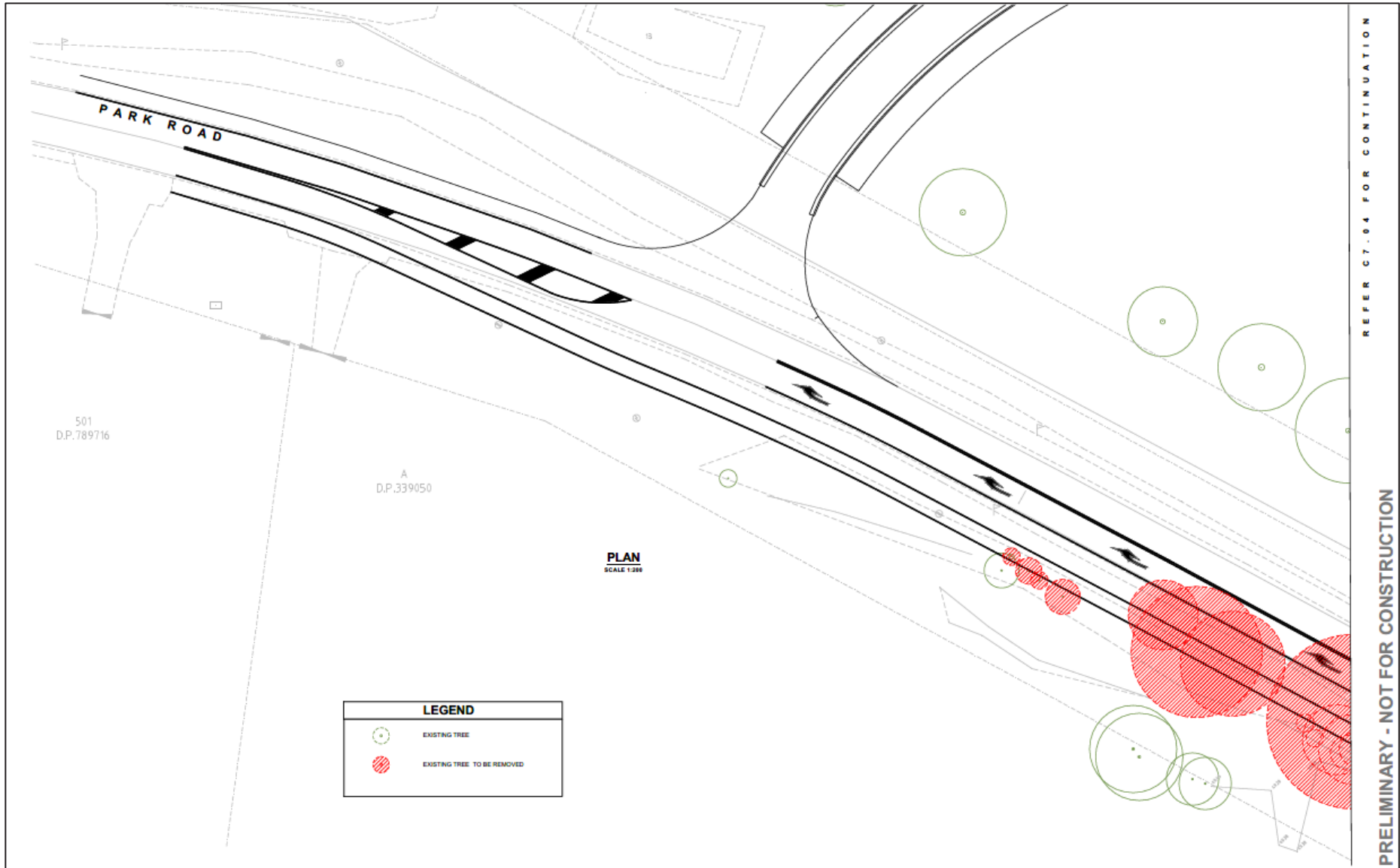


Figure 7: Tree removal plan sheet 2 (Warren Smith & Partners 2020)

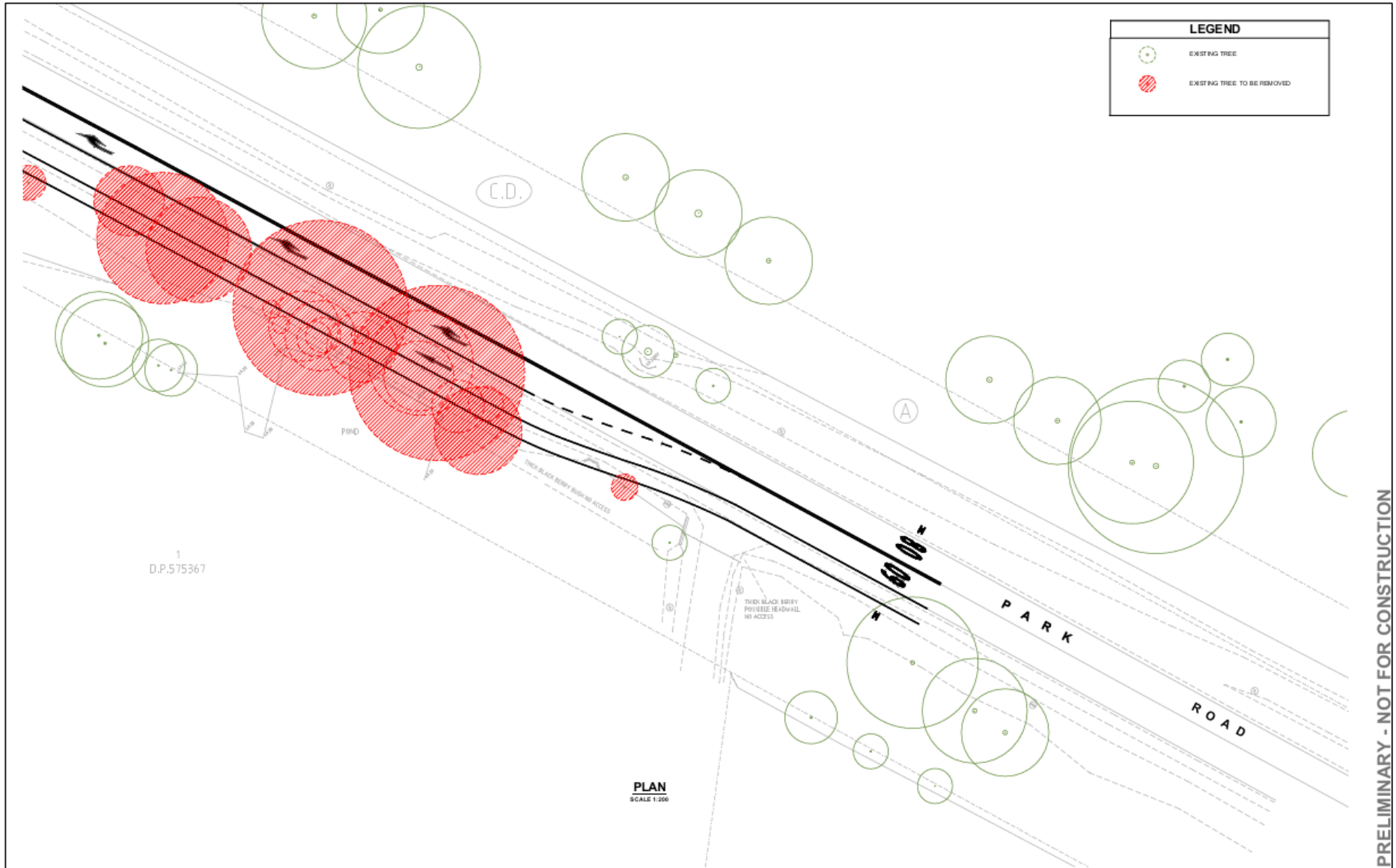


Figure 8: Tree removal plan sheet 3 (Warren Smith & Partners 2020)

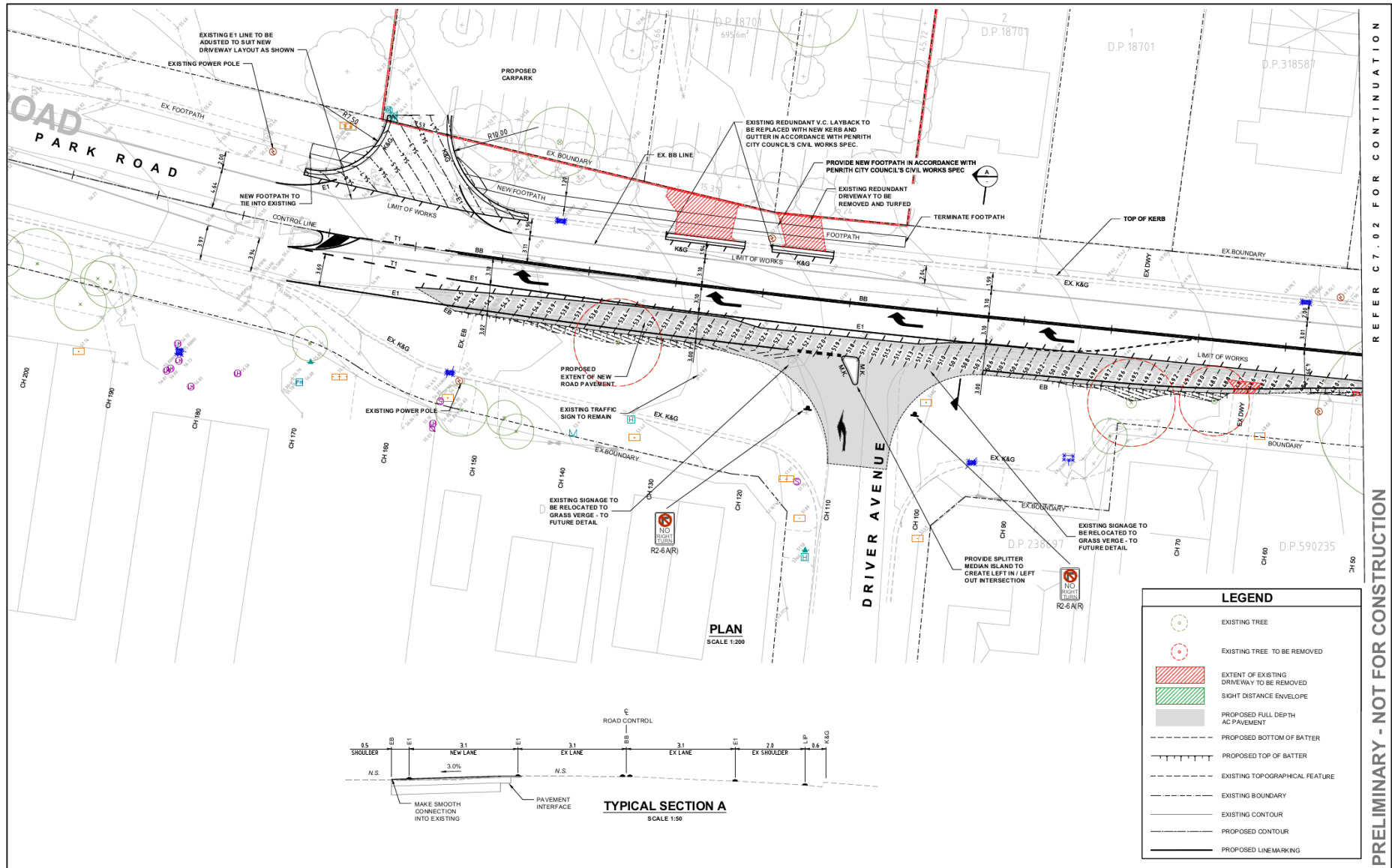


Figure 9: External works plan sheet 1 (Warren Smith & Partners 2020)

Appendix G Site photos



Figure 11: Trees 1 to 3



Figure 12: Trees 4 and 5



Figure 13: Tree 6



Figure 14: Tree 7



Figure 15: Tree 7 fungal bracket



Figure 16: Tree 8



Figure 17: Tree 9



Figure 18: Trees 10 to 18



Figure 19: Tree 19



Figure 20: Tree 20

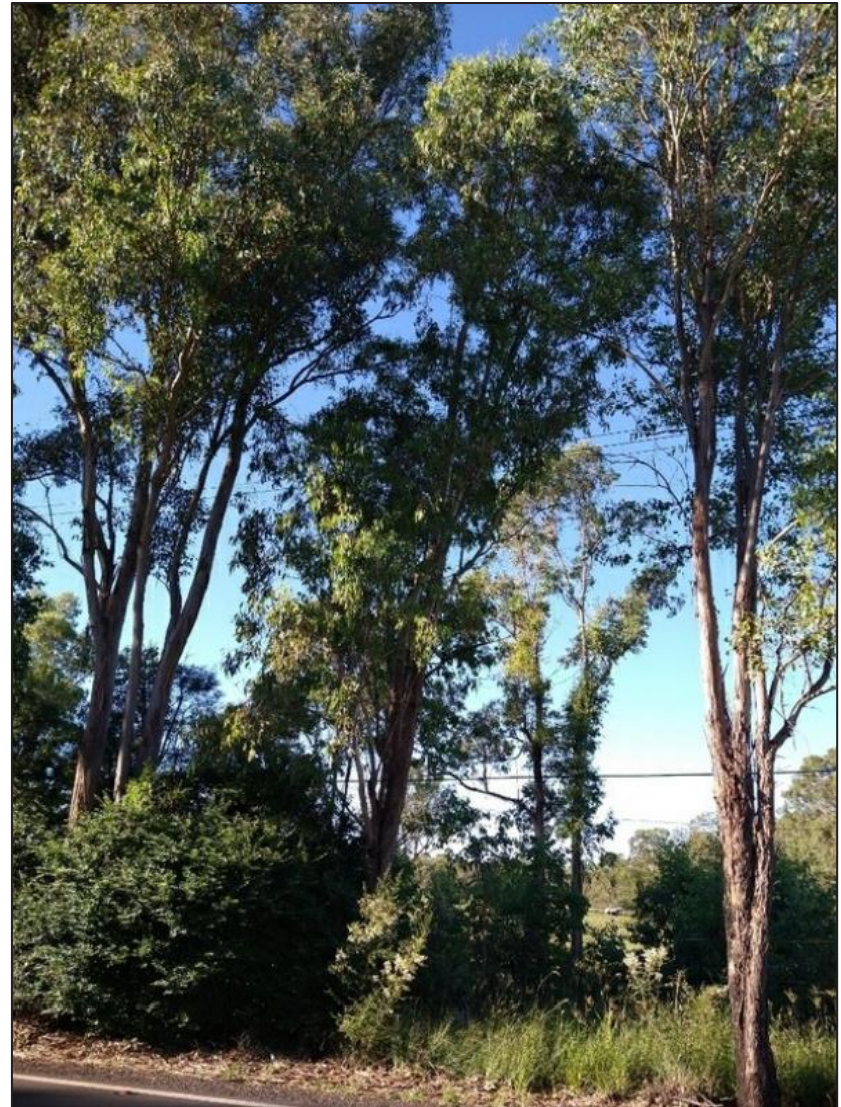


Figure 21: Tree 21



Figure 22: Tree 22



Figure 23: Tree 23



Figure 24: Tree 24



Figure 25: Tree 25



Figure 26: Tree 26



Figure 27: Tree 27



Figure 28: Tree 28



Figure 29: Tree 29

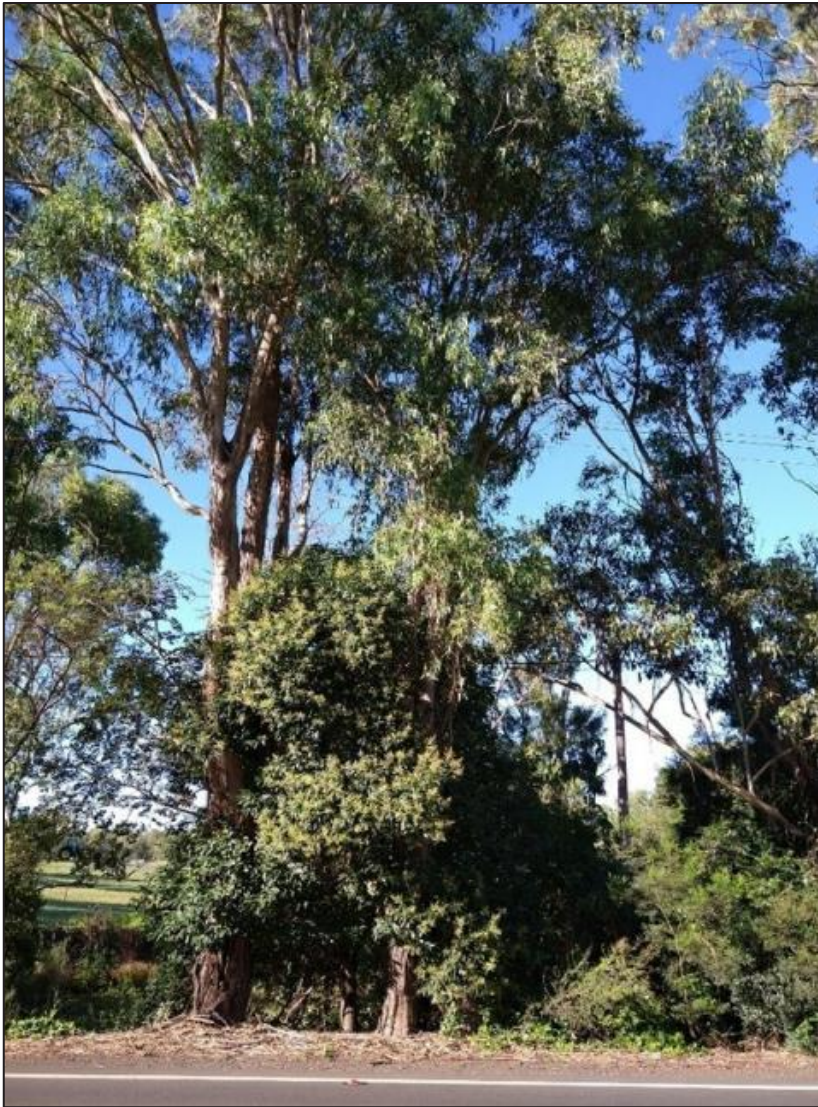


Figure 30: Tree 30 and 31



Figure 31: Tree 32



Figure 32: Tree 33



Figure 33: Tree 34



Figure 34: Tree 35



Figure 35: Tree 36

