

## Appendix F – Arboricultural Impact Assessment Reports



# Moss Vale Regional Rail Enabling Works Arboricultural Impact Assessment

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**Aurecon Pty Ltd**

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## DOCUMENT TRACKING

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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 (AIA) was prepared for Aurecon Pty Ltd in relation to a proposed regional rail enabling works at Moss Vale train station. 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	Argyle Street, Moss Vale NSW 2577
Lot and DP	Lot 1, 3 and 4 DP1173719 (partial)
Local Government Area	Wingecarribee Shire 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 – 16 trees are subject to high impact (>20% TPZ encroachment) and require removal to enable the proposed regional rail works.
Pruning vegetation	Yes – Only pruning of a ‘minor nature’ as defined by the Wingecarribee Shire Council (2021) will be undertaken.
Earthworks including regrading, excavation and trenching <ul style="list-style-type: none"> <li>• For building</li> <li>• For services</li> </ul>	<p>Yes, excavation works will be undertaken to facilitate the stabling of the new fleet (the proposal). Key features of the proposal are:</p> <ul style="list-style-type: none"> <li>• Main access road</li> <li>• Amenities block, relocation of the existing amenities block located from the existing stabling yard to the new stabling yard to accommodate the extended roads. This includes: <ul style="list-style-type: none"> <li>- All associated services required such as communications, data, power, water, sewer</li> <li>- Vehicle access provisions including garbage removal, stores and delivery of cleaning supplies</li> </ul> </li> </ul>

Activities that can impact trees	Description of proposed activities
	<ul style="list-style-type: none"> <li>• Parking bays</li> <li>• Proposed asphalt walkway</li> <li>• Track</li> <li>• Friction buffer stop for each track</li> <li>• Proposed noise and extension of existing noise barriers</li> <li>• Combined services route (CSR) including trenching work for underground cables and galvanised steel troughing (width approx. 500 mm)</li> <li>• High voltage (HV) works, introduction of new HV supply for shore supply points to suit stabling extension including upgraded cables, switch board(s), cabinets and connection to the new trains</li> <li>• Low voltage enabling works</li> <li>• Noise wall along Lackey Road at the Stabling Yard</li> </ul>
Changes to stormwater management	Yes – the lengthening of the two existing storage and servicing sidings located on the city side of the fuel point on the up side to accommodate six three car sets and associated earthworks, drainage (track drainage and stormwater drainage), footpaths, lighting, gates, fencing and potable water to accommodate the reconfigured stabling yard
Landscaping	No, the scope of works does not include the remit for any landscaping works.





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.

Wingecarribee Shire Council defines a tree as:

*'having a height of 6 m; and has an outside circumference of at least 500 mm at a height of 1m above ground; or has an outside circumference of at least 500 mm measured at ground level where the tree has been cut down or removed; or has a branch and foliage crown spread of at least 4 m'* (Wingecarribee Shire Council 2010).

### 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 **43 subject trees** were inspected on Wednesday 9 December 2020 by AQF Level 5 Consulting Arborist, Roger Uebe.

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 locations of the subject trees were recorded using hand-held GPS units. These placements have error in the accuracy of approximately 2 - 20 m.
- 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 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 or re-location of building/s 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.

## 2.4 Protection zones

### 2.4.1 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.

### 2.4.2 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.

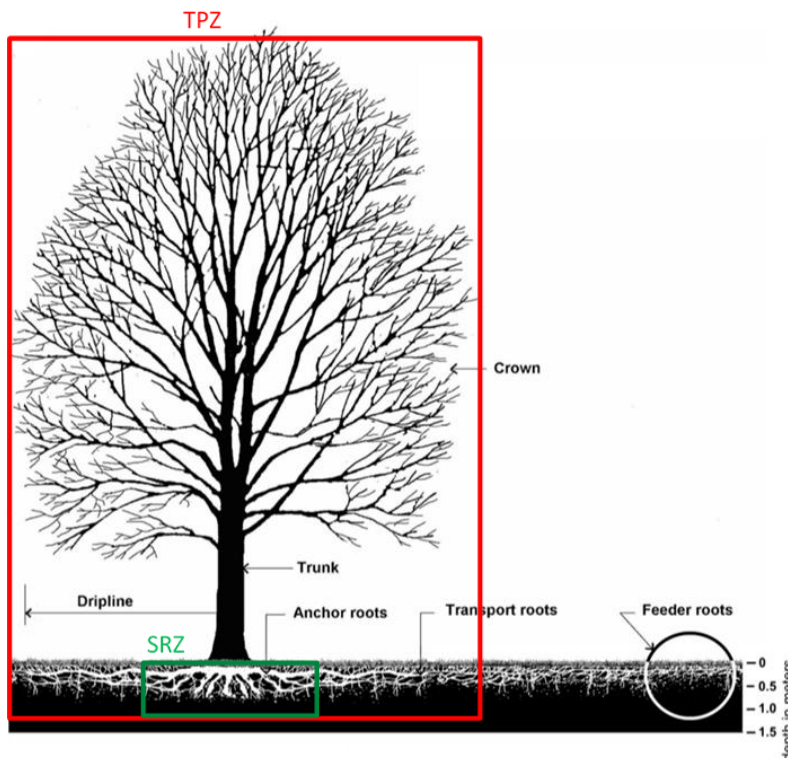


Figure 2: Representative tree structure and indicative TPZ and SRZ

## 2.5 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.

## 2.6 Proposed action

The proposed actions to either retain or remove each tree are determined by the impact from the proposed design footprint, conversations of intent with the client and corresponding mitigation measures. Proposed actions are defined as follows:

- **Remove:** Trees that are to be impacted by the proposed development to the extent whereby retention is not suitable and / or incompatible if the current plans are approved. All tree removal must comply with guidelines specified in section 4 of this report and subject to regulatory approval.

- **Retain:** Trees that are suitable for retention granted they follow the specific mitigation measures discussed in section 3 and / or the tree protection measures outlined in section 4 and / or the tree protection guidelines outlined in Appendix E.

### 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	Proposed to be removed (high impact)	Potential to be retained subject to further investigation (medium impact)	Proposed to be retained (low impact)	Proposed to be retained (no impact)	Total
Priority for retention (High)	3	3	3	4	13
Consider for retention (Medium)	9	2	3	7	21
Consider for removal (Low)	3	1	-	3	7
Priority for removal	1	1	-	-	2
<b>Total</b>	<b>16</b>	<b>7</b>	<b>6</b>	<b>14</b>	<b>43</b>

#### 3.1 Site overview

The northern end of the site contains a stand of *Ulmus glabra* (Golden Elms) most of which are inside the rail yard boundary. Most of these trees have previously been lopped off at approximately 1.5 to 2 m above ground and have reshot from their trunks. Four exotic species were identified within the site (Trees 1-12, 14-42 and 46). The majority (>90%) being *Ulmus glabra* (Trees 1-10 and 46). The remaining three being *Quercus robur* (Trees 25 and 26), *Populus alba* (Trees 37, 39-42) and *Cupressus leylandii* (Tree 12). Whilst the majority of these trees have poor structure, they do provide a good visual screen from the rail yard. The stand is quite wide so, if required, some of the inside trees could be removed to make space for construction without impacting on the visual amenity value.

All trees within the site were assessed as having a short to medium ULE, mostly due to the site conditions and past trimming practices. Whilst all trees within the site were exotic and, individually, they did not provide a high significance to the landscape, as a stand of vegetation they do provide a good visual screen from the rail yard. This screen is likely to be very important to the residents and businesses on the opposite side of Lackey Road.

Further details on the site assessment are provided below.

#### 3.2 Trees proposed to be removed (high impact)

A total of **16 trees** will be highly affected (high impact, 20% TPZ encroachment) by the proposed rail works and design modification/relocation would be required to retain these trees. Retention values are outlined below.

- **High retention value:** a total of **three** high retention value trees (Trees 10, 19 and 23)

- **Medium retention value:** a total of **nine** medium retention value trees (Trees 9, 11, 21, 22, 24, 25, 32, 35 and 46)
- **Low retention value:** a total of **three** low retention value trees (Trees 26, 27 and 28)
- **Priority for removal:** **one** tree (Trees 31) was assessed as hazardous and should be removed within the next 6 months as they have significant decay.

Any loss of trees should be offset with replacement planting in accordance with the TfNSW Offset Guide.

### 3.3 Trees with potential to be retained subject to further investigation (medium impact)

A total of **seven trees** will be subject to medium impact (<20% TPZ but >10% TPZ encroachment) from the proposed rail works. These trees may be retained subject to further investigation and mitigation measures. i.e. root mapping. The project arborist may require detailed root investigation to demonstrate that the trees would remain viable. Retention values are outlined below.

- **High retention value:** a total of **three** high retention value trees (Trees 20, 29 and 38)
- **Medium retention value:** a total of **two** medium retention value trees (Trees 37 and 39)
- **Low retention value:** **one** low retention value tree (Tree 41)
- **Priority for removal:** **one** tree (Trees 40) was assessed as hazardous and should be removed within the next 6 months as they have significant decay.

### 3.4 Trees to be retained (low impact and no impact)

A total of **six trees** will be subject to low impact (<10% TPZ encroachment) from the proposed rail works. These trees can be retained. Retention values are outlined below.

- **High retention value:** a total of **three** high retention value trees (Trees 15, 17 and 18)
- **Medium retention value:** a total of **three** medium retention value tree (Trees 8, 30 and 42)

A total of **14 trees** will be subject to no impact (0% TPZ encroachment) from the proposed rail works. These trees can be retained. Retention values are outlined below.

- **High retention value:** a total of **four** high retention value trees (Trees 12, 13, 14 and 16)
- **Medium retention value:** a total of **seven** medium retention value tree (Trees 1, 3, 4, 5, 6, 7 and 34)
- **Low retention value:** a total of **three** low retention value trees (Trees 2, 33 and 36).

## 4. Tree protection plan

- Only pruning works that are of a ‘minor nature,’ as defined by the Wingecarribee Shire Council can be undertaken. Pruning works that are exempt from requiring a Council Permit, but are to be undertaken under the supervision of an AQF Level 5 Consulting Arborist are as follows:
  - a) removing branches or other growth as part of the natural cultivation of the tree or plant, such a pruning roses, hydrangeas, fruit trees and vines, maintaining hedges or mowing of grass OR*
  - b) removing branches or other growth which has suffered storm, wind or similar damage. OR*
  - c) removing branches or other growth which is decayed and threatens the viability of the tree. OR*
  - d) removing branches or other growth in order to allow a planting up to four (4) metres in height to develop a stronger growth habit. OR*
  - e) removing branches or other growth from planting greater than four (4) metres in height, which will, in the opinion of a minimum AQF Level 3 professional Arborist, protect or enhance the growth and habit of that planting.*

Professional opinion from an AQF Level 5 Consulting Arborist shall be obtained in writing and be available for Council perusal if requested. Further TfNSW approval in consultation with Council would be required for any additional pruning works that is not outlined above.

- 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).
- 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*.
- Further approval would be required for additional tree removal in accordance with TfNSW planning approval processes.

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 (i.e. pre-construction, during construction and post-construction) 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.

This report is required to be incorporated into the project Construction Environmental Management Plan (CEMP). 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**

Inspections on trees to be retained are to be undertaken no less than six months apart until completion of the works (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

- Barrell, J. 2001. 'SULE: Its use and status into the new millennium', in *Management of mature trees, Proceedings of the 4th NAAA Tree Management Seminar*, NAAA, Sydney.
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- Harris, R.W., Matheny, N.P., and Clark, J.R., 1999. *Arboriculture: integrated management of landscape trees, shrubs, and vines*, Prentice Hall, Upper Saddle River, New Jersey.
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- Standards Australia 2003. *Composition, Soil and Mulches, AS 4454 (2003)*, Standards Australia, Sydney.
- 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

- Aurecon 2021. *Regional Rail Enabling Works Electrical – Low Voltage, Moss Vale Yard*. DRG No. RRPENW-AUR-MOS-CV-DRG-000104, Revision D, dated 6 June 2021
- Aurecon 2021. *Regional Rail Enabling Works Civil, Moss Vale Yard*. DRG No. RRPENW-AUR-MOS-CV-DRG-000101, Revision D, dated 6 June 2021
- Wingecarribee Shire Council 2010. *Section 6 Vegetation Management & Landscaping, A6.1 Preservation of Trees and Other Vegetation, A6.1.4 Definitions, Moss Vale Township Development Control Plan*. Effective 30 October 2019, pg. 53.
- Wingecarribee Shire Council 2021. *What "Pruning" is EXEMPT from requiring a Council Permit? Tree and Vegetation Management - Private Land*. [www.wsc.nsw.gov.au/Environment/Management-of-Trees-and-Vegetation/Tree-and-Vegetation-Management-Private-Land#section-5](http://www.wsc.nsw.gov.au/Environment/Management-of-Trees-and-Vegetation/Tree-and-Vegetation-Management-Private-Land#section-5).

## 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.

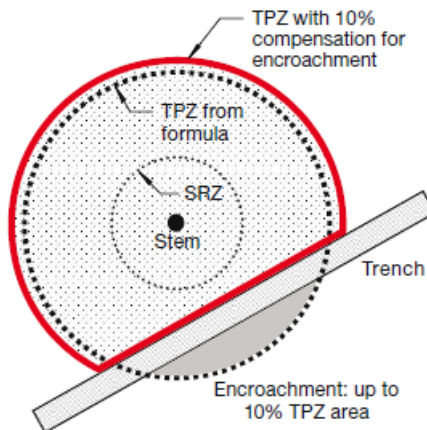
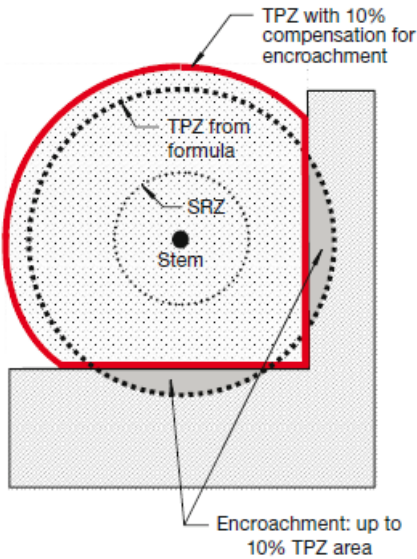
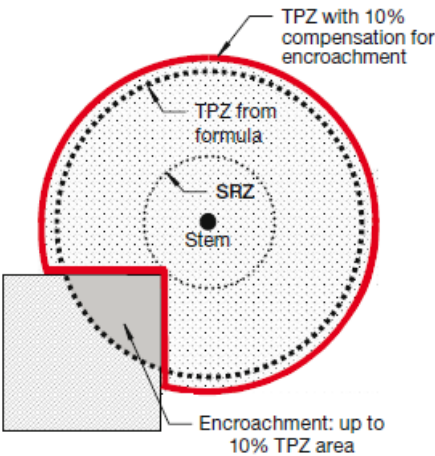
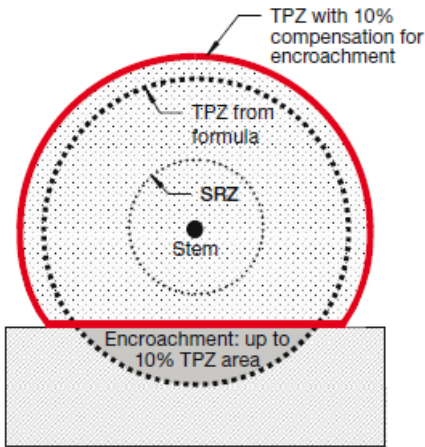
Low	Medium	High
<p>The tree is in fair-poor condition and good or low vigour.</p> <p>The tree has form atypical of the species</p> <p>The tree is not visible or is partly visible from the surrounding properties or obstructed by other vegetation or buildings</p> <p>The tree provides a minor contribution 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><b>Environmental Pest / Noxious Weed</b></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><b>Hazardous /Irreversible Decline</b></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><b>Priority for retention (High):</b> 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><b>Consider for retention (Medium):</b> 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><b>Consider for removal (Low):</b> Tree not considered important for retention, nor requiring special works or design modification to be implemented for their retention.</p>
	<p><b>Priority for removal:</b> 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 values



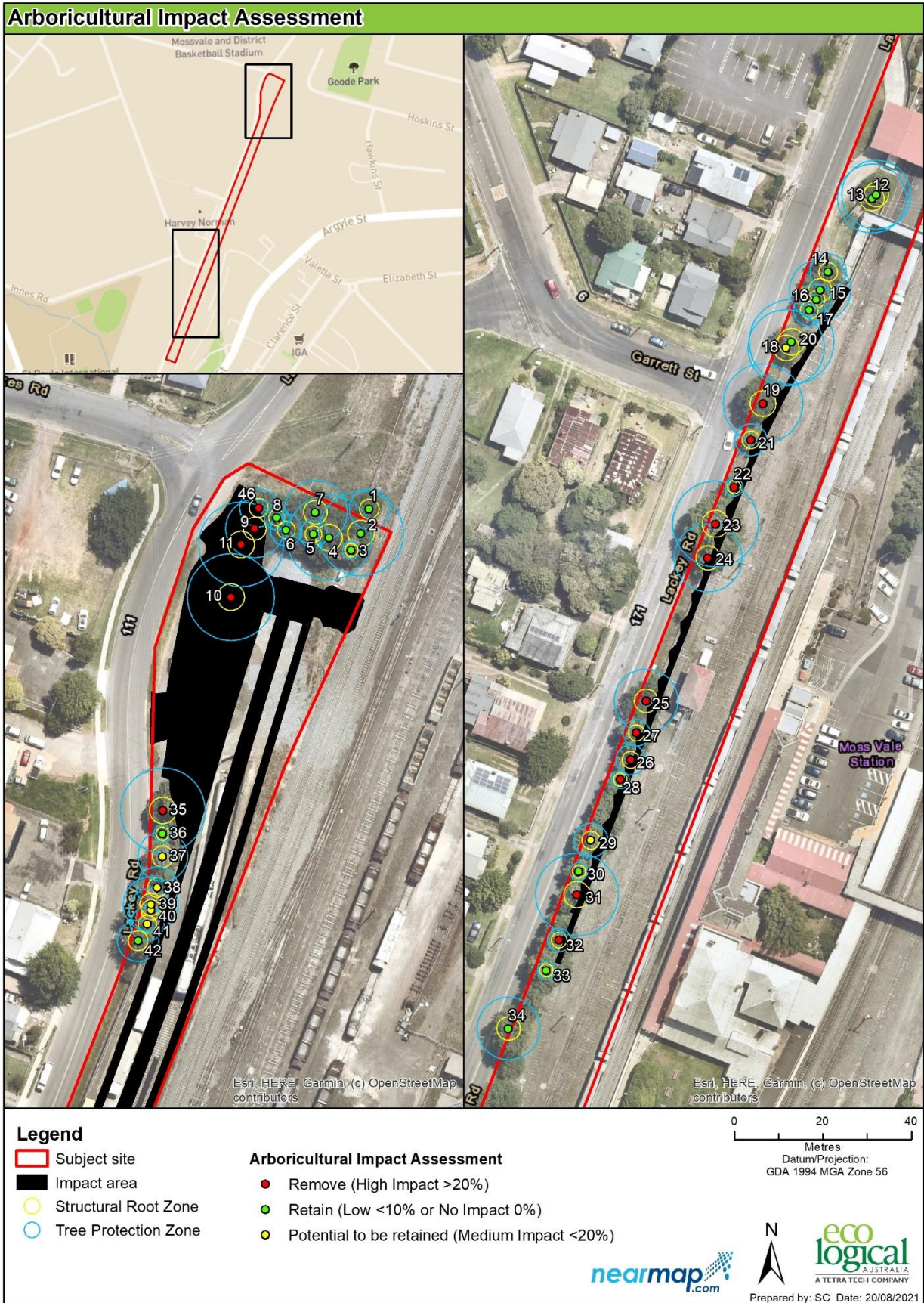


Figure 5: Arboricultural impact assessment

## Appendix D Tabulated results of arboricultural assessment

Tree	Botanical name	Height (m)	Spread (m)	Health	Structure	ULE	DBH (mm)	TPZ (m)	SRZ (m)	Retention value	Impact	Proposed action	Notes
1	<i>Ulmus glabra</i>	9	5	Good	Fair	Medium (15-40 years)	380	4.56	2.20	Medium	No Impact: 0%	Retain	tree has been lopped in past and now has multiple branch shoots
2	<i>Ulmus glabra</i>	10	6	Fair	Poor	Medium (15-40 years)	800	9.60	3.01	Low	No Impact: 0%	Retain	Multiple trunks
3	<i>Ulmus glabra</i>	10	6	Good	Poor	Short (5-15 years)	60	2.00	1.50	Medium	No Impact: 0%	Retain	all trees in this area have been lopped at BH and have reshot
4	<i>Ulmus glabra</i>	8	5	Good	Poor	Medium (15-40 years)	800	9.60	3.01	Medium	No Impact: 0%	Retain	Multiple trunks
5	<i>Ulmus glabra</i>	13	9	Good	Fair	Medium (15-40 years)	259	3.11	1.88	Medium	No Impact: 0%	Retain	Multiple trunks
6	<i>Ulmus glabra</i>	12	7	Good	Fair	Medium (15-40 years)	300	3.60	2.00	Medium	No Impact: 0%	Retain	Multiple trunks
7	<i>Ulmus glabra</i>	15	9	Good	Fair	Medium (15-40 years)	600	7.20	2.67	Medium	No Impact: 0%	Retain	Multiple trunks
8	<i>Ulmus glabra</i>	13	7	Good	Good	Medium (15-40 years)	230	2.76	1.79	Medium	Low Impact: <10%	Retain	straight trunk vines
9	<i>Ulmus glabra</i>	10	7	Good	Fair	Medium (15-40 years)	550	6.60	2.57	Medium	High Impact: >20%	Remove	Multiple trunks
10	<i>Ulmus glabra</i>	10	12	Good	Good	Medium (15-40 years)	820	9.84	3.04	High	High Impact: >20%	Remove	Multiple trunks
11	<i>Ulmus glabra</i>	11	11	Good	Fair	Medium (15-40 years)	800	9.60	3.01	Medium	High Impact: >20%	Remove	Multi trunked
12	<i>Cupressus x leylandii</i>	9	7	Good	Poor	Long (>40 years)	650	7.80	2.76	High	No Impact: 0%	Retain	DBH estimated, aesthetic high value
13	<i>Cupressus sempervirens</i>	9	7	Good	Good	Medium (15-40 years)	650	7.80	2.76	High	No Impact: 0%	Retain	remove this record double up
14	<i>Ulmus glabra</i>	10	5	Good	Good	Medium (15-40 years)	340	4.08	2.10	High	No Impact: 0%	Retain	screening value
15	<i>Ulmus glabra</i>	10	5	Good	Good	Medium (15-40 years)	580	6.96	2.63	High	Low Impact: <10%	Retain	
16	<i>Ulmus glabra</i>	9	5	Good	Good	Medium (15-40 years)	290	3.48	1.97	High	No Impact: 0%	Retain	
17	<i>Ulmus glabra</i>	7	5	Good	Good	Medium (15-40 years)	300	3.60	2.00	High	Low Impact: <10%	Retain	multiple regrowth trees providing screening value
18	<i>Ulmus glabra</i>	8	9	Good	Good	Medium (15-40 years)	800	9.60	3.01	High	Low Impact: <10%	Retain	Multiple trunks
19	<i>Ulmus glabra</i>	10	9	Good	Good	Medium (15-40 years)	750	9.00	2.93	High	High Impact: >20%	Remove	
20	<i>Ulmus glabra</i>	10	8	Good	Good	Medium (15-40 years)	720	8.64	2.88	High	Medium Impact: <20%	Potential to be retained subject to further investigation as outlined in section 3	
21	<i>Ulmus glabra</i>	6	4	Good	Fair	Medium (15-40 years)	300	3.60	2.00	Medium	High Impact: >20%	Remove	Multi-stemmed regrowth sucker
22	<i>Ulmus glabra</i>	9	9	Good	Fair	Medium (15-40 years)	150	2.00	1.50	Medium	High Impact: >20%	Remove	Multi-stemmed regrowth shoots provides good screen
23	<i>Ulmus glabra</i>	14	13	Good	Good	Medium (15-40 years)	810	9.72	3.03	High	High Impact: >20%	Remove	large tree providing high amenity value
24	<i>Ulmus glabra</i>	11	6	Good	Fair	Short (5-15 years)	640	7.68	2.74	Medium	High Impact: >20%	Remove	suppressed below tree 20 canopy however still provides good screen from rail yard
25	<i>Quercus robur</i>	10	9	Fair	Fair	Medium (15-40 years)	600	7.20	2.67	Medium	High Impact: >20%	Remove	under powerline multi stem good amenity screen
26	<i>Quercus robur</i>	11	3	Fair	Fair	Short (5-15 years)	280	3.36	1.94	Low	High Impact: >20%	Remove	suppressed by other trees

Tree	Botanical name	Height (m)	Spread (m)	Health	Structure	ULE	DBH (mm)	TPZ (m)	SRZ (m)	Retention value	Impact	Proposed action	Notes
27	<i>Ulmus glabra</i>	11	7	Good	Fair	Medium (15-40 years)	250	3.00	1.85	Low	High Impact: >20%	Remove	multiple regrowth shoots in one location provides good screen can easily be replaced
28	<i>Ulmus glabra</i>	9	12	Good	Poor	Short (5-15 years)	150	2.00	1.50	Low	High Impact: >20%	Remove	multiple regrowth shoots provide good screen for 10 m can easily be replaced
29	<i>Ulmus glabra</i>	10	7	Good	Fair	Medium (15-40 years)	320	3.84	2.05	High	Medium Impact: <20%	Potential to be retained subject to further investigation as outlined in section 3	one main tree with multiple regrowth shoots good screen
30	<i>Ulmus glabra</i>	9	6	Good	Fair	Short (5-15 years)	150	2.00	1.50	Medium	Low Impact: <10%	Retain	multiple regrowth shoots
31	<i>Ulmus glabra</i>	11	6	Fair	Poor	Remove (<5 years)	780	9.36	2.98	Priority for removal	High Impact: >20%	Remove	significant decay in trunk
32	<i>Ulmus glabra</i>	9	8	Good	Fair	Medium (15-40 years)	220	2.64	1.75	Medium	High Impact: >20%	Remove	multiple regrowth shoots
33	<i>Ulmus glabra</i>	7	8	Good	Fair	Short (5-15 years)	150	2.00	1.50	Low	No Impact: 0%	Retain	multiple young regrowth shoots
34	<i>Ulmus glabra</i>	12	11	Fair	Fair	Short (5-15 years)	590	7.08	2.65	Medium	No Impact: 0%	Retain	Leaning
35	<i>Ulmus glabra</i>	11	9	Good	Fair	Medium (15-40 years)	800	9.60	3.01	Medium	High Impact: >20%	Remove	multi stemmed tree DBH is estimate only
36	<i>Ulmus glabra</i>	8	6	Good	Fair	Medium (15-40 years)	150	2.00	1.50	Low	No Impact: 0%	Retain	multiple regrowth shoots
37	<i>Populus sp.</i>	14	6	Fair	Fair	Short (5-15 years)	470	5.64	2.41	Medium	Medium Impact: <20%	Potential to be retained subject to further investigation as outlined in section 3	alba white poplar
38	<i>Ulmus glabra</i>	10	5	Good	Good	Medium (15-40 years)	390	4.68	2.23	High	Medium Impact: <20%	Potential to be retained subject to further investigation as outlined in section 3	
39	<i>Populus sp.</i>	12	11	Good	Fair	Medium (15-40 years)	520	6.24	2.51	Medium	Medium Impact: <20%	Potential to be retained subject to further investigation as outlined in section 3	codominant stems x2
40	<i>Populus sp.</i>	13	5	Good	Poor	Remove (<5 years)	410	4.92	2.28	Priority for removal	Medium Impact: <20%	Potential to be retained subject to further investigation as outlined in section 3	decay in base of trunk
41	<i>Populus sp.</i>	12	4	Fair	Poor	Short (5-15 years)	320	3.84	2.05	Low	Medium Impact: <20%	Potential to be retained subject to further investigation as	leaning over fence canopy spread is suppressed

Tree	Botanical name	Height (m)	Spread (m)	Health	Structure	ULE	DBH (mm)	TPZ (m)	SRZ (m)	Retention value	Impact	Proposed action	Notes
												outlined in section 3	
42	<i>Populus sp.</i>	12	6	Good	Good	Medium (15-40 years)	390	4.68	2.23	Medium	Low Impact: <10%	Retain	
46	<i>Ulmus glabra</i>	10	6	Good	Fair	Medium (15-40 years)	360	4.32	2.15	Medium	High Impact: >20%	Remove	just inside fence multiple stems

## 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.

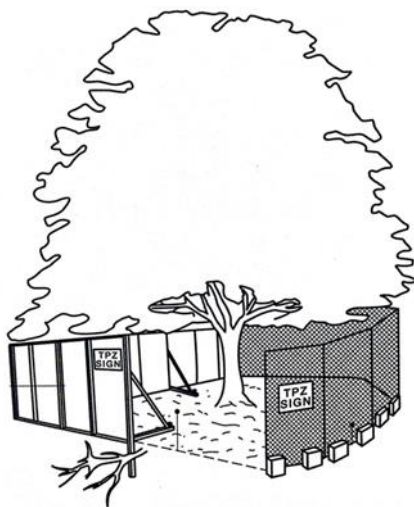
### E3 Trunk protection

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.

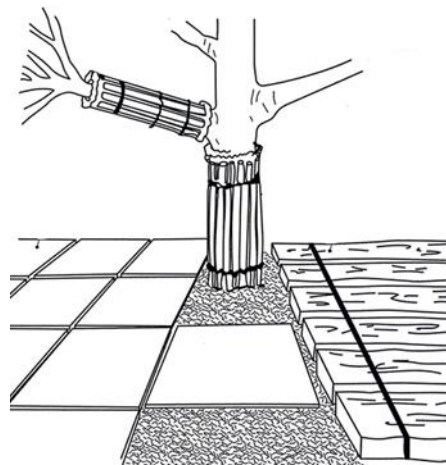
The removal of bark or branches allows the potential ingress of micro-organisms which may cause decay. Furthermore, the removal of bark restricts the trees' ability to distribute water, mineral ions (solutes), and glucose.

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

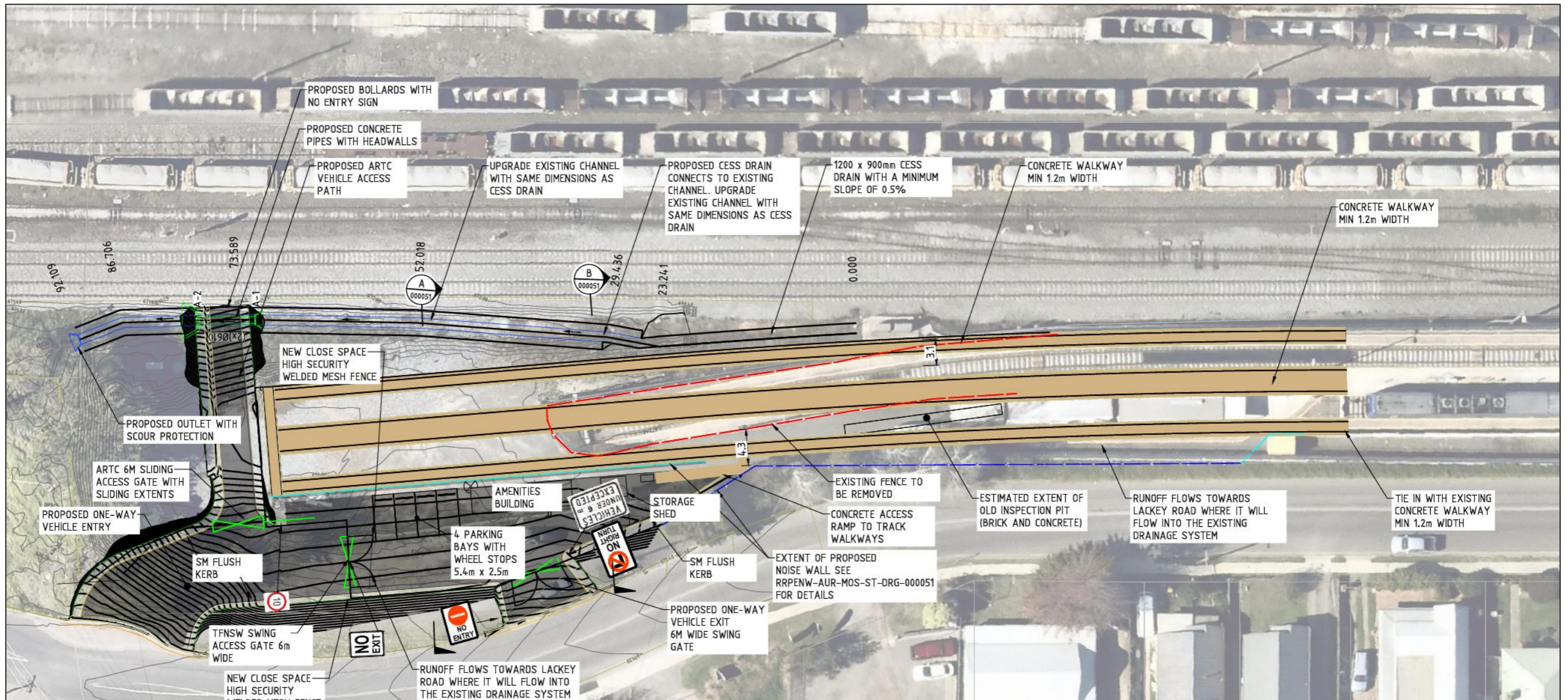


Figure 6: Civil works site plan (Aurecon 2021)



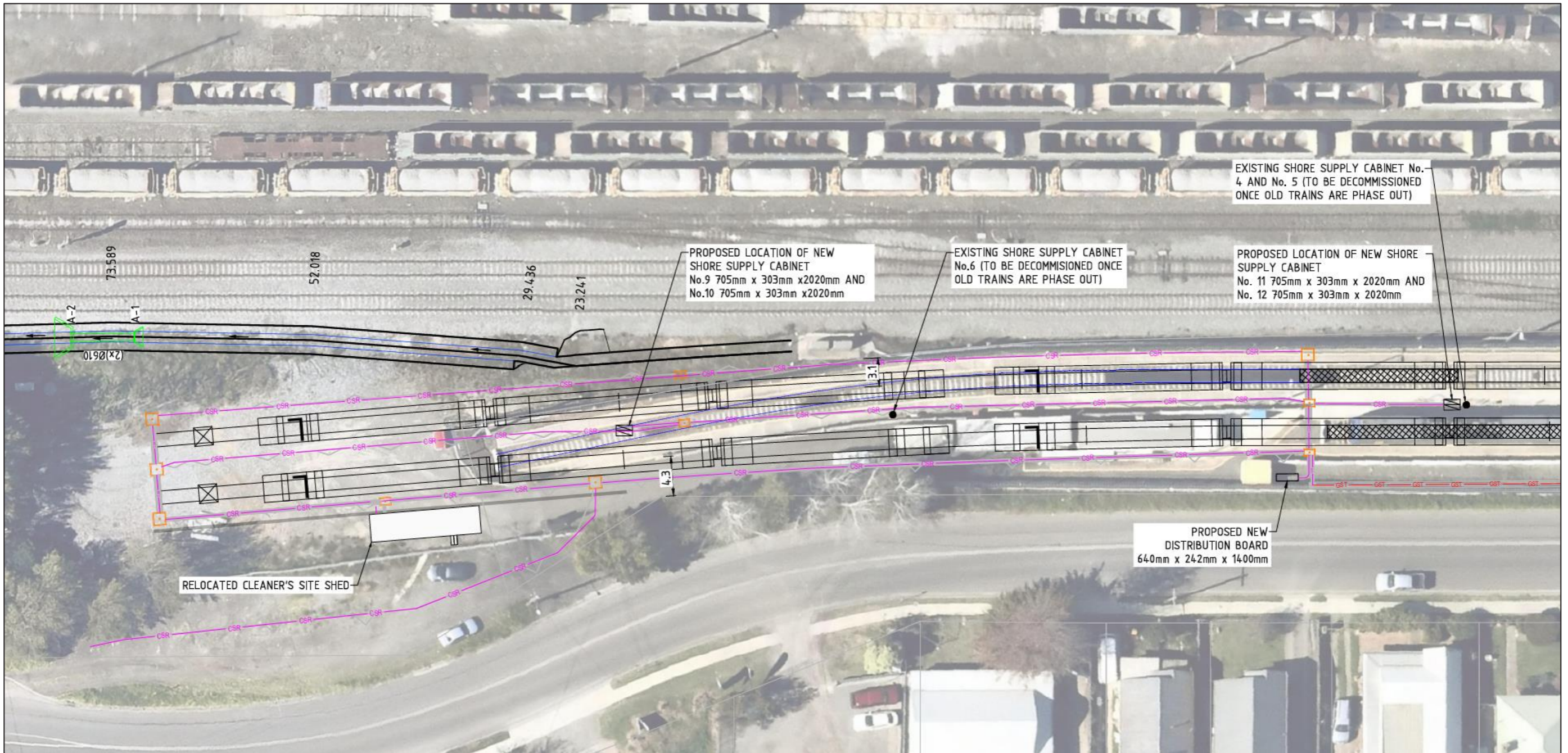


Figure 7: Electrical works site plan (Aurecon 2021)

## Appendix G Site photos



**Figure 8: Stand of Golden Elms at northern end of yard taken from Lackey Road looking North**



**Figure 9: Stand of Golden Elms at northern end of yard looking south from outside yard**



**Figure 10: Stand of White Poplars and Golden Elms, Pin Oak in background on opposite side of Lackey Road**



**Figure 11: Two trees across Lackey Road, Pin Oak in distance and Chinese Elm in foreground**



**Figure 12: Large English Oak opposite Lackey road at the northern end of the site**



Figure 13: Leyland Cypress adjacent to walkway bridge



**Figure 14: Southern end of site taken from opposite side of Lackey Road, notice the good visual screen of the railyard that the trees provide**



**Figure 15: Looking North from the southern end of the yard on opposite side of Lackey Road**





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MANAGEMENT

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CONSULTING ARBORICULTURISTS



# REPORT:

## ARBORICULTURAL IMPACT ASSESSMENT

Addendum Report  
Trees 47-71

### MOSS VALE STATION AND STABLING YARD UPGRADE

### Moss Vale NSW

Prepared 1 November 2023  
Reference 26201  
Rev.4



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## **Appendices**

Appendix A Tree Assessment

Appendix B Tree Location Plan

Appendix C Tree Protection Plan

Appendix D IACA Significance of a Tree, Assessment Rating System (STARS) (IACA, 2010) ©

Appendix E Matrix - Sustainable Retention Index Value (SRIV), Version 4, (IACA, 2010) ©

Appendix F Extract from Australian Standard AS4970 2009 *Protection of trees on development sites*, Section 3, Determining the tree protection zones of the selected trees, 3.1 Tree protection zone (TPZ)

Appendix G Extract from Australian Standard AS4970 2009 *Protection of trees on development sites*, Section 3, Determining the protection zones of the selected trees, 3.3.5 Structural root zone (SRZ)

Appendix H Glossary of terminology

## EXECUTIVE SUMMARY

To be read in conjunction with the Arboricultural Impact Assessment (AIA) Report by Eco Logical Australia Ref. 20SUT-15827, dated August 2021.

This addendum report considers 17 additional trees to the Eco Logical AIA Report, which are assessed further in this addendum. These are additional trees to those already assessed as part of the AIA Report by Eco Logical Australia. Trees 1-46 were assessed as part of that report. Trees 47-71 are included and assessed within this report. Where 'Actions' (Retain/Prune or Remove) have been altered from the initial report (25 trees), such trees are included as additional (Appendix A – Tree Assessment) with their amended 'Actions' listed and superseding those original 'Actions'.

### Tree Assessment

The trees assessed are numbered and their genus, species and common name included in Appendix A - Tree Assessment. Tree numbers are marked on Appendix B – Tree Location Plan.

All trees are considered common taxa, which have been planted (or established as suckers) over an estimated period of approx. 10-80 years.

Of the 25 trees assessed, 6 are recommended for removal and 19 retained and protected. Of the retained trees, 3 are considered large shrubs.

### Retention

A total of 19 trees in the construction footprint (Trees 47, 48, 52 – 60 & 64-71) are proposed to be retained/pruned -

- Trees 47 & 48 require pruning only (Appendix C – Tree Protection Plan 3 of 3).
- Trees 52-60 & 64-71 will be subject to major encroachment as per AS4970 (2009) Section 3, 3.3.3.
- Trees 55, 56, 58, 67 & 70 would be subject to major encroachment for footpath widening, including Structural Root Zone (SRZ). Due to age, taxa and size, instability and reduced life expectancy is likely depending on demolition/construction methods undertaken. Tree sensitive works are recommended to minimise impact (Appendix C – Tree protection Plan 3 of 3). The trees are expected to remain viable and stable with the protection specifications prescribed.

### Removal

A total of 6 trees (Trees 49 - 51 & 61 – 63) are proposed to be removed -

- Tree 49 is listed an endangered species (Biodiversity Conservation Act 2016). This specimen is planted (outside of its natural range), being commonly used within landscapes (largely as street/park trees) throughout many municipalities in NSW over the past 30-40 years.
- Tree 50 is a self-sown, exotic, young specimen (undersize), with *Low* amenity and retention value.
- Tree 51 is young, planted, native specimen (undersize) with low amenity and retention value.
- Trees 49-51 require removal as located within the current construction footprint.
- Trees 61-63 are commonly planted, deciduous, young, exotic specimens. They support a *Low* retention value, however provide screening value for the neighbouring property. Removal is advised as located within/too close to the current construction footprint. Replacement planting is recommended to maintain screening and any loss of trees should be offset with replacement planting in accordance with the Transport Biodiversity Policy (2022).

### Tree Significance

Determined by using the Tree Significance - Assessment Criteria of the *IACA Significance of a Tree, Assessment Rating System (STARS)*© (IACA, 2010) - Appendix D. The trees are rated, High, Medium or Low. The number of trees in each category is summarised in Table 1.0. The STARS significance rating of each individual tree is shown in Appendix A – Tree Assessment.

**Table 1.0** Tree Significance – summary of Trees 47 – 60 in different categories using the Significance of a Tree, Assessment Rating System (STARS)© (IACA, 2010).

Significance Scale	High	Medium	Low
Number of trees in each category	3	14	8

### Tree Retention Value

Determined by using the Retention Value – *Sustainable Retention Index Value (SRIV)*© (IACA, 2010), Appendix E. The trees are rated, High, Medium, Low or Remove. The number of trees in each category is summarised in Table 2.0. The SRIV retention rating of each individual tree is shown in Appendix A – Tree Assessment.

**Table 2.0** Retention Value - summary of trees in different categories using the Sustainable Retention Index Value (SRIV)© (IACA, 2010).

Retention Value	High Priority for Retention	Medium Consider for Retention	Low Consider for Removal	Remove Priority for Removal
Number of trees in each category	3	14	8	0

## 1.0 INTRODUCTION

Urban Tree Management © has prepared this report for and on behalf of Aecom.

For background overview of the site, relevant legislations and works proposed, please see AIA Report by Eco Logical Australia Ref. 20SUT-15827, dated August 2021 (*the report*).

*The report* assessed and documented those trees within –

- Work Area 1 - Stabling Yard,
- Work Area 2 - Diesel Exhaust Fluid System (DEFS),
- Work Area 3 - Lackey Road Entrance,
- Work Area 4 – Temporary Stabling Yard which incorporated Trees 1 – 46.

This addendum report covers –

- Work Area 5 - Site Compounds,
- Work Area 6 - Mobile Training Simulator (MTS),
- Work Area 7 - Dalys Way,
- Work Area 8 - Argyle Street.

Some trees within *the report* have had their 'Actions' altered from retain to remove therefore are again listed and corrected in Appendix A – Tree Assessment of this addendum report. This report supersedes *the report* where trees overlap or are listed within.

Trees 12 – 34 (22 trees) within Work Area 4 – Temporary Stabling Yard were detailed within *the report*. However, actual tree numbers are greater, potentially being between approx. 110 & 120. Most trees are *Ulmus glabra* - Wych Elm which can sucker profusely and become undesirable/weed plantings/landscapes. Most are suckers (40-80mm Diameter at Breast Height (DBH)) and therefore may have been numerically identified as one plant for each grouping. Never the less, most of these specimens are now recommended for removal to accommodate wall/retaining wall re-construction.

*The site* was attended on Friday 11 August 2023 and *the trees* and their growing environments were examined by a Visual Tree Assessment (VTA) (Mattheck & Breloer, 1994) conducted from the ground.

This report and any works recommended herein, that require approval from the consenting authority are provided to inform the REF and mitigation measures for the proposal. The Tree Protection Plan (Appendix C) is to be included into and used in conjunction with the set of plans for the site.

The aims and objectives of this report are to detail and comply with the tree protection requirements specified in AS4970 (2009) *Protection of trees on development sites*. The information in this report is intended to provided tree management and protection through all stages of development.

The tree/s are indicated in Appendix C & B – Tree Protection & Location Plan. This report has relied upon the following plan/s and documents:

Site Plan by Architectus, Dwg. No. 3150505-AR-DRG-SK201, Rev. E, dated 14 July 2023.

Site Plan – Platform Level by Architectus, Dwg. No. 3150505-AR-DRG-SK211, Rev. E, dated 14 July 2023.

Argyle Street Ramp and Footbridge Plan by Architectus, Dwg. No. 3150505-AR-DRG-SK212, Rev. E, dated 14 July 2023.

Courtyard Lift Plans by Architectus, Dwg. No. 3150505-AR-DRG-SK213, Rev. E, dated 14 July 2023.

Lackey Road Plans by Architectus, Dwg. No. 3150505-AR-DRG-SK214, Rev. E, dated 14 July 2023.

Lackey Road Lift Elevations by Architectus, Dwg. No. 3150505-AR-DRG-SK220, Rev. E, dated 14 July 2023.

Argyle Street Sections by Architectus, Dwg. No. 3150505-AR-DRG-SK222, Rev. E, dated 14 July 2023.

MTS – Civil Works Plan by SMEC. Dwg. No. TAP3150505-SMC-MVL-CV-M2D-002100, Rev. A, dated 16 June 2023.

## 2.0 METHODOLOGY

**Note: Individual methodologies applied as applicable.**

2.1 The method of assessment of tree/s applied is adapted from the principles of Visual Tree Assessment (VTA) (*Mattheck & Breloer, 1994*), undertaken from the ground, which considers and includes:

1. Tree health and subsequent stability, both long and short term
2. Sustainable Retention Index Value (SRIV) Version 4 (IACA, 2010) ©
3. Hazard potential to people and property
4. Amenity values
5. Habitat values
6. Significance – Significance of a Tree, Assessment Rating System (STARS) (IACA, 2010) ©

2.2 Tree Assessment - This assessment is undertaken using standard tree assessment criteria for each tree based on the values above and is implemented as a result of at least one comprehensive and detailed site inspection to undertake a visual tree assessment of each individual tree, or stand of trees, or a representative population sample. See Appendix A – Tree Assessment.

2.3 Any dimensions recorded as averages, or by approximation are noted accordingly.

2.4 This report adopts Australian Standard AS4970 (2009) *Protection of trees on development sites* as a point of reference and guide for the recommended minimum setbacks (Appendix F) from the center of a tree's trunk to development works and the distances may be increased or decreased by the author in accordance with AS4970 as a result of other factors providing mitigating circumstances or constraints as indicated by but not restricted to the following:

- Condition of individual trees,
- Tolerance of individual species to disturbance,
- Geology e.g. physical barriers in soil, rock floaters, bedrock to surface,
- Topography e.g. slope, drainage,
- Soil e.g. depth, drainage, fertility, structure,
- Microclimate e.g. due to landform, exposure to dominant wind,
- Engineering e.g. techniques to ameliorate impact on trees such as structural soil, gap graded fill, lateral boring,
- Construction e.g. techniques to ameliorate impact on trees such as pier and beam, bridge footings, suspended slabs,
- Root mapping,
- Physical limitations - existing modifications to the environment and any impact to tree/s by development e.g. property boundaries, built structures, houses, swimming pools, road reserves, utility services easements, previous impact by excavation, or construction in other directions, soil level changes by cutting or filling, existing landscaping works within close proximity, modified drainage patterns,
- Extraneous factors e.g. potential future impacts from development on adjoining land when the tree is located on or near to a property boundary.

### 2.5 Tree Protection Setbacks

Tree Protection Zone (TPZ) and Structural Root Zone (SRZ) setbacks are based on Australian Standard AS4970 2009 *Protection of trees on development sites*, Section 3 Determining the protection zone of the selected trees, see Appendices B and D, respectively. Approved construction works should be no closer, including excavation, than the dimensions stated herein, save for AS4970(2009) sec. 3.3.

Variations to the TPZ, 3.3.2 Minor Encroachment - *If the proposed encroachment is less than 10% of the area of the TPZ and is outside 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; and sec 3.3.3 Major Encroachment - If the proposed encroachment is greater than 10% of the area of the TPZ or inside the SRZ the project arborist must demonstrate that the tree(s) would remain viable. The area lost to this encroachment should be compensated for elsewhere and contiguous with the TPZ.*” The trees requiring TPZ and SRZ protection setbacks are detailed in APPENDIX C – Tree Protection & Location Plan.

- 2.6 Stands of Trees - Trees in groups may be referred to as stands and a stand may exclusively contain specimens to be either retained or removed or a combination of both. A stand may be used to discuss all the trees on a given site to expedite their assessment, or refer to trees growing proximate to one another or within a defined space. Stands may be comprised by mass boundary or screen plantings, to form a group of the same or a mixture of taxa. Each stand is considered as a single unit with each component tree assessed and expressed in tabular form, or indicated by a given percentage as a population sample of each stand. Where it is appropriate for a stand of trees to be retained in full or part, the location and setback of Tree Protection Zone fences or works, are prescribed to provide for the preservation of the stand or selected trees. These are to be maintained in a condition not less than that at the time of initial inspection for its incorporation into the landscape works for the site, or in a reduced but sustainable condition due to the impact of the development but ameliorated through tree protection measures.
- 2.7 Tree Significance - The trees/s have been allocated a significance rating as determined by using the Tree Significance - Assessment Criteria of the IACA Significance of a Tree, Assessment Rating System (STARS)© (IACA, 2010), Appendix D.
- 2.8 The meanings for terminology used herein are taken from the IACA Dictionary for Managing Trees in Urban Environments 2009. An extract from the IACA Dictionary forms a glossary of terms included as Appendix H.

### **3.0 PRUNING STANDARDS**

- 3.1 Any pruning recommended in this report is to be to the Australian Standard® AS4373 *Pruning of amenity trees*, and conducted in accordance with the *Guide to Managing Risks of Tree Trimming and Removal Work*, July 2016, Safe Work Australia.
- 3.2 All pruning or removal works are to be in accordance with the appropriate Tree Management Policy where applicable, or Tree Management Order (TMO), or Tree Preservation Order (TPO).
- 3.3 Tree maintenance work is specialised and to be undertaken safely. To assist in the safe removal, should be undertaken by a qualified Arboriculturist with appropriate competencies recognised within the Australian Qualification Framework. These are to have a minimum of 5 years of continual experience within the industry of operational amenity arboriculture, and covered by appropriate and current types of insurance to undertake such works.

#### **4.0 RECOMMENDATIONS** (As provided by TfNSW and their construction contractor)

- 4.1 Trees 9 - 11, 19, 21 - 28, 31 - 32, 35 and 46 (16 trees) of the report by Eco Logical Australia are to be removed as originally identified. Note trees 20, 29, 37 - 41 were identified for potential retention but subject to further investigation.
- 4.2 This addendum report made additional changes to the report by Eco Logical. This identified additional trees for removal. Trees 1 - 8, 14, 15 - 18, 20, 29 - 30, 33 - 34 and 36 - 42 were identified for removal (25 trees).
- 4.3 Trees 47, 48, 52 - 60 & 64 - 71 (19 trees) are to be pruned and/or retained and protected within a Tree Protection Zone fence or trunk protection as prescribed. Trees 52 - 60 & 64 - 71 require special protection works undertaken as detailed in Appendix C – Tree Protection Plan.
- 4.4 Trees 49 - 51 & 61 - 63 (6 trees) are to be removed and undertaken in accordance with Section 3.0 Pruning Standards.
- 4.5 Where Tree Protection Zone works are to be modified or relocated this must be undertaken in consultation with the Project Arborist to ensure that tree protection is maintained.



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## REFERENCES

1. Draper BD and Richards PA 2009, *Dictionary for Managing Trees in Urban Environments*, Institute of Australian Consulting Arboriculturists (IACA), CSIRO Publishing, Collingwood, Victoria, Australia.
2. IACA, 2010, *Sustainable Retention Index Value (SRIV)*, Version 4, A visual method of objectively rating the viability of urban trees for development sites and management, based on general tree and landscape assessment criteria, Institute of Australian Consulting Arboriculturists, Australia, [www.iaca.org.au](http://www.iaca.org.au) .
3. IACA, 2010, *IACA Significance of a Tree, Assessment Rating System (STARS)*, Institute of Australian Consulting Arboriculturists, Australia, [www.iaca.org.au](http://www.iaca.org.au)
4. Mattheck K & Breloer H 1994, *The body language of trees*. A handbook for failure analysis, Published by TSO London, UK.
5. New South Wales Department of Education and Communities (DEC), 2015, *Tree Management Guidelines*, Tree Management in NSW Government Schools, NSW Government, Asset Management Directorate.
6. Standards Australia 2007, *Australian Standard 4373 Pruning of amenity trees*, Standards Australia, Sydney, Australia.
7. Standards Australia 2009, *Australian Standard 4970 Protection of trees on development sites*, Standards Australia, Sydney, Australia.
8. Safe Work Australia, *Managing Risks of Tree Trimming and Removal Work*, July 2016, viewed 6 February 2018, <https://www.safeworkaustralia.gov.au/system/files/documents/1702/guide-to-managing-risks-tree-trimming-removal-01082016.pdf>
9. Transport for NSW 2022, *Biodiversity Policy*, NSW Government.

## DISCLAIMER

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

# APPENDIX A – Tree Assessment

Note – Shaded area indicative of trees assessed and documented by Eco Logical Report, Ref. 20SUT-15827, dated August 202 (see Appendix D in that report).

Tree ID number	Botanical Name	Condition G = Good F = Fair P = Poor M = Moribund D = Dead	Age Y: Young SM: Semi Mature M: Mature OM: Overmature (senescent)	Height (m)	Spread (av.) (m)	DBH (mm)	DARB (mm)	TPZ (m. rad) AS 4970 (2009)	SRZ (m. rad) AS 4970 (2009)	SRIV Age, Vigour, Condition / Index Rating (see Appendix D) www.iaca.org.au SM = Y / Estimated Life Expectancy 1 = Long 2 = Medium 3 = Short	STARS Significance scale (see Appendix A) www.iaca.org.au 1 = High 2 = Medium 3 = Low / Retention Value 1 = High 2 = Medium 3 = Low 4 = Remove	ACTION Retain / Remove / Prune  pr = prune cr = crown  * Action Amended from 2021 AIA Report by Eco Logical	Comments
Tree ID number	Botanical Name, common name	Condition	Age	Height	Spread	DBH	DARB	TPZ	SRZ	SRIV	STARS	Action	Comments <i>Comments italicised from Eco Logical Report</i>
1	<i>Ulmus glabra</i> – Wych Elm	G	-	9	5	380	NA	4.56	2.20	Not Available	Not Available	Remove *	<i>Tree has been lopped in past and now has multiple branch shoots</i> *Action amended to that previously stated within Eco Logical Report Ref. 20SUT-15827.
2	<i>Ulmus glabra</i> – Wych Elm	F	-	10	6	800	NA	9.60	3.01	Not Available	Not Available	Remove *	<i>Multiple trunks</i> *Action amended to that previously stated within Eco Logical Report Ref. 20SUT-15827.
3	<i>Ulmus glabra</i> – Wych Elm	G	-	10	6	60	NA	2.00	1.50	Not Available	Not Available	Remove *	<i>All trees in this area have been lopped at BH and have reshot</i> *Action amended to that previously stated within Eco Logical Report Ref. 20SUT-15827.
4	<i>Ulmus glabra</i> – Wych Elm	G	-	8	5	800	NA	9.60	3.01	Not Available	Not Available	Remove *	<i>Multiple trunks</i> *Action amended to that previously stated within Eco Logical Report Ref. 20SUT-15827.
5	<i>Ulmus glabra</i> – Wych Elm	G	-	13	9	259	NA	3.11	1.88	Not Available	Not Available	Remove *	<i>Multiple trunks</i> *Action amended to that previously stated within Eco Logical Report Ref. 20SUT-15827.
6	<i>Ulmus glabra</i> – Wych Elm	G	-	12	7	300	NA	3.60	2.00	Not Available	Not Available	Remove *	<i>Multiple trunks</i> *Action amended to that previously stated within Eco Logical Report Ref. 20SUT-15827.
7	<i>Ulmus glabra</i> – Wych Elm	G	-	15	9	600	NA	7.20	2.67	Not Available	Not Available	Remove *	<i>Multiple trunks</i> *Action amended to that previously stated within Eco Logical Report Ref. 20SUT-15827.
8	<i>Ulmus glabra</i> – Wych Elm	G	-	13	7	230	NA	2.60	1.79	Not Available	Not Available	Remove *	<i>Straight trunk vines</i> *Action amended to that previously stated within Eco Logical Report Ref. 20SUT-15827.
9	<i>Ulmus glabra</i> – Wych Elm	G	-	10	7	550	NA	6.60	2.57	Not Available	Not Available	Remove	<i>Multiple trunks</i>
10	<i>Ulmus glabra</i> – Wych Elm	G	-	10	12	820	NA	9.84	3.04	Not Available	Not Available	Remove	<i>Multiple trunks</i>
11	<i>Ulmus glabra</i> – Wych Elm	G	-	11	11	800	NA	9.60	3.01	Not Available	Not Available	Remove	<i>Multi trunked</i>
12	<i>Cupressus x leylandii</i> – Leyland's Cypress	G	-	9	7	650	NA	7.80	2.76	Not Available	Not Available	Retain	<i>DBH estimated, aesthetic high value</i>
13	-												<i>Remove this record double up</i>
14	<i>Ulmus glabra</i> – Wych Elm	G	-	10	5	580	NA	6.96	2.63	Not Available	Not Available	Remove *	<i>Screening value</i> *Action amended to that previously stated within Eco Logical Report Ref. 20SUT-15827.
15	<i>Ulmus glabra</i> – Wych Elm	G	-	9	5	290	NA	3.48	1.97	Not Available	Not Available	Remove *	*Action amended to that previously stated within Eco Logical Report Ref. 20SUT-15827.
16	<i>Ulmus glabra</i> – Wych Elm	G	-	7	5	300	NA	3.60	2.00	Not Available	Not Available	Remove *	*Action amended to that previously stated within Eco Logical Report Ref. 20SUT-15827.
17	<i>Ulmus glabra</i> – Wych Elm	G	-	8	9	800	NA	9.60	3.01	Not Available	Not Available	Remove *	<i>Multiple regrowth trees providing screening value</i> *Action amended to that previously stated within Eco Logical Report Ref. 20SUT-15827.
18	<i>Ulmus glabra</i> – Wych Elm	G	-	10	9	750	NA	9.00	2.93	Not Available	Not Available	Remove *	<i>Multiple trunks</i> *Action amended to that previously stated within Eco Logical Report Ref. 20SUT-15827.
19	<i>Ulmus glabra</i> – Wych Elm	G	-	10	8	720	NA	8.64	2.88	Not Available	Not Available	Remove	
20	<i>Ulmus glabra</i> – Wych Elm	G	-	6	4	300	NA	3.60	2.00	Not Available	Not Available	Remove *	*Action amended to that previously stated within Eco Logical Report Ref. 20SUT-15827.
21	<i>Ulmus glabra</i> – Wych Elm	G	-	9	9	150	NA	2.00	1.50	Not Available	Not Available	Remove	<i>Multi-stemmed regrowth sucker</i>
22	<i>Ulmus glabra</i> – Wych Elm	G	-	14	13	810	NA	9.72	3.03	Not Available	Not Available	Remove	<i>Multi-stemmed regrowth shoots provides good screen</i>
23	<i>Ulmus glabra</i> – Wych Elm	G	-	11	6	640	NA	7.68	2.74	Not Available	Not Available	Remove	<i>Large tree providing high amenity value</i>
24	<i>Ulmus glabra</i> – Wych Elm	F	-	10	9	600	NA	7.20	2.67	Not Available	Not Available	Remove	<i>Suppressed below tree 20 canopy however still provides good screen from rail yard</i>
25	<i>Quercus robur</i> – English Oak	F	-	11	3	280	NA	3.36	1.64	Not Available	Not Available	Remove	<i>Under powerline multi stem good amenity screen</i>

# APPENDIX A – Tree Assessment – Continues

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Tree ID number	Botanical Name, common name	Condition	Age	Height	Spread	DBH	DARB	TPZ	SRZ	SRIV	STARS	Action	Comments <i>Comments italicised from Eco Logical Report</i>
26	<i>Quercus robur</i> – English Oak	F	-	11	3	280	NA	3.36	1.64	Not Available	Not Available	Remove	<i>Suppressed by other trees</i>
27	<i>Ulmus glabra</i> – Wych Elm	G	-	11	7	250	NA	3.00	1.85	Not Available	Not Available	Remove	<i>Multiple regrowth shoots in one location provides good screen can easily be replaced</i>
28	<i>Ulmus glabra</i> – Wych Elm	G	-	9	12	150	NA	2.00	1.50	Not Available	Not Available	Remove	<i>Multiple regrowth shoots provide good screen for 10m can easily be replaced</i>
29	<i>Ulmus glabra</i> – Wych Elm	G	-	10	7	320	NA	3.84	2.05	Not Available	Not Available	Remove *	<i>One main tree with multiple regrowth shoots good screen *Action amended to that previously stated within Eco Logical Report Ref. 20SUT-15827.</i>
30	<i>Ulmus glabra</i> – Wych Elm	G	-	9	6	150	NA	2.00	1.50	Not Available	Not Available	Remove *	<i>Multiple regrowth shoots *Action amended to that previously stated within Eco Logical Report Ref. 20SUT-15827.</i>
31	<i>Ulmus glabra</i> – Wych Elm	F	-	11	6	780	NA	9.36	2.98	Not Available	Not Available	Remove	<i>Significant decay in trunk</i>
32	<i>Ulmus glabra</i> – Wych Elm	G	-	9	8	220	NA	2.64	1.75	Not Available	Not Available	Remove	<i>Multiple regrowth shoots</i>
33	<i>Ulmus glabra</i> – Wych Elm	G	-	7	8	150	NA	2.00	1.50	Not Available	Not Available	Remove *	<i>Multiple young regrowth shoots *Action amended to that previously stated within Eco Logical Report Ref. 20SUT-15827.</i>
34	<i>Ulmus glabra</i> – Wych Elm	F	-	12	11	590	NA	7.08	2.65	Not Available	Not Available	Remove *	<i>Leaning *Action amended to that previously stated within Eco Logical Report Ref. 20SUT-15827.</i>
35	<i>Ulmus glabra</i> – Wych Elm	G	-	11	9	800	NA	9.60	3.01	Not Available	Not Available	Remove	<i>Multi stemmed tree DBH is estimate only</i>
36	<i>Populus alba</i> – White Poplar	G	-	8	6	150	NA	2.00	1.50	Not Available	Not Available	Remove *	<i>Multiple regrowth shoots</i>
37	<i>Populus alba</i> – White Poplar	F	-	14	6	470	NA	5.64	2.41	Not Available	Not Available	Remove *	<i>Alba white poplar *Action amended to that previously stated within Eco Logical Report Ref. 20SUT-15827.</i>
38	<i>Populus alba</i> – White Poplar	G	-	10	5	390	NA	4.68	2.23	Not Available	Not Available	Remove *	<i>*Action amended to that previously stated within Eco Logical Report Ref. 20SUT-15827.</i>
39	<i>Populus alba</i> – White Poplar	G	-	12	11	520	NA	6.24	2.51	Not Available	Not Available	Remove *	<i>Codominant stems x2 *Action amended to that previously stated within Eco Logical Report Ref. 20SUT-15827.</i>
40	<i>Populus alba</i> – White Poplar	G	-	13	5	410	NA	4.92	2.28	Not Available	Not Available	Remove *	<i>Decay in base of trunk *Action amended to that previously stated within Eco Logical Report Ref. 20SUT-15827.</i>
41	<i>Populus alba</i> – White Poplar	F	-	12	4	320	NA	3.84	2.05	Not Available	Not Available	Remove *	<i>Leaning over fence canopy spread is suppressed *Action amended to that previously stated within Eco Logical Report Ref. 20SUT-15827.</i>
42	<i>Populus alba</i> – White Poplar	G	-	12	6	390	NA	4.68	2.23	Not Available	Not Available	Remove *	<i>*Action amended to that previously stated within Eco Logical Report Ref. 20SUT-15827.</i>
46	<i>Populus alba</i> – White Poplar	G	-	10	6	360	NA	4.32	2.15	Not Available	Not Available	Remove	<i>Just inside fence multiple stems *Action amended to that previously stated within Eco Logical Report Ref. 20SUT-15827.</i>
47	<i>Platanus x hispanica</i> – Plane Tree	G	M	16	18	750	800	9.0	3.0	MGVG-10/1	1/1	Retain/Prune cr	Good form/structure. Selective prune by crown lift to 4-5m above g.l. with maximum branch diameter of 50mm.
48	<i>Platanus x hispanica</i> – Plane Tree	G	M	16	14	550	600	6.6	2.7	MGVG-10/1	1/1	Retain/Prune cr	Good form/structure. Selective prune by crown lift to 4-5m above g.l. with maximum branch diameter of 50mm.
49	<i>Eucalyptus scoparia</i> – Wallangara White Gum	G	M	14	12	400	450	4.8	2.8	MGVG-10/2	1/1	Remove	Planted specimen with high visual amenity. Good form/structure. Within current construction footprint.
50	<i>Cupressus macrocarpa</i> – Monterey Cypress	G	Y	3	1	60	60	1.0	1.0	YGVG-9/3	3/3	Remove	Appears self sown, undersize as per tree definition AS4970. Good form/structure. Within current construction footprint.
51	<i>Tristanopsis laurina</i> – Water Gum	G	Y	3	3	80	100	1.0	1.3	YGVG-9/1	3/3	Remove	Planted specimen, undersize as per tree definition AS4970. Good form/structure. Within current construction footprint.
52	<i>Cupressus macrocarpa cv.</i> – Monterey Cypress	G	Y	1.2	1	100	100	1.0	1.3	YGVG-9/1	3/3	Retain/Prune cr	Planted specimen, pruned as hedge. Undersize as per tree definition AS4970. Prune to west only for proposed path widening.
53	<i>Cupressus macrocarpa cv.</i> – Monterey Cypress	G	Y	1.2	1	100	100	1.0	1.3	YGVG-9/1	3/3	Retain/Prune cr	Planted specimen. Selective Prune to west only for proposed path widening.

# APPENDIX A – Tree Assessment - Continues

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Tree ID number	Botanical Name, common name	Condition	Age	Height	Spread	DBH	DARB	TPZ	SRZ	SRIV	STARS	Action	Comments
54	<i>Hebe cv.</i> – Hebe shrub <i>establish</i>	G	M	3	5	80	80	1.0	1.1	MGVG-9/2	3/3	Retain/Prune cr	Shrub. Planted specimen. Undersize as per tree definition AS4970. Prune to west only for proposed path widening.
55	<i>Populus nigra</i> 'Italica' – Lombardy Poplar	F	O	14	5	1200	1400	14.4	3.8	OGVF-5/3	2/2	Retain/Prune cr	Planted specimen. Selective Prune basal epicormic growth only emerging at lower trunk region to west to 3m above g.l. for pedestrian clearance (proposed path widening). Undertake tree sensitive construction for adjacent footpath widening works.
56	<i>Populus nigra</i> 'Italica' – Lombardy Poplar	F	O	14	5	1300	1500	15.0	3.9	OGVF-5/3	2/2	Retain/Prune cr	Planted specimen. Selective Prune basal epicormic growth only emerging at lower trunk region to west to 3m above g.l. for pedestrian clearance (proposed path widening). Undertake tree sensitive construction for adjacent footpath widening works.
57	<i>Viburnum tinus</i> –Viburnum	G	M	4	7	100	100	1.0	1.3	MGVG-9/2	2/2	Retain/Prune cr	Shrub. Planted specimen. Prune to west only for proposed path widening.
58	<i>Populus nigra</i> 'Italica' – Lombardy Poplar	F	O	14	5	1500	1800	15	4.2	OGVF-5/3	2/2	Retain/Prune cr	Planted specimen. Selective Prune basal epicormic growth only emerging at lower trunk region to west to 3m above g.l. for pedestrian clearance (proposed path widening). Undertake tree sensitive construction for adjacent footpath widening works.
59	<i>Viburnum sp.</i>	G	M	4	8	100	100	1.0	1.3	MGVG-9/2	2/2	Retain/Prune cr	Shrub. Planted specimen. Undersize as per tree definition AS4970. Prune to west only for proposed path widening.
60	<i>Viburnum sp.</i>	G	M	4	8	100	100	1.0	1.3	MGVG-9/2	2/2	Retain/Prune cr	Shrub. Planted specimen. Undersize as per tree definition AS4970. Prune to south/west only for proposed path widening.
61	<i>Betula pendula</i> – Silver Birch	G	Y	5	3	100	100	1.0	1.3	YGVG-9/3	3/3	Remove	Planted specimen. Good form/structure. Within/too close to proposed construction works.
62	<i>Malus floribunda cv.</i> – Crab Apple	G	Y	4	3	100	100	1.0	1.3	YGVG-9/3	3/3	Remove	Planted specimen. Good form/structure. Within/too close to proposed construction works.
63	<i>Unknown deciduous tree</i>	G	Y	5	4	150	150	1.8	1.5	YGVG-9/3	3/3	Remove	Planted specimen. Good form/structure. Within/too close to proposed construction works.
64-66	<i>Unknown - data not collected</i>	F-G	M	Approx. 3	Approx. 8	-	-	-	-	-	2/2	Retain/Prune cr	Mix of planted shrubs/trees. Prune to west only for proposed path widening. Undertake tree sensitive construction for adjacent footpath widening works.
67	<i>Populus nigra</i> 'Italica' – Lombardy Poplar <i>data not collected</i>	F	O	Approx. 14	Approx. 5	-	-	-	-	-	2/2	Retain/Prune cr	Planted specimen. Selective Prune basal epicormic growth only emerging at lower trunk region to west to 3m above g.l. for pedestrian clearance (proposed path widening). Undertake tree sensitive construction for adjacent footpath widening works.
68-69	<i>Unknown - data not collected</i>	F-G	M	Approx. 3	Approx. 5-8	-	-	-	-	-	2/2	Retain/Prune cr	Mix of planted shrubs/trees. Shrubs - Undersize as per tree definition AS4970. Prune to east only for proposed path widening. Trees - Selective Prune basal epicormic growth only emerging at lower trunk region to east to 3m above g.l. for pedestrian clearance (proposed path widening). Undertake tree sensitive construction for adjacent footpath widening works.
70	<i>Populus nigra</i> 'Italica' – Lombardy Poplar	F	O	Approx. 14	Approx. 5	-	-	-	-	-	2/2	Retain/Prune cr	Planted specimen. Selective Prune basal epicormic growth only emerging at lower trunk region to west to 3m above g.l. for pedestrian clearance (proposed path widening). Undertake tree sensitive construction for adjacent footpath widening works.
71	<i>Unknown - data not collected</i>	F-G	M	Approx. 6	Approx. 3	-	-	-	-	-	2/2	Retain/Prune cr	Mix of planted shrubs/trees. Selective Prune at lower trunk region to east to 3m above g.l. for pedestrian clearance (proposed path widening). Undertake tree sensitive construction for adjacent footpath widening works.

## APPENDIX B – Tree Location Plan 1 of 6

(trees numbered per Appendix A - Tree Assessment)

**Moss Vale Station & Stabling Upgrades**

**Ref: 26201**

Prepared by Urban Tree Management Australia P/L, 65 Excelsior Street, Merrylands NSW 2160, tel. 02 9760 1389.

Source – Aecom email correspondence.

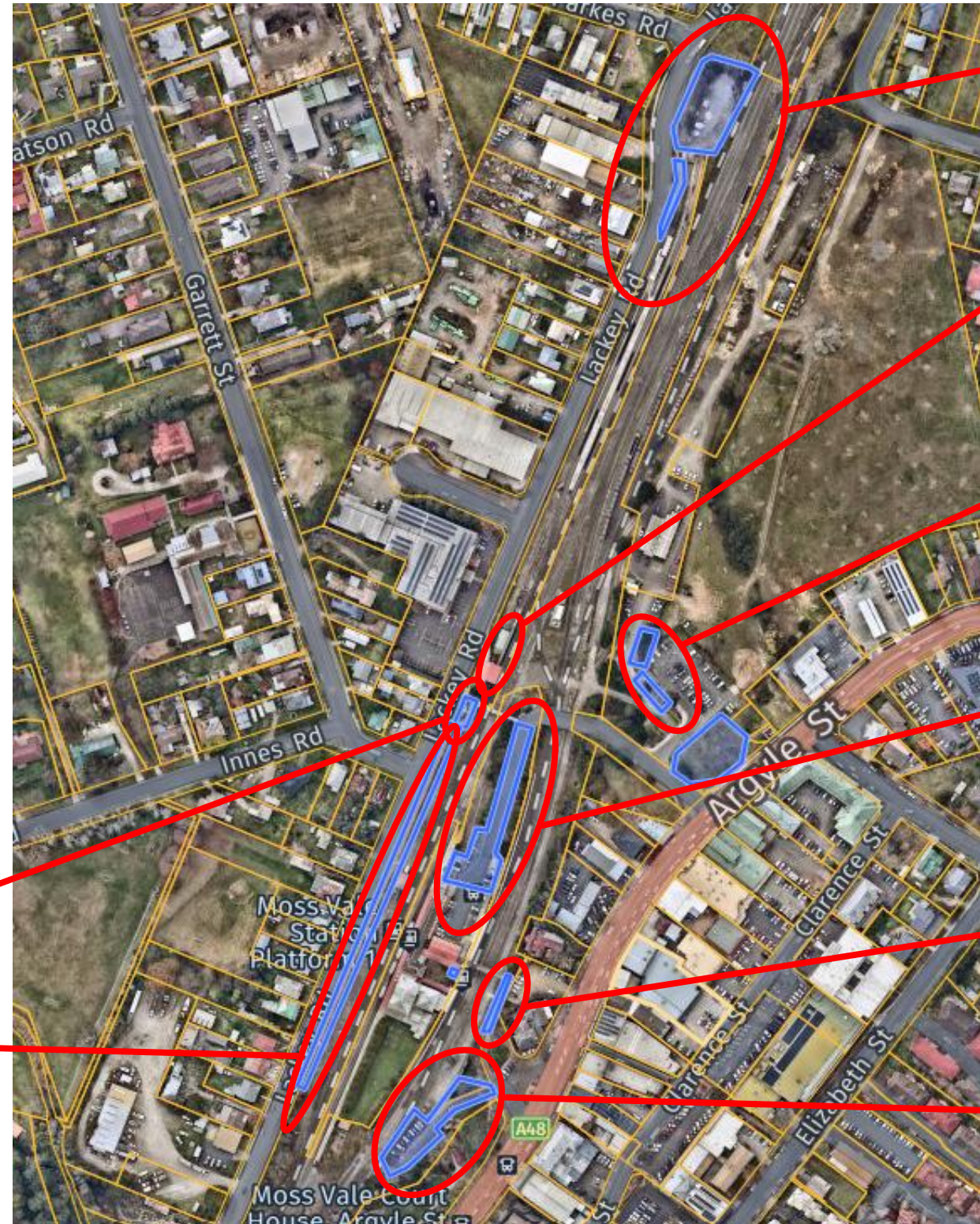
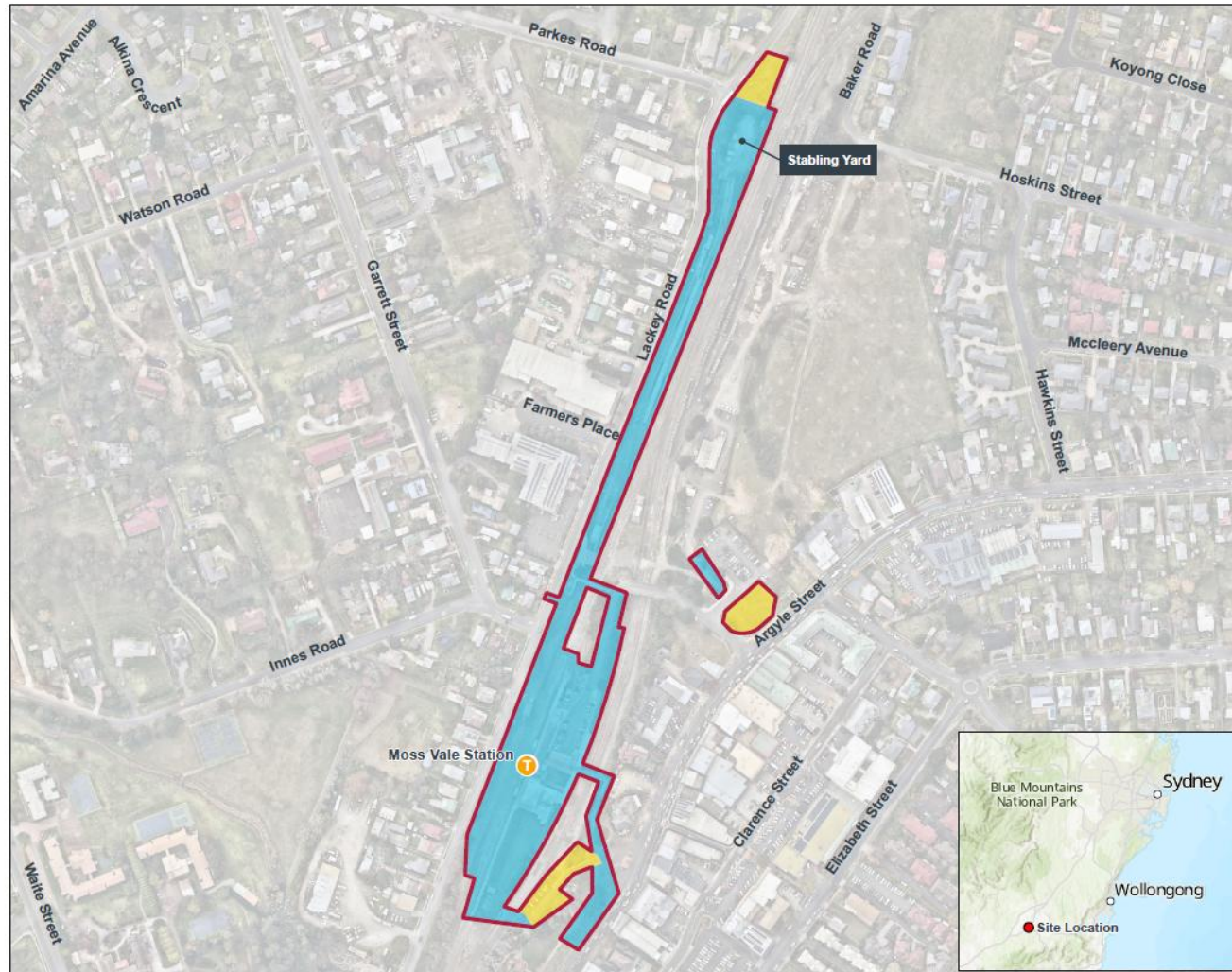
### Legend

**10.** Tree/s or stands of trees numbered in **orange and bold** or surrounded by an unbroken line are recommended for **retention**.

**11.** Tree/s or stands of trees numbered in **blue and not bold** or surrounded by a broken line are recommended for **removal**.



Note: trees indicated, unnumbered are either shrubs, or trees of species, or dimensions, or condition class not protected by the Tree Preservation Order or trees not affected by the proposed works or were already removed.



Stabling Yard  
Work Area 1

Diesel Exhaust  
Fluid System  
Work Area 2

Mobile Train  
Simulator  
Work Area 6

Dalys Way  
Work Area 7

Argyle Street  
Work Area 8

Site  
Compounds  
Work Area 5

Lackey Rd  
Entrance  
Work Area 3

Temporary  
Stabling Yard  
Work Area 4

## APPENDIX B – Tree Location Plan 2 of 6 (trees numbered per Appendix A - Tree Assessment)

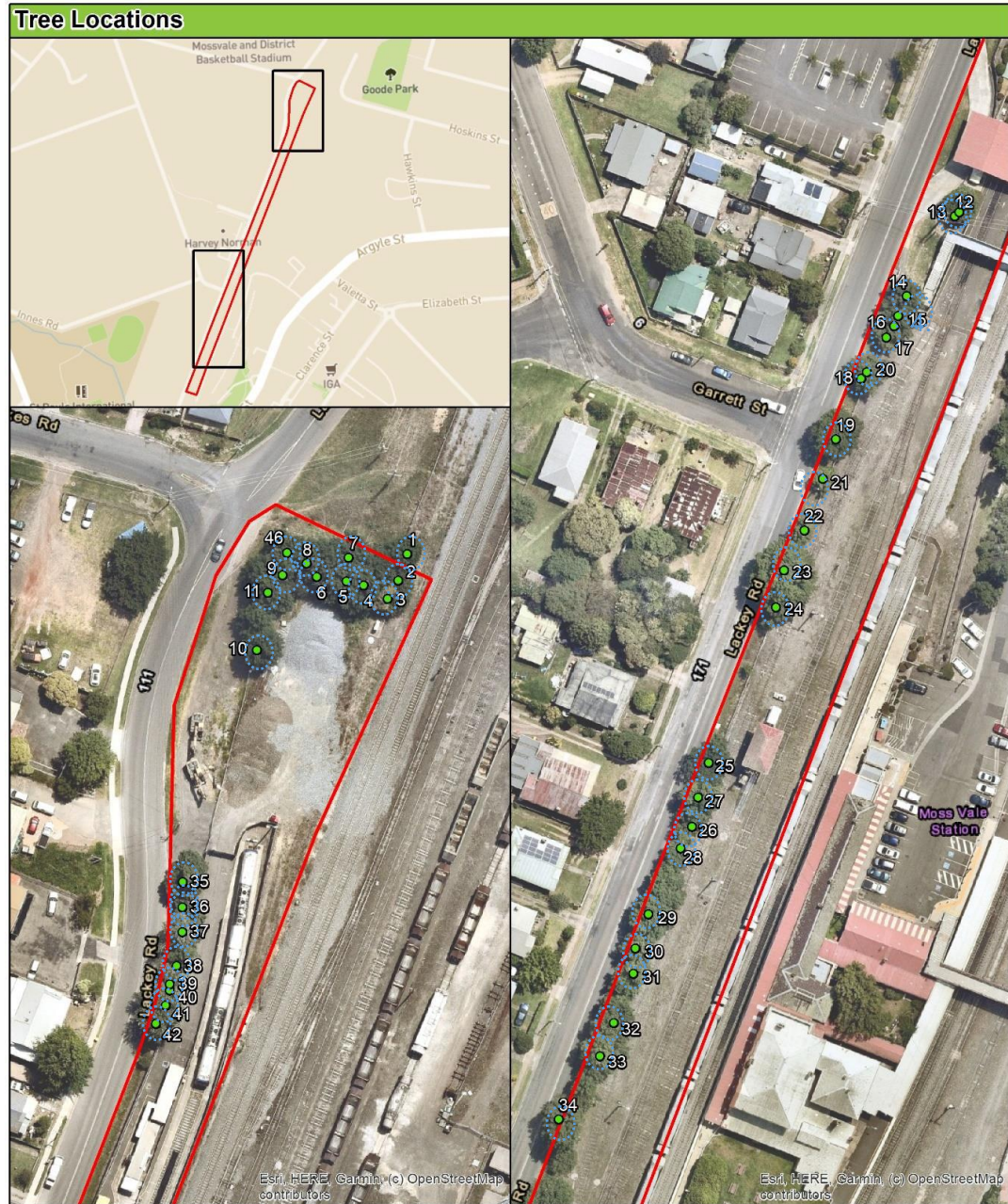
**Moss Vale Station & Stabling Upgrades**      **Ref: 26201**

Prepared by Urban Tree Management Australia P/L, 65 Excelsior Street, Merrylands NSW 2160, tel. 02 9760 1389.

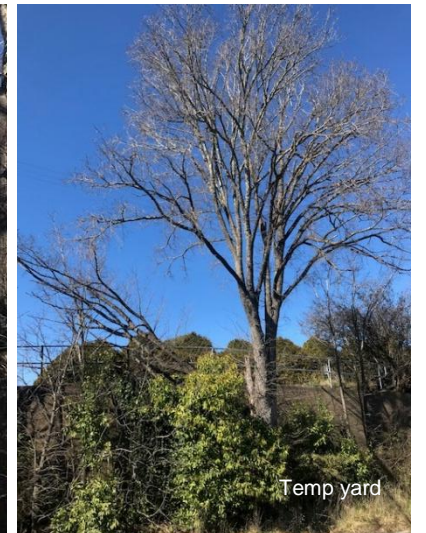
Source – Aecom email correspondence. Photo's taken by author at time of inspection.



Source – AIA Report by Eco Logical, Ref. 20SUT-15827, dated August 2021 - Appendix C



- Work Area's 1- 4**
- 1 / Stabling Yard 15 trees**
    - Trees 1-8, 36-42 (Remove)
  - 2 / DEFS X0 trees**
  - 3 / Lackey Road Entrance 1 Tree**
    - Tree 14 (Remove)
  - 4 / Temporary Stabling Yard 10 trees**
    - Trees 15-18, 20, 29, 30, 33-34 (Remove)



See Eco Logical Report Ref. 20SUT-15827, dated August 2021, (Appendix D) for tree assessment details of trees in Work Areas 1 - 4.  
 'Proposed Actions' have been amended to 'Remove' for Trees 1 - 8, 14, 15 - 18, 20, 29, 30, 33 - 34 & 36 - 42.

## APPENDIX B – Tree Location Plan 3 of 6 (trees numbered per Appendix A - Tree Assessment)

**Moss Vale Station & Stabling Upgrades** Ref: 26201

Prepared by Urban Tree Management Australia P/L, 65 Excelsior Street, Merrylands NSW 2160, tel. 02 9760 1389.

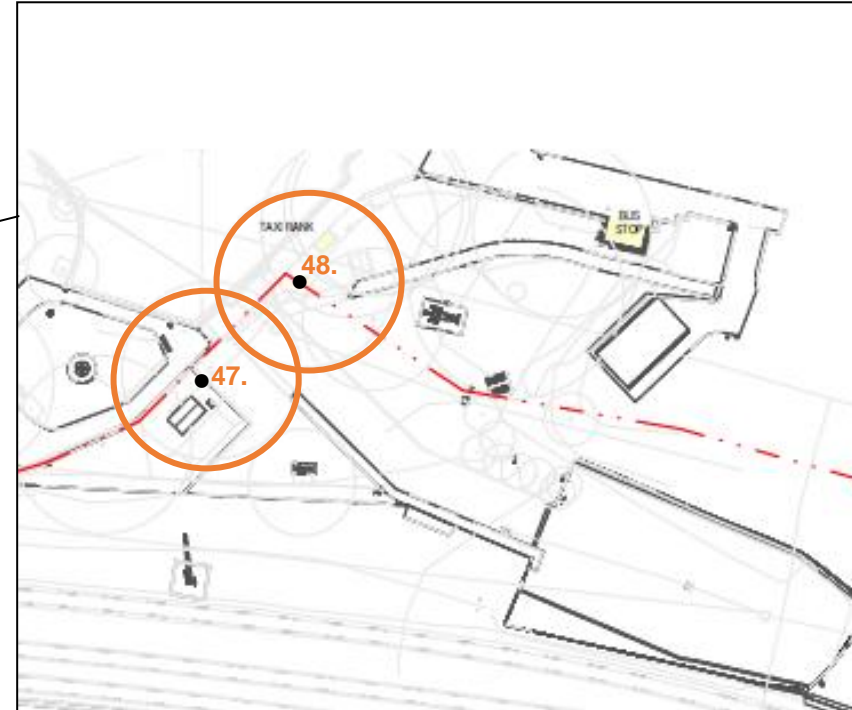
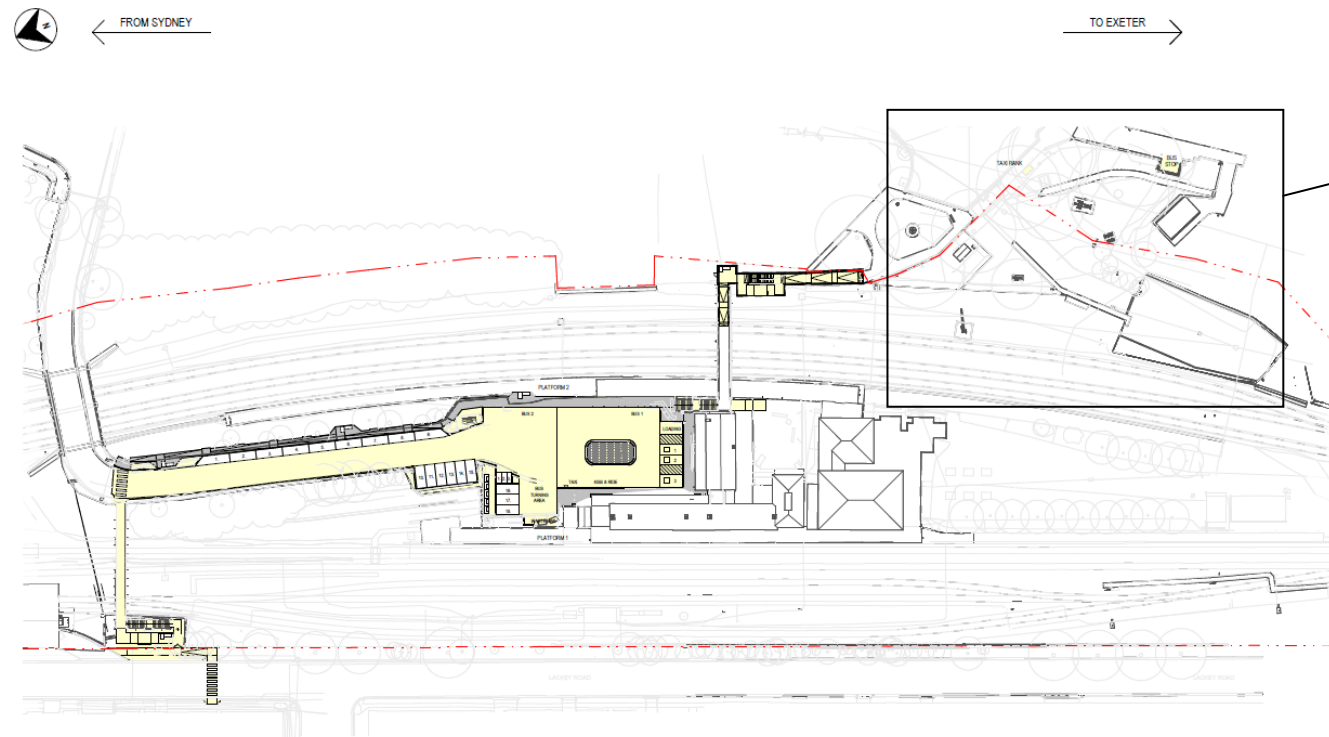
Source – Aecom email correspondence. Photo's taken by author at time of inspection.

### Legend

**10.** Tree/s or stands of trees numbered in **orange and bold** or surrounded by an unbroken line are recommended for **retention/pruning**.

**11.** Tree/s or stands of trees numbered in **blue and not bold** or surrounded by a broken line are recommended for **removal**.

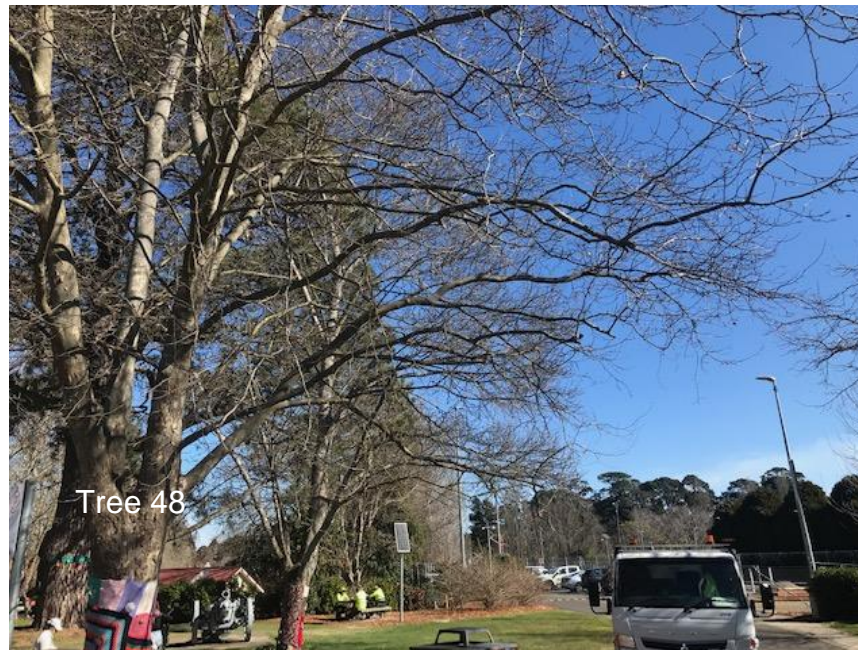
Note: trees indicated, unnumbered are either shrubs, or trees of species, or dimensions, or condition class not protected by the Tree Preservation Order or trees not affected by the proposed works or were already removed.



### Work Area 5

- 5 / Site Compounds

2 trees – Trees 47 & 48 (Retain - Prune)



Tree 48



Tree 47

Photos facing west.

## APPENDIX B – Tree Location Plan 4 of 6 (trees numbered per Appendix A - Tree Assessment)

**Moss Vale Station & Stabling Upgrades Ref: 26201**

Prepared by Urban Tree Management Australia P/L, 65 Excelsior Street, Merrylands NSW 2160, tel. 02 9760 1389.

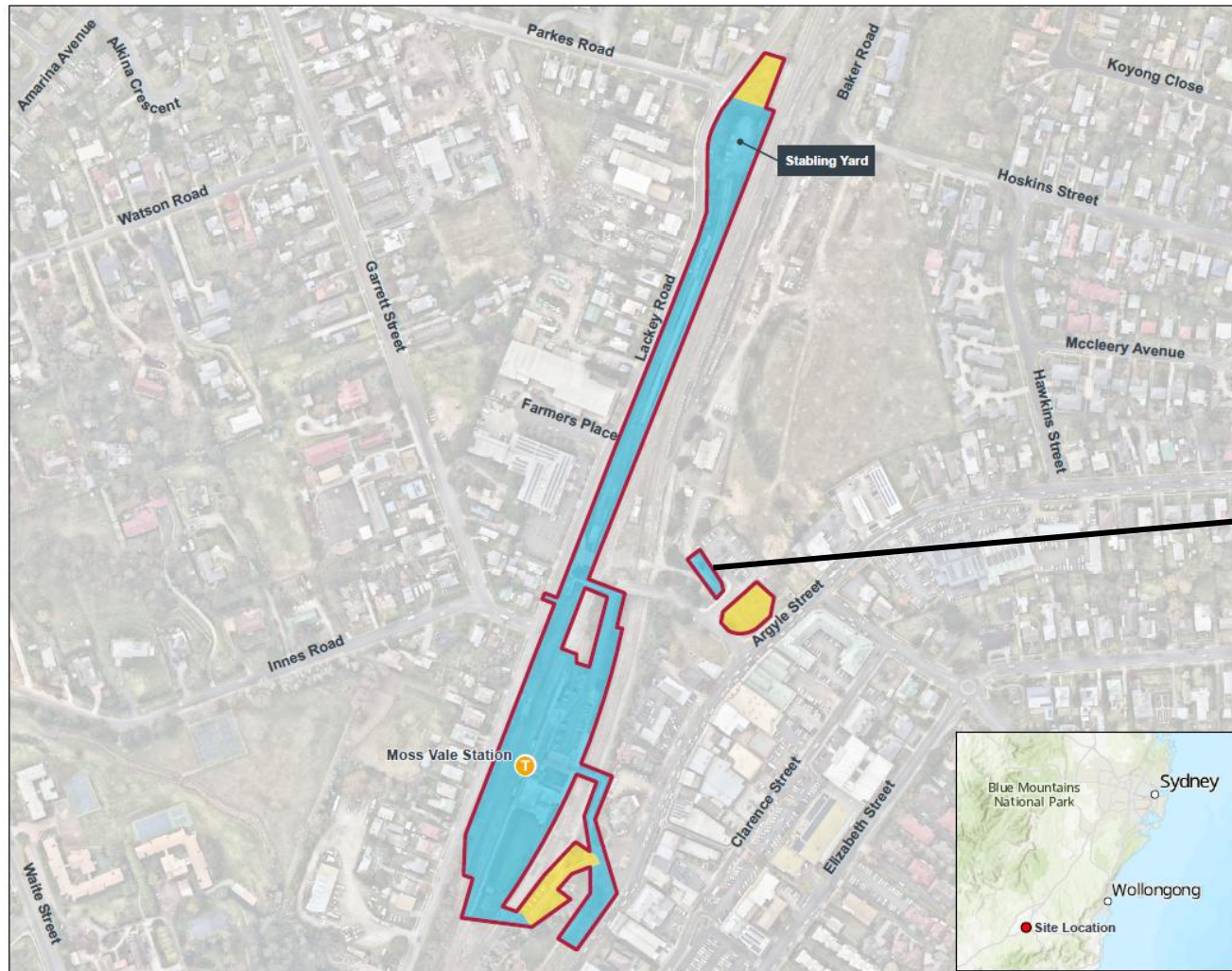
Source – Aecom email correspondence. Photo's taken by author at time of inspection.

### Legend

**10.** Tree/s or stands of trees numbered in **orange and bold** or surrounded by an unbroken line are recommended for **retention/pruning**.

**11.** Tree/s or stands of trees numbered in **blue and not bold** or surrounded by a broken line are recommended for **removal**.

Note: trees indicated, unnumbered are either shrubs, or trees of species, or dimensions, or condition class not protected by the Tree Preservation Order or trees not affected by the proposed works or were already removed.



Source – Google maps, viewed 30 August 2023.

Source – Aecom email correspondence.

**Work Area 6**  
 - **5 / MTS**  
 3 trees – Trees 49, 50, 51 (Remove)





## APPENDIX B – Tree Location Plan 5 of 6 (trees numbered per Appendix A - Tree Assessment)

**Moss Vale Station & Stabling Upgrades** Ref: 26201

Prepared by Urban Tree Management Australia P/L, 65 Excelsior Street, Merrylands NSW 2160, tel. 02 9760 1389.

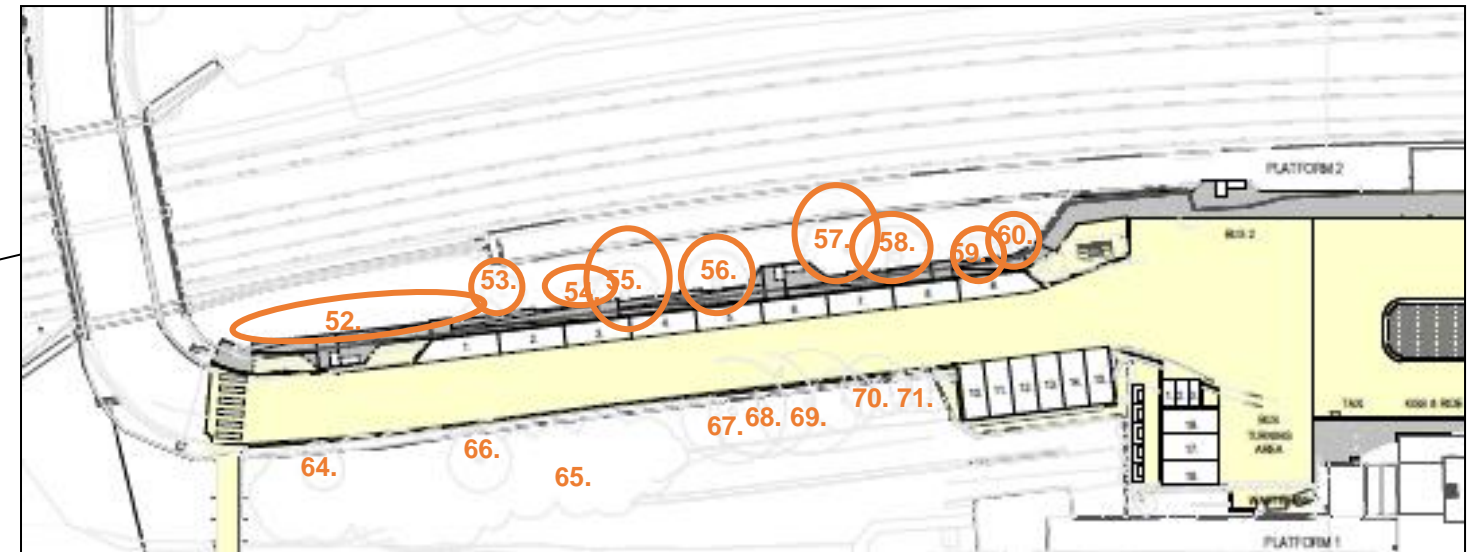
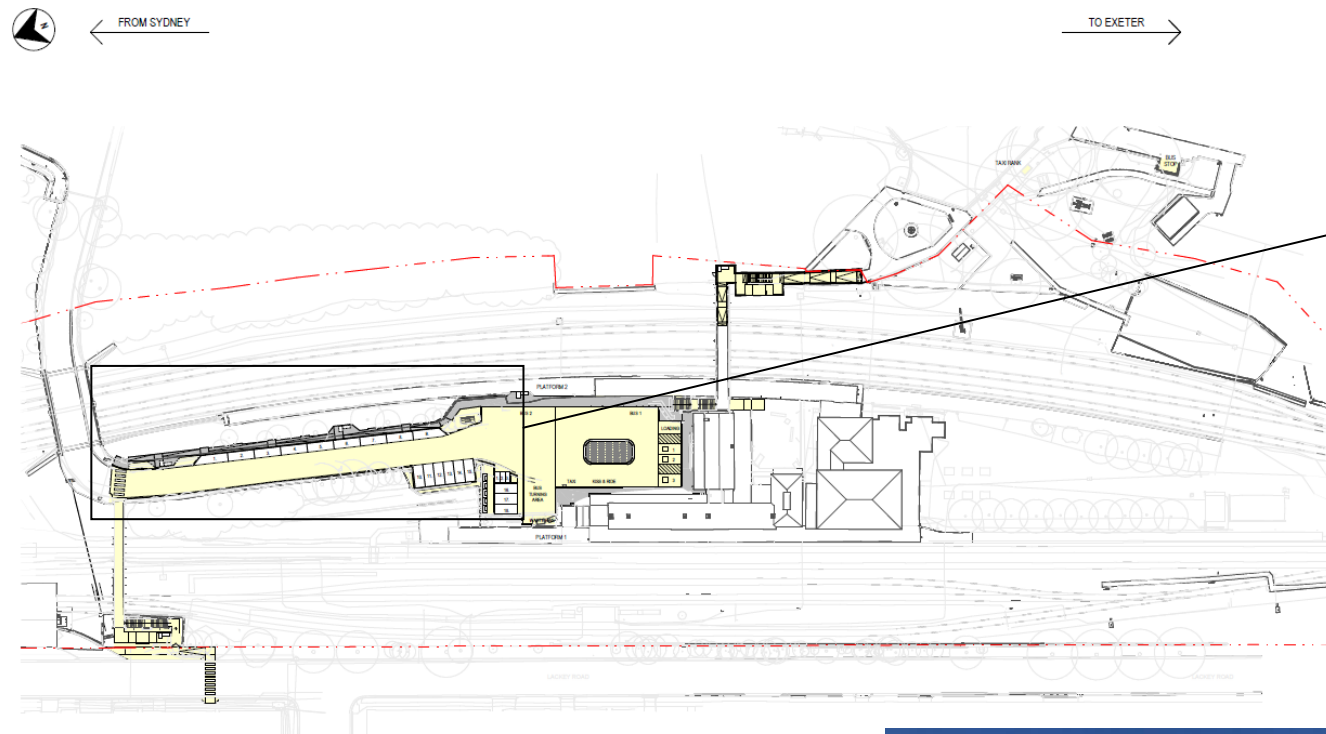
Source – Aecom email correspondence. Photo's taken by author at time of inspection.

### Legend

**10.** Tree/s or stands of trees numbered in **orange and bold** or surrounded by an unbroken line are recommended for **retention/pruning**.

**11.** Tree/s or stands of trees numbered in **blue and not bold** or surrounded by a broken line are recommended for **removal**.

Note: trees indicated, unnumbered are either shrubs, or trees of species, or dimensions, or condition class not protected by the Tree Preservation Order or trees not affected by the proposed works or were already removed.



### Work Area 7

- **6 / Dalys Way**
- 9 trees (east side) (Retain) – (includes 4 trees and x5 large shrubs) Trees 52 – 60
- 8 trees (west side) (Retain) Trees 64 – 71



## APPENDIX B – Tree Location Plan 6 of 6

(trees numbered per Appendix A - Tree Assessment)

Moss Vale Station & Stabling Upgrades

Ref: 26201

Prepared by Urban Tree Management Australia P/L, 65 Excelsior Street, Merrylands NSW 2160, tel. 02 9760 1389.

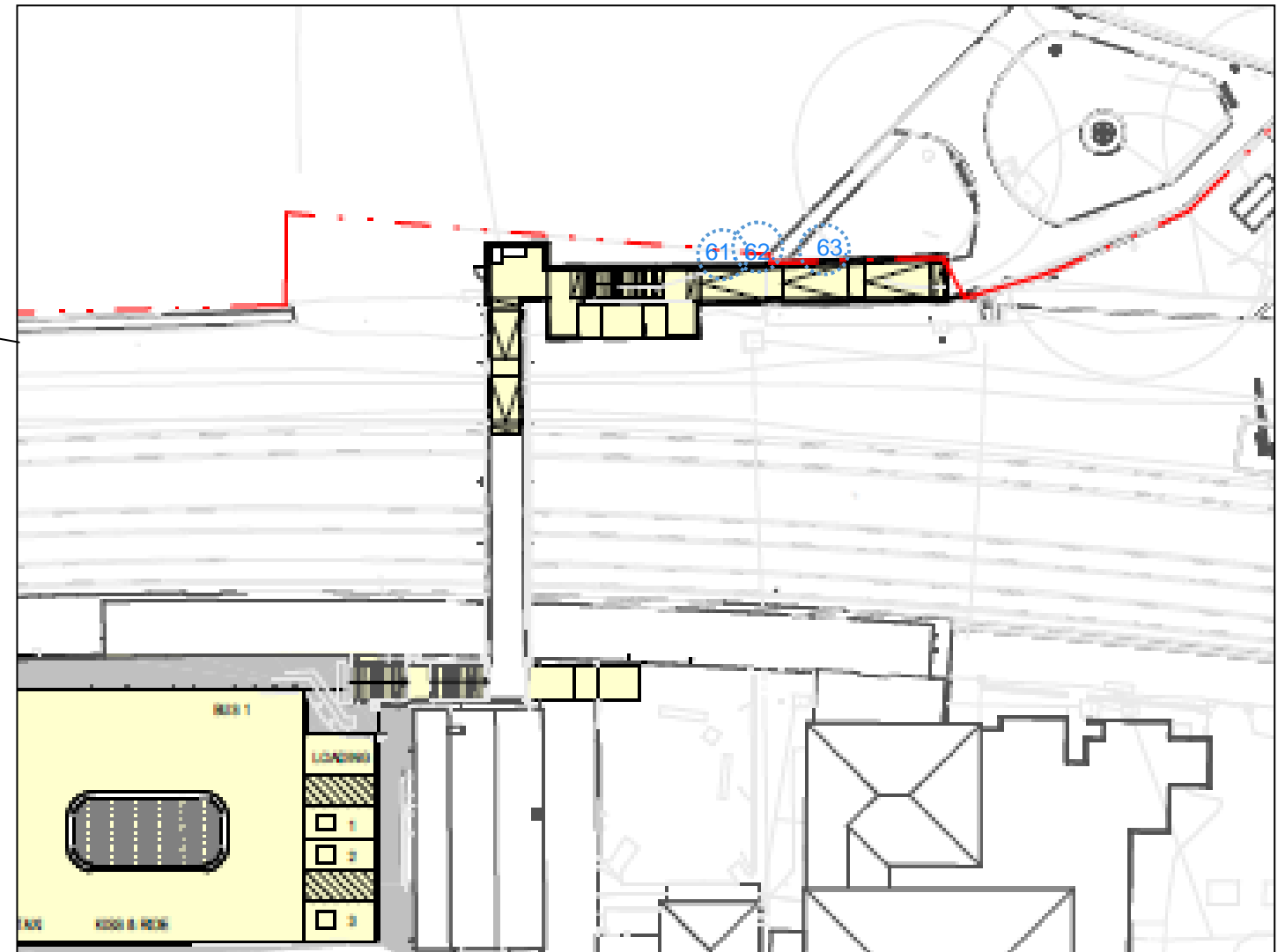
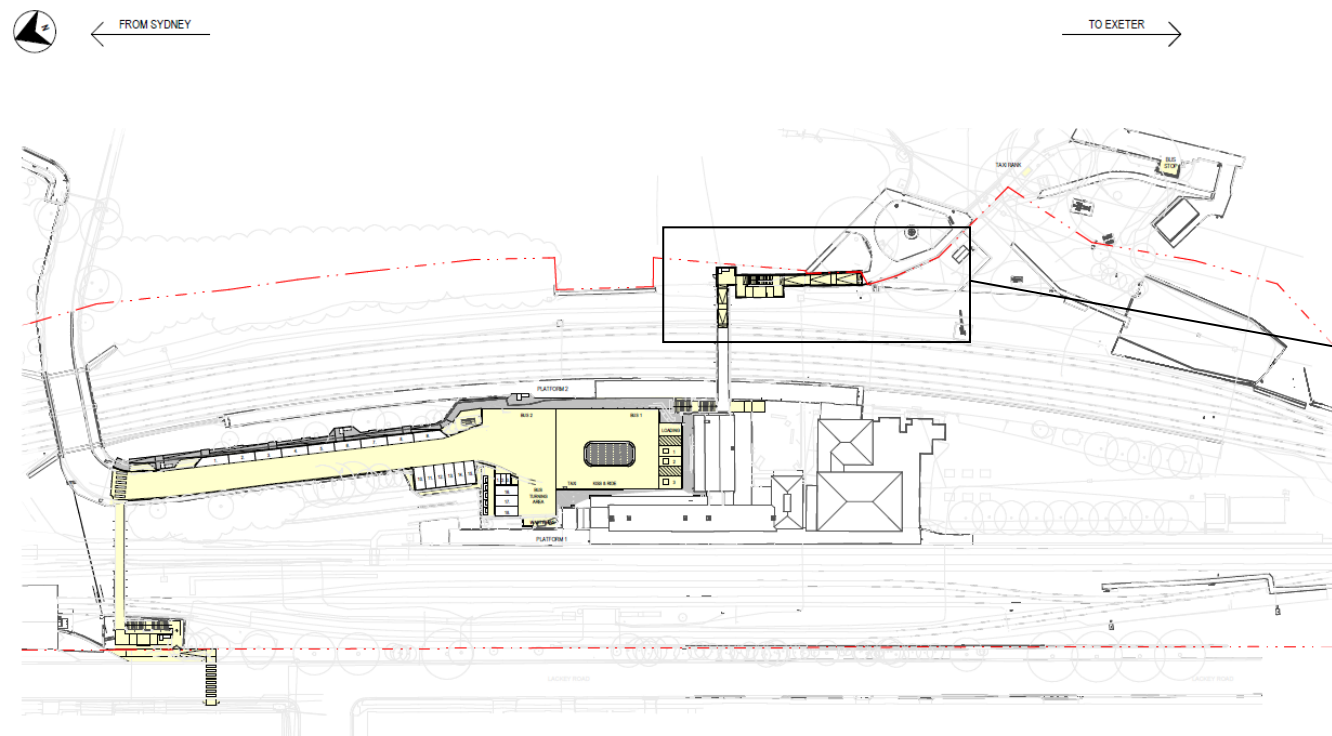
Source – Site Plan by Architectus, DWG. No. 3150505-AR-DRG-SK201, Rev. E, dated 14 July 2023.  
Photo's taken by author at time of inspection.

### Legend

10. Tree/s or stands of trees numbered in orange and bold or surrounded by an unbroken line are recommended for retention.

11. Tree/s or stands of trees numbered in blue and not bold or surrounded by a broken line are recommended for removal.

Note: trees indicated, unnumbered are either shrubs, or trees of species, or dimensions, or condition class not protected.



**Work Area 8**  
- 7 / Argyle Street  
3 trees – Trees 61- 63 (Remove)

Photos facing south.

## APPENDIX C – TREE PROTECTION PLAN 1 of 3 - Tree Protection Zones - Standard Procedure



The Protective fencing where required may delineate the **TPZ** and should be located as determined by the project arborist in accordance with AS4970 *Protection of trees on development sites*, Section 4, 4.3. "Fencing should be erected before any machinery or materials are brought onto the site and before the commencement of works including demolition. Once erected, protective fencing must not be removed or altered without approval by the project arborist. The TPZ must be secured to restrict access. AS4687 *Temporary fencing and hoardings* specifies applicable fencing requirements. Shade cloth or similar should be attached to reduce the transport of dust, other particulate matter and liquids into the protected area. Fence posts and supports should have a diameter greater than 20 mm and be located clear of roots. Existing perimeter fencing and other structures may be suitable as part of the protective fencing."

AS4970 Section 4, Tree protection measures, Figure 3 Protective fencing shows examples of such fencing.

**Legend:**

- 1 Chain wire mesh panels with shade cloth (if required) attached, held in place with concrete feet.
- 2 Alternative plywood or wooden paling fence panels. The fencing material also prevents building materials or soil entering the TPZ.
- 3 Mulch installation across surface of TPZ (at the discretion of the project arborist). No excavation, construction activity, grade changes, surface treatment or storage of materials of any kind is permitted within the TPZ.
- 4 Bracing is permissible within the TPZ. Installation of supports should avoid damaging roots."

AS4970 Section 4, Tree protection measures, 4.2 Activities restricted within the TPZ

"Activities generally excluded from the TPZ included but are not limited to-

- (a) Machine excavation including trenching;
- (b) Excavation for silt fencing;
- (c) cultivation;
- (d) storage;
- (e) preparation of chemicals, including preparation of cement products;
- (f) parking of vehicles and plant;
- (g) refuelling;
- (h) dumping of waste;
- (i) wash down and cleaning of equipment;
- (j) placement of fill;
- (k) lighting of fires;
- (l) soil level changes;
- (m) temporary or permanent installation of utilities and signs, and
- (n) physical damage to the tree."

**Tree Protection signage** is to be attached to each **Tree Protection Zone** and displayed from within the development site in accordance with AS4970 2009 *Protection of trees on development sites*, Section 4.4 and example Figure C1 (as shown) and lettering to comply with AS1319.

Where a tree is to be retained and a **Tree Protection Zone** cannot be adequately established due to restricted access e.g. tree located along side an access way, the trunk and branches in the lower crown will be protected by wrapping 2 layers of hessian or carpet underfelt around the trunk and branches for a minimum of 2 m or as lower branches permit, then wire or rope secures 75x50x2000 mm hardwood battens together around the trunk (do not nail or screw to the trunk or branches). The number of battens to be used is as required to encircle the trunk and the battens are to extend to the base of the tree (AS4970 2009 *Protection of trees on development sites*, Figure 4 Examples of Trunk, Branch and ground protection).

**Trunk/Branch and root protection** If a tree is growing down slope from an excavation, a silt fence located along the contours of the site in the area immediately above the **Tree Protection Zone** fencing may need to be installed and regularly maintained to prevent burial and asphyxiation of the roots of the tree. To allow for the maintenance of both fences, the silt fence must be constructed separately to the tree protection fence and the 2 fences must be constructed independently of each other and standalone. To reduce competition with the tree the area within the **Tree Protection Zone** is to be kept free of weeds. These are best removed by the application of foliar herbicide with Glyphosate as the active constituent. This is the preferred method rather than removal by cultivation of the soil within the dripline, to minimise root disturbance to the tree. The removal of woody weeds such as Privet should use the cut and paint method of herbicide application. Weeds to be controlled within the **Tree Protection Zone**, for the duration of the project.

The area of the Tree Protection Zone to be mulched to a depth of 100 mm with organic material being 75% leaf litter and 25% wood, and this being composted material preferably from the same genus and species of tree as that to where the mulch is to be applied, i.e. species specific mulch. The depth of mulch and type as indicated, to be maintained for the duration of the project. Where deep excavation will expose the soil profile to drying out the root plate is to be protected by pegging jute matting across the ground surface 2 m back from the edge of the profile and 2 m down the face of the profile and is to be in one continuous sheet or layers up to 5 mm thick and overlapped 300 mm and pegged. Pegs are to be a minimum length of 200 mm and spaced at 500 mm increments in a grid pattern. Once installed mulch is to be placed on top of the jute matting previously described.

No services either temporary or permanent are to be located within the **Tree Protection Zone**. If services are to be located within the **Tree Protection Zone**, special details will need to be provided by the Project Arborist for the protection of the tree regarding the location of the service/s.

A tree will not be fertilised during its protection within the **Tree Protection Zone**, as this may hasten its decline if it were to decline. If a tree is to be fertilised this should be in consultation with the Project Arborist as per AS4970 (2009).

In the event of prolonged dry periods, or where a tree has been transplanted, or where excavation nearby, especially up slope, leads to drying out of a soil profile, or modification to ground water flow, or flows across an existing ground surface to the tree and its growing environment; deep root watering thoroughly at least twice a week is to be undertaken to irrigate the tree. The need for such watering is determined readily by observing the dryness of the soil surface within the dripline of the tree by scraping back some mulch. Mulch is to be reinstated afterwards. In the event of disrupted ground or surface water flows to the tree due to excavation, filling or construction, a reticulated irrigation system may be required to be installed within the **Tree Protection Zone**. If an irrigation system is to be installed, consideration must be given to volume, frequency, and drainage of water delivered, and this should be in consultation with the Project Arborist as per AS4970 (2009).

**Scaffolding** "Where scaffolding is required it should be erected outside the TPZ. Where it is essential for scaffolding to be erected within the TPZ, branch removal should be minimized. This can be achieved by designing scaffolding to avoid branches or tying back branches. Where pruning is unavoidable it must be specified by the project arborist in accordance with AS4373. Ground below the scaffolding should be protected by boarding (e.g. scaffolding board or plywood sheeting) as shown in Figure 5. Where access is required, a board walk or other surface material should be installed to minimise soil compaction. Boarding should be placed over a layer of mulch and impervious sheeting to prevent soil contamination. The boarding should be left in place until the scaffolding is removed." (Standards Australia 2009, p. 18).

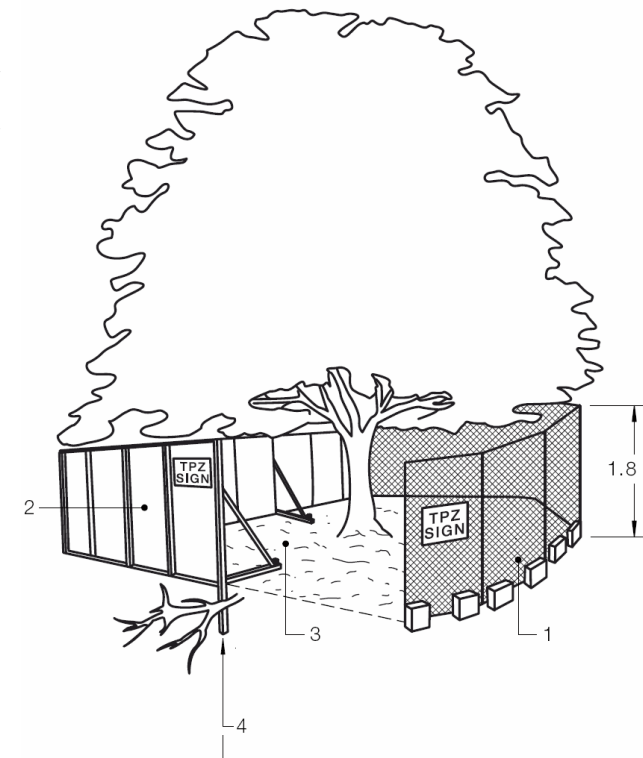


FIGURE 3 PROTECTIVE FENCING



FIGURE C1 TREE PROTECTION ZONE SIGN

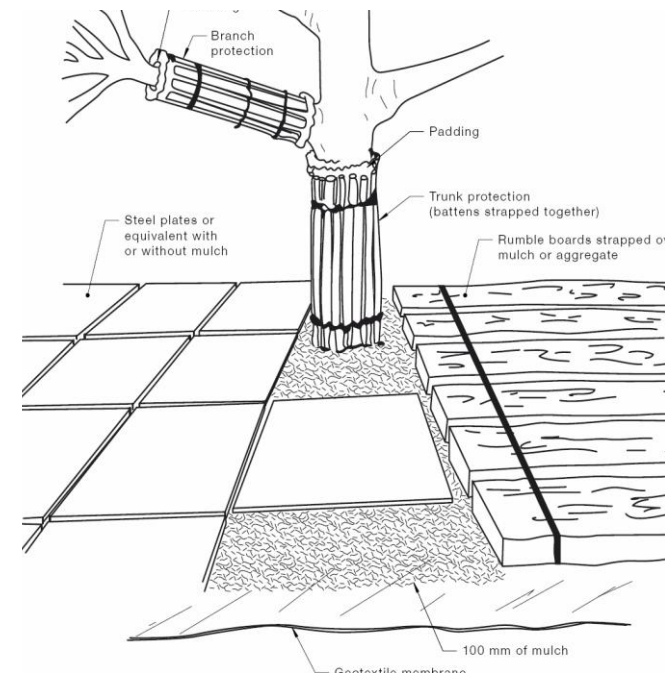
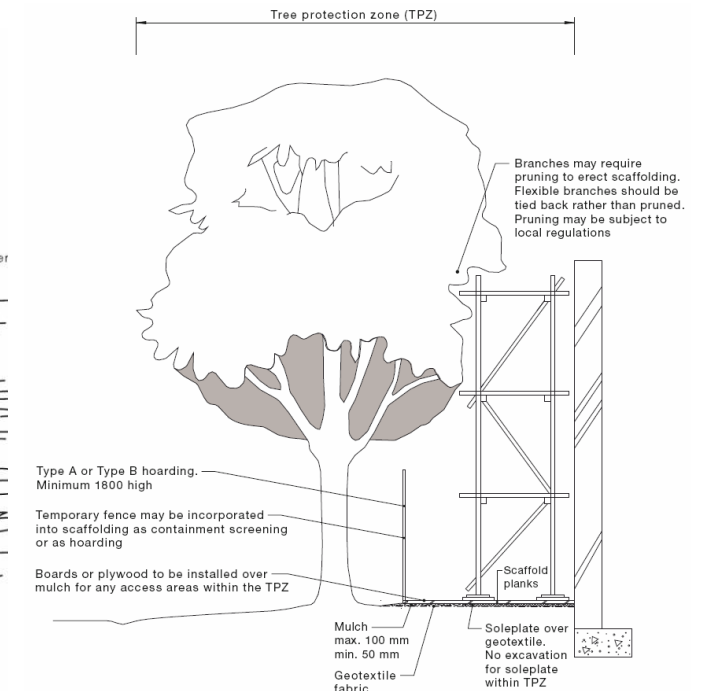


FIGURE 4 EXAMPLES OF TRUNK, BRANCH AND GROUND PROTECTION



NOTE: Excavation required for the insertion of support posts for tree protection fencing should not involve the severance of any roots greater than 20 mm in diameter, without the prior approval of the project arborist.

FIGURE 5 INDICATIVE SCAFFOLDING WITHIN A TPZ

## APPENDIX C – Tree Protection Plan - Plan 2 of 3 (trees numbered per Appendix A - Tree Assessment)

Ref: 26201



### Moss Vale Station & Stabling Upgrades

Prepared by Urban Tree Management Australia P/L, 65 Excelsior Street, Merrylands NSW 2160, tel. 02 9760 1389.

Note – tree protection works established from and limited to the information provided at the time of writing this report.

### Tree Protection Works - General

All retained tree/s Existing levels are to be preserved and no excavation except by hand to protect structural roots is to be undertaken within the Tree Protection Zones unless specified by the Project Arborist.

Induction for Tree Protection All workers entering the site involved in construction must be advised of the tree protection measures and specifications outlined within this report during the site induction. This is to be verbally acknowledged and signed off before commencement of work.

### Tree Protection Works - Specific

#### Prior to Construction

Tree Protection Zone (TPZ) Fencing - Tree 47-48 (2 trees) Enclose within a Tree Protection Zone with protective fencing and maintained and retained until the completion of all building works. Protective fencing is to be installed as shown in Appendix H – Tree Protection Plan - Tree Protection Zone - Standard Procedure, Plan 1 of 4, such as temporary fencing panels or star steel pickets with safety fencing (mesh) etc.

Trunk Protection - Tree 55, 56 & 58 (3 trees) As per AS4970 (2009) *Protection of trees on development sites*, Section 4 Tree protection measures, 4.5.2 Trunk and branch protection - the trunks to 2 m are to be protected from possible damage during footpath construction/widening and are to be wrapped with 4 layers of hessian or a single layer of carpet underfelt around the subject stems for a minimum of 2 m and extending to first order branches, then wire or rope is to be used to secure 75x50x2000 mm hardwood battens to the trunk (do not nail or screw to the trunk). The number of battens to be used is as required to encircle the trunk and the battens are to extend to the base of the tree as per AS4970 (2009) Figure 4, (see Appendix G, Plan 1 of 3).

Pruning - Tree 47 Crown Lift as Crown maintenance pruning, (AS4973 2007, p 13) to remove branches at the lower crown to east & south/east only (4-5m above ground and up to 50mm diameter).

Tree 48 Crown Lift as Crown maintenance pruning, (AS4973 2007, p 13) to remove branches at the lower crown to west & south/west only (4-5m above ground and up to 50mm diameter).

Trees 52, 54, 57, 59 & 60 Shrubs. Prune as hedging to west for proposed path widening/pedestrian clearance.

Trees 55, 56 & 58 Selective Pruning as Crown maintenance pruning, (AS4973 2007, p 14) epicormic growth only emerging at lower trunk region to west (3m above ground level).

Trees 64, 65, 66, 68, 69 & 71 Shrubs. Prune as hedging to east for proposed path widening/pedestrian clearance.

Trees 67 & 70 Selective Pruning as Crown maintenance pruning, (AS4973 2007, p 14) epicormic growth only emerging at lower trunk region to east (3m above ground level).

#### During Demolition

Tree Removal - Trees 1-8, 14, 15-18, 20, 29, 30, 33, 34, 36-42, 46, 49, 50, 51, 61, 62 & 63 (32 trees) To be removed and their stumps removed or ground to 300 mm below grade. To be removed with those trees recommended for removal in Eco Logical Report, Ref. 20SUT-15827, dated August 2021.

Root Protection - Trees 55, 56, 58, 67 & 70 (5 trees) Footpath removal (if required), undertake by tree sensitive measures. Position excavator by working away from the trees, utilising the adjacent road as a stable platform to prevent soil compaction. Carefully lift/remove existing concrete footpath without excavating soil or damaging roots growing at surface. Retain existing soil levels.

#### During Construction

Maintain TPZ fencing/trunk protection for the entire construction period.

Root Protection - Trees 55, 56, 58, 67 & 70 (5 trees) Undertake tree sensitive measures for footpath construction/widening. Construct at or above grade to protect roots. DO NOT REMOVE/SEVERE ROOTS. Hand consolidate sub grade only. Advise project arborist if level changes are required to establish tree sensitive methods or material selection. Consider clearance distance from footpath to roots/buttress/trunk for future growth/expansion (allow min 100mm clearance to structural roots ( $\geq 50\text{mm}\varnothing$ ) and min. 200mm clearance to edge of trunk).

Root Pruning - Trees 52 - 60 & 64 - 71 (16 trees) Any root  $\geq 25\text{mm}\varnothing$  emerging from adjacent shrubs/hedges are to be severed by clean cutting. Such works are to be monitored and certified by the Project Arborist. No roots are to be severed from Trees 55, 56, 58, 67 & 70 as works located within the structural root zone (SRZ).

#### Post Construction

Tree Protection Zone fencing/trunk protection is to be removed during this period.

## APPENDIX C – Tree Protection Plan, plan 3 of 3




(trees numbered per Appendix A - Tree Assessment)

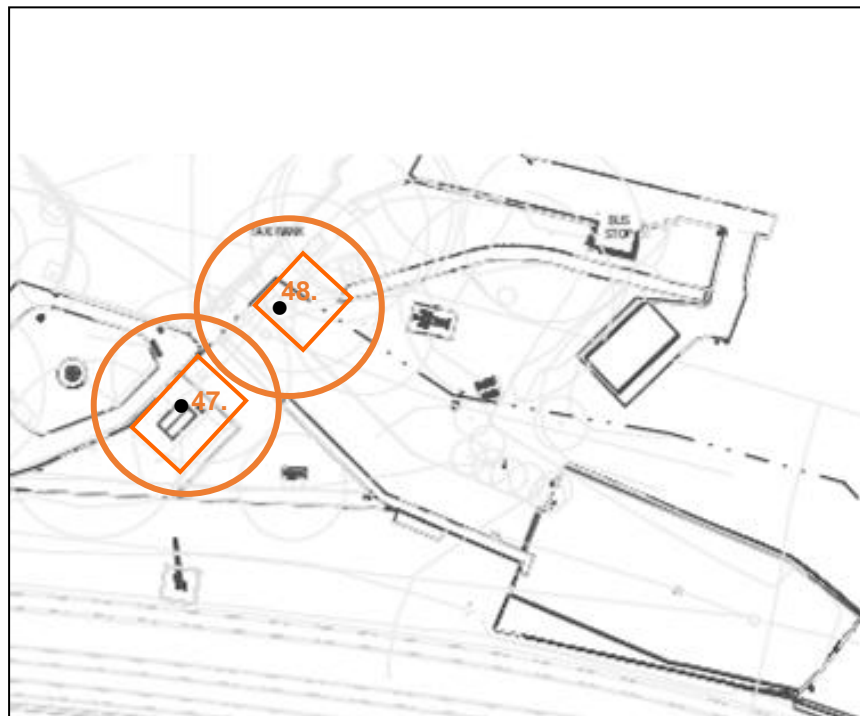
### Moss Vale Station & Stabling Upgrades

Ref: 26201

Prepared by Urban Tree Management Australia P/L, 65 Excelsior Street, Merrylands NSW 2160, tel. 02 9760 1389.

#### Legend

-  **Tree Protection Zone (TPZ)**, as fencing with setbacks as indicated, or other protection measures or works as indicated.
-  **Tree Protection Zone**, within the site, area of special protection measures or works outside of or instead of a fenced area.
- 11.** Tree/s or stands of trees numbered in **orange and bold** or surrounded by an unbroken line are recommended for **retention**.
-  **Trunk Protection**

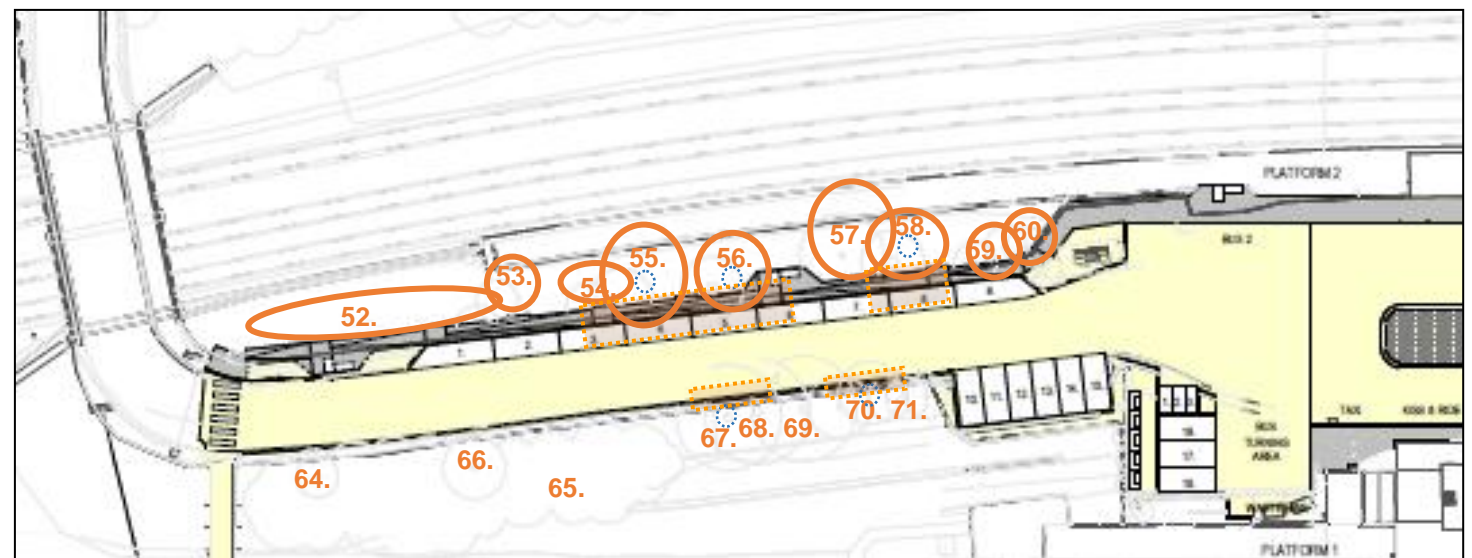


**Pruning Diagram/Specifications** Note – prune to hatched line above.  
**Tree 47** Crown Lift as Crown maintenance pruning, (AS4973 2007, p 13) to remove branches at the lower crown to east & south/east only (4-5m above ground and up to 50mm diameter).  
**Tree 48** Crown Lift as Crown maintenance pruning, (AS4973 2007, p 13) to remove branches at the lower crown to west & south/west only (4-5m above ground and up to 50mm diameter).

Table 3			
1. UTM Tree No. / UTM Stand No.	2. Tree Protection Zone (TPZ) = 12 x DBH (m) From centre of trunk (COT) in metres AS4970 (2009) Section 3 (see Appendix B)	3. Structural Root Zone (SRZ) From centre of trunk (COT), trunk diameter above root buttress (DARB) AS4970 (2009) Section 3, 3.3.5 (see Appendix C) where applicable (m)	4. Proposed distance of works on the side closest to building construction in metres From centre of trunk (COT), (m)
47	9.0	3.0	1.5 Driveway
48	6.6	2.7	2.5 Driveway
55	14.4	3.8	0.2 Footpath (EOT)
56	15.0	3.9	0.1 Footpath (EOT)
58	15.0	4.2	0.2 Footpath (EOT)
67	15.0	4.2	0.2 Footpath (EOT)
70	15.0	4.2	0.2 Footpath (EOT)

### Work Area 5

- 5 / Site Compounds
- 2 trees – Trees 47 & 48 (Retain)



### Work Area 7

- 7 / Dalys Way 9 trees (east side) – (includes 4 trees and 5 large shrubs) Trees 52 – 60 (Retain) - 3 trees requiring trunk protection
- 8 trees (west side) – Trees 64-71. Trees 67 & 70 (Retain) - 2 trees requiring trunk protection.

# Appendix D

## IACA Significance of a Tree, Assessment Rating System (STARS) © (IACA 2010)©

In the development of this document IACA acknowledges the contribution and original concept of the Footprint Green Tree Significance & Retention Value Matrix, developed by Footprint Green Pty Ltd in June 2001.

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

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

### Tree Significance - Assessment Criteria



#### 1. High Significance in landscape

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

#### 2. Medium Significance in landscape

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

#### 3. Low Significance in landscape

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

##### Environmental Pest / Noxious Weed Species

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

##### Hazardous/Irreversible Decline

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

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

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

**Table 1.0 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					
	Dead					

<u>Legend for Matrix Assessment</u>	
	<b>Priority for Retention (High)</b> - 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 <i>Protection of trees on development sites</i> . Tree sensitive construction measures must be implemented e.g. pier and beam etc if works are to proceed within the Tree Protection Zone.
	<b>Consider for Retention (Medium)</b> - 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.
	<b>Consider for Removal (Low)</b> - These trees are not considered important for retention, nor require special works or design modification to be implemented for their retention.
	<b>Priority for Removal</b> - These trees are considered hazardous, or in irreversible decline, or weeds and should be removed irrespective of development.



**REFERENCES**

Australia ICOMOS Inc. 1999, *The Burra Charter – The Australian ICOMOS Charter for Places of Cultural Significance*, International Council of Monuments and Sites, [www.icomos.org/australia](http://www.icomos.org/australia)

Draper BD and Richards PA 2009, *Dictionary for Managing Trees in Urban Environments*, Institute of Australian Consulting Arboriculturists (IACA), CSIRO Publishing, Collingwood, Victoria, Australia.

Footprint Green Pty Ltd 2001, *Footprint Green Tree Significance & Retention Value Matrix*, Avalon, NSW Australia, [www.footprintgreen.com.au](http://www.footprintgreen.com.au)

# Appendix E

## Matrix - Sustainable Retention Index Value (SRIV) ©

Version 4, 2010

Developed by IACA – Institute of Australian Consulting Arboriculturists [www.iaca.org.au](http://www.iaca.org.au)

The matrix is to be used with the value classes defined in the Glossary for Age / Vigour / Condition.  
 An index value is given to each category where ten (10) is the highest value.

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





# Appendix F

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

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

#### 3.1 Tree protection zone (TPZ)

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

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

#### 3.2 Determining the TPZ

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

$$\text{TPZ} = \text{DBH} \times 12$$

where

DBH = trunk diameter measured at 1.4 m above ground

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

# Appendix G

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

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

#### 3.3.5 Structural root zone (SRZ)

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

#### Determining the SRZ

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

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

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

where

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

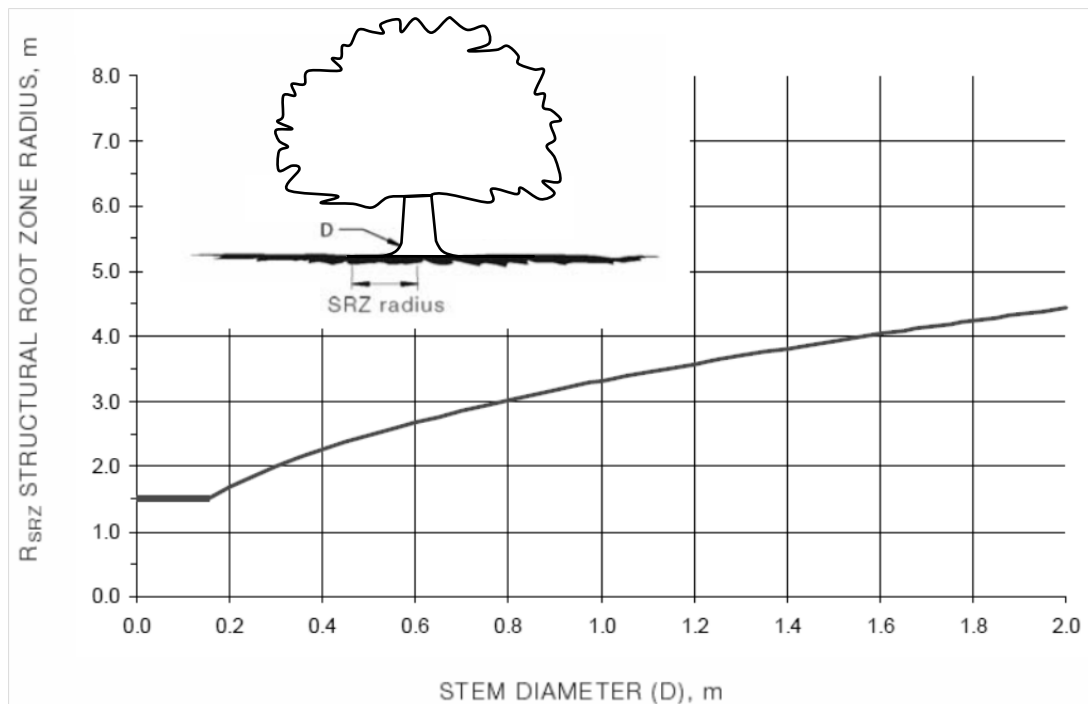


FIGURE 1 STRUCTURAL ROOT ZONE CALCULATION  
(AS 4970 – 2009, Amendment No. 1 March 2010)

#### NOTES:

- 1  $R_{SRZ}$  is the calculated structural root zone radius (SRZ radius).
- 2 *D* is the stem diameter measured immediately above root buttress.
- 3 The  $R_{SRZ}$  for trees less than 0.15 m diameter is 1.5 m.
- 4 The  $R_{SRZ}$  formula and graph do not apply to palms, other monocots, cycads and tree ferns.
- 5 This does not apply to trees with an asymmetrical root plate.

# Appendix H

## Glossary

From

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

### Vigour

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

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

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

**Low Vigour** Reduced ability of a tree to sustain its life processes. This may be evident by the *atypical* growth of leaves, reduced *crown cover* and reduced *crown density*, branches, roots and trunk, and a deterioration of their functions with reduced *resistance to predation*. This is independent of the *condition* of a tree but may impact upon it, and especially the ability of a tree to sustain itself against predation.

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

### Age of Trees

**Age** Most trees have a stable biomass for the major proportion of their life. The estimation of the age of a tree is based on the knowledge of the expected lifespan of the taxa *in situ* divided into three distinct stages of measurable biomass, when the exact age of the tree from its date of cultivation or planting is unknown and can be categorized as *Young*, *Mature* and *Over-mature* (British Standards 1991, p. 13, Harris *et al*, 2004, p. 262).

**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.

### Periods of Time

**Periods of Time** The life span of a tree in the urban environment may often be reduced by the influences of encroachment and the dynamics of the environment and can be categorized as *Immediate*, *Short Term*, *Medium Term* and *Long Term*.

**Immediate** An *episode* or occurrence, likely to happen within a twenty-four (24) hour period, e.g. tree failure or collapse in full or part posing an imminent danger.

**Short Term** A period of time less than <1 – 15 years.

**Medium Term** A period of time 15 – 40 years.

**Long Term** A period of time greater than >40 years.

### Trunk

**Trunk** A single stem extending from the *root crown* to support or elevate the *crown*, terminating where it divides into separate *stems* forming *first order branches*. A trunk may be evident at or near ground or be absent in *acaulescent* trees of *deliquescent* habit, or may be continuous in trees of *excurrent* habit. The trunk of any *caulescent* tree can be divided vertically into three (3) sections and can be categorized as *Lower Trunk*, *Mid Trunk* and *Upper Trunk*. For a *leaning* tree these may be divided evenly into sections of one third along the trunk.

**Acaulescent** A *trunkless* tree or tree growth forming a very short *trunk*. See also *Caulescent*.

**Caulescent** Tree grows to form a *trunk*. See also *Acaulescent*.

## Condition of Trees

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

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

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

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

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

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

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

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

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

*Symptoms*

Permanent leaf loss;

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

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

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

## Leaning Trees

**Leaning** A tree where the *trunk* grows or moves away from upright. A lean may occur anywhere along the *trunk* influenced by a number of contributing factors e.g. genetically predetermined characteristics, competition for space or light, prevailing winds, aspect, slope, or other factors. A *leaning* tree may maintain a *static lean* or display an increasingly *progressive lean* over time and may be hazardous and prone to *failure* and *collapse*. The degrees of leaning can be categorized as *Slightly Leaning*, *Moderately Leaning*, *Severely Leaning* and *Critically Leaning*.

**Slightly Leaning** A leaning tree where the trunk is growing at an angle within 0°-15° from upright.

**Moderately Leaning** A leaning tree where the trunk is growing at an angle within 15°-30° from upright.

**Severely Leaning** A leaning tree where the trunk is growing at an angle within 30°-45° from upright.

**Critically Leaning** A leaning tree where the trunk is growing at an angle greater than >45° from upright.

**Progressively Leaning** A tree where the degree of *leaning* appears to be increasing over time.

**Static Leaning** A leaning tree whose lean appears to have stabilized over time.

## Form of Trees

**Crown Form** The shape of the crown of a tree as influenced by the availability or restriction of space and light, or other contributing factors within its growing environment. Crown Form may be determined for tree shape and habit generally as *Dominant*, *Codominant*, *Intermediate*, *Emergent*, *Forest* and *Suppressed*. The habit and shape of a *crown* may also be considered qualitatively and can be categorized as *Good Form* or *Poor Form*.

**Good Form** Tree of *typical* crown shape and habit with proportions representative of the taxa considering constraints such as origin e.g. indigenous or exotic, but does not appear to have been adversely influenced in its development by environmental factors in situ such as *soil water* availability, prevailing wind, or cultural practices such as lopping and competition for space and light.

**Poor Form** Tree of *atypical* crown shape and habit with proportions not representative of the species considering constraints and appears to have been adversely influenced in its development by environmental factors in situ such as *soil water* availability, prevailing wind, cultural practices such as lopping and competition for space and light; causing it to be *misshapen* or disfigured by disease or vandalism.

**Crown Form Codominant** Crowns of trees restricted for space and light on one or more sides and receiving light primarily from above e.g. constrained by another tree/s or a building.

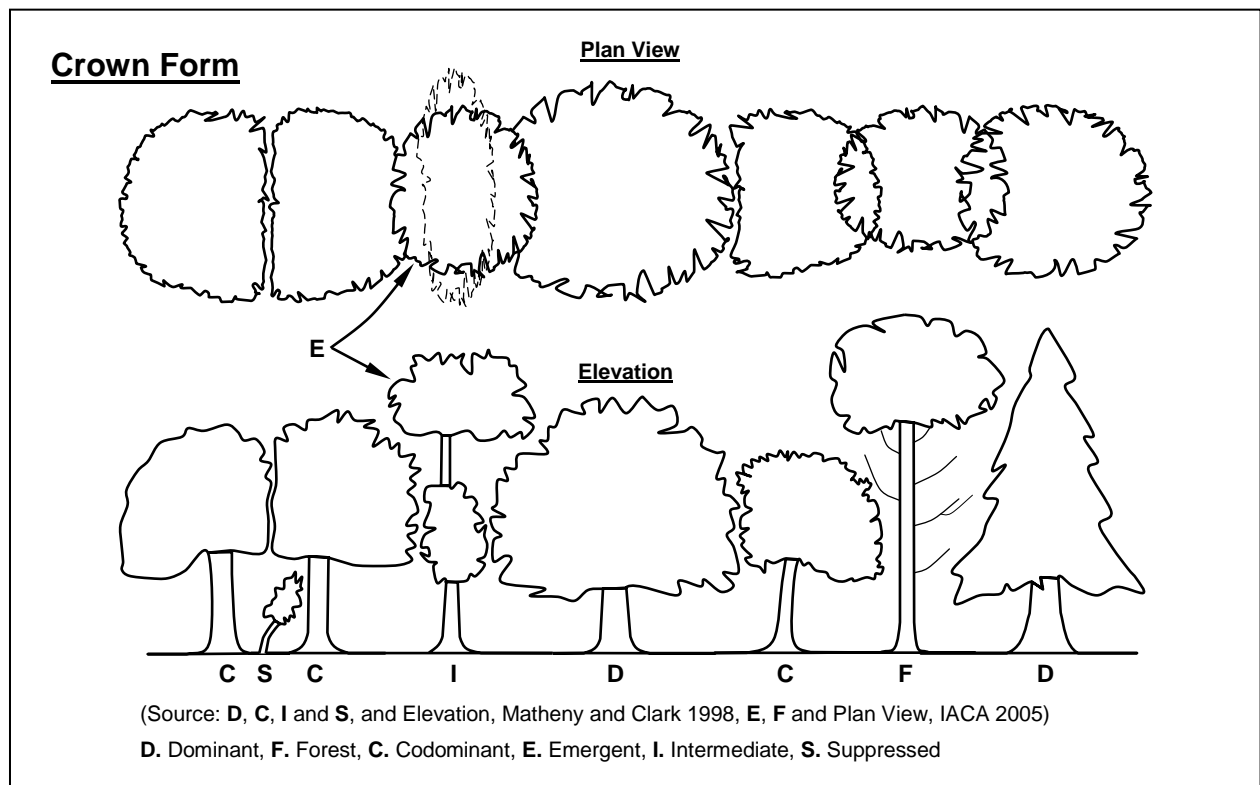
**Crown Form Dominant** Crowns of trees generally not restricted for space and light receiving light from above and all sides.

**Crown Form Emergent** Crowns of trees restricted for space on most sides receiving most light from above until the *upper crown* grows to protrude above the canopy in a stand or forest environment. Such trees may be *crown form dominant* or transitional from *crown form intermediate* to *crown form forest* asserting both *apical dominance* and *axillary dominance* once free of constraints for space and light.

**Crown Form Forest** Crowns of trees restricted for space and light except from above forming tall trees with narrow spreading crowns with foliage restricted generally to the top of the tree. The trunk is usually erect, straight and continuous, tapering gradually, crown often excurrent, with first order branches becoming structural, supporting the live crown concentrated towards the top of the tree, and below this point other first order branches arising radially with each *inferior* and usually temporary, divergent and ranging from horizontal to ascending, often with internodes exaggerated due to competition for space and light in the *lower crown*.

**Crown Form Intermediate** Crowns of trees restricted for space on most sides with light primarily from above and on some sides only.

**Crown Form Suppressed** Crowns of trees generally not restricted for space but restricted for light by being *overtopped* by other trees and occupying an understory position in the canopy and growing slowly.



## **Symmetry**

**Symmetry** Balance within a *crown*, or *root plate*, above or below the *axis* of the trunk of branch and foliage, and root distribution respectively and can be categorized as *Asymmetrical* and *Symmetrical*.

**Asymmetrical** Imbalance within a crown, where there is an uneven distribution of branches and the foliage *crown* or *root plate* around the vertical *axis* of the trunk. This may be due to *Crown Form Codominant* or *Crown Form Suppressed* as a result of natural restrictions e.g. from buildings, or from competition for space and light with other trees, or from exposure to wind, or artificially caused by pruning for clearance of roads, buildings or power lines. An example of an expression of this may be, crown asymmetrical, bias to west.

**Symmetrical** Balance within a crown, where there is an even distribution of branches and the *foliage crown* around the vertical *axis* of the trunk. This usually applies to trees of *Crown Form Dominant* or *Crown Form Forest*. An example of an expression of this may be crown symmetrical.

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

**Crown Spread Orientation Non-radial** Where the crown extent is longer than it is wide, e.g. east/west or E/W. Further examples, north/south or N/S, and may be *Crown Form Codominant*, e.g. **A** or **B**, *Crown Form Intermediate* e.g. **A**, or *Crown Form Suppressed* e.g. **B**, and crown symmetry is *symmetrical* e.g. **A**, or *asymmetrical* e.g. **B**.

**Crown Spread Orientation Radial** Where the *crown spread* is generally an even distance in all directions from the trunk and often where a tree has *Crown Form Dominant* and is *symmetrical*.

**Significant** Important, weighty or more than ordinary.

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

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

**Sustainable Retention Index Value (SRIV)** A visual tree assessment method to determine a qualitative and numerical rating for the viability of urban trees for development sites and management purposes, based on general tree and landscape assessment criteria using classes of *age*, *condition* and *vigour*. SRIV is for the professional manager of urban trees to consider the tree *in situ* with an assumed knowledge of the *taxon* and its growing environment. It is based on the physical attributes of the tree and its response to its environment considering its position in a matrix for age class, vigour class, condition class and its sustainable retention with regard to the safety of people or damage to property. This also factors the ability to retain the tree with remedial work or beneficial modifications to its growing environment or removal and replacement. SRIV is supplementary to the decision made by a tree management professional as to whether a tree is retained or removed (IACA - Institute of Australian Consulting Arboriculturists 2005).

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

**Crown Projection (CP)** Area within the *dripline* or beneath the lateral extent of the *crown* (Geiger 2004, p. 2). See also *Crown spread* and *Dripline*.

**Dripline** A line formed around the edge of a tree by the lateral extent of the *crown*. Such a line may be evident on the ground with some trees when exposed soil is displaced by rain shed from the crown. See also *Crown Projection*.

**Tree Protection Zone (TPZ)** Area around a tree set aside to protect the trunk, roots and crown during development works. This is to protect the tree physically and a sufficient proportion of its growing environment above and below ground to assist *stability* and prolong viability. The TPZ is often delineated by an enclosed fence and established prior to demolition or construction and maintained until the completion of works. The fenced-off area around the tree is usually located at a specific distance from the trunk determined as multiples of the trunk diameter, usually *Diameter at breast height* (DBH). Special protection or construction works may provide a TPZ without a fence having been erected, e.g. a barrier formed by site sheds located on piers. Such a protection area may form an exclusion zone for all works including the temporary or permanent location of utility services. Note: Any *encroachment* into the area would require additional tree protection specifications or works in consultation with the *Project arborist*.

**Encroachment** 1. The growth of branches, trunk or roots onto another property. 2. Any work within a *Tree Protection Zone* other than for the maintenance of the Tree Protection Zone.

## **Deadwood**

**Deadwood** Dead branches within a tree's crown and considered quantitatively as separate to *crown cover* and can be categorised as *Small Deadwood* and *Large Deadwood* according to diameter, length and subsequent *risk* potential. The amount of dead branches on a tree can be categorized as *Low Volume Deadwood*, *Medium Volume Deadwood* and *High Volume Deadwood*. See also *Dieback*.

**Deadwooding** Removing of dead branches by *pruning*. Such pruning may assist in the prevention of the spread of *decay* from *dieback* or for reasons of safety near an identifiable target.

**Small Deadwood** A dead branch up to 10mm diameter and usually <2 metres long, generally considered of low *risk* potential.

**Large Deadwood** A dead branch >10mm diameter and usually >2 metres long, generally considered of high *risk* potential.

**Low Volume Deadwood** Where <5 dead branches occur that may require *removal*.

**Medium Volume Deadwood** Where 5-10 dead branches occur that may require *removal*.

**High Volume Deadwood** Where >10 dead branches occur that may require *removal*.

## **Dieback**

**Dieback** The death of some areas of the *crown*. Symptoms are leaf drop, bare twigs, dead branches and tree death, respectively. This can be caused by root damage, root disease, bacterial or fungal canker, severe bark damage, intensive grazing by insects, *abrupt changes* in growth conditions, drought, water-logging or over-maturity. Dieback often implies reduced *resistance*, *stress* or *decline* which may be temporary. Dieback can be categorized as *Low Volume Dieback*, *Medium Volume Dieback* and *High Volume Dieback*.

**Low Volume Dieback** Where <10% of the *crown cover* has died. See also *Dieback*, *High Volume Dieback* and *Medium Volume Dieback*.

**Medium Volume Dieback** Where 10-50% of the *crown cover* has died.

**High Volume Dieback** Where >50% of the *crown cover* has died.

## **Epicormic shoots**

**Epicormic Shoots** Juvenile shoots produced at branches or trunk from *epicormic strands* in some Eucalypts (Burrows 2002, pp. 111-131) or sprouts produced from dormant or latent buds concealed beneath the bark in some trees. Production can be triggered by fire, pruning, wounding, or root damage but may also be as a result of *stress* or *decline*. Epicormic shoots can be categorized as *Low Volume Epicormic Shoots*, *Medium Volume Epicormic Shoots* and *High Volume Epicormic Shoots*.

**Low Volume Epicormic Shoots** Where <10% of the *crown cover* is comprised of live *epicormic shoots*.

**Medium Volume Epicormic Shoots** Where 10-50% of the *crown cover* is comprised of live *epicormic shoots*.

**High Volume Epicormic Shoots** Where >50% of the *crown cover* is comprised of live *epicormic shoots*.

## **Roots**

**First Order Roots (FOR)** Initial woody roots arising from the *root crown* at the base of the *trunk*, or as an *adventitious root mass* for structural support and *stability*. Woody roots may be buttressed and divided as a marked gradation, gradually tapering and continuous or tapering rapidly at a short distance from the root crown. Depending on soil type these roots may descend initially and not be evident at the root crown, or become buried by changes in soil levels. Trees may develop 4-11 (Perry 1982, pp. 197-221), or more first order roots which may radiate from the trunk with a relatively even distribution, or be prominent on a particular aspect, dependent upon physical characteristics e.g. leaning trunk, *asymmetrical crown*; and constraints within the growing *environment* from topography e.g. slope, soil depth, rocky outcrops, exposure to predominant wind, soil moisture, depth of *water table* etc.

**Orders of Roots** The marked divisions between woody roots, commencing at the initial division from the base of the trunk, at the *root crown* where successive branching is generally characterised by a gradual reduction in root diameters and each gradation from the trunk and can be categorized numerically, e.g. *first order roots*, second order roots, third order roots etc. Roots may not always be evident at the *root crown* and this may be dependent on species, age class and the growing environment. Palms at maturity may form an adventitious root mass.

**Root Plate** The entire root system of a tree generally occupying the top 300-600mm of soil including roots at or above ground and may extend laterally for distances exceeding twice the height of the tree (Perry 1982, pp. 197-221). Development and extent is dependent on water availability, soil type, *soil depth* and the physical characteristics of the surrounding landscape.

**Root Crown** Roots arising at the base of a trunk.

**Zone of Rapid Taper** The area in the *root plate* where the diameter of *structural roots* reduces substantially over a short distance from the *trunk*. Considered to be the minimum radial distance to provide structural support and *root plate* stability. See also *Structural Root Zone (SRZ)*.

**Structural Roots** Roots supporting the infrastructure of the *root plate* providing strength and *stability* to the tree. Such roots may taper rapidly at short distances from the *root crown* or become large and woody as with gymnosperms and dicotyledonous angiosperms and are usually 1<sup>st</sup> and 2<sup>nd</sup> order roots, or form an *adventitious root mass* in monocotyledonous angiosperms (palms). Such roots may be crossed and grafted and are usually contained within the area of *crown projection* or extend just beyond the *dripline*.