Operational Instruction

Trees in Medians and Roadsides in the Urban Environment
Trees in Medians and Roadsides in the Urban Environment-19.8

AMENDMENT RECORD

<table>
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<th>Version</th>
<th>Page(s)</th>
<th>Date</th>
<th>Amendment Description</th>
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<td>1,4,5,8</td>
<td>13/08/01</td>
<td>Background, discussion, appendix</td>
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<td>4</td>
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<td>25/08/04</td>
<td>Scope, Background, Introduction, Community, Environmental &amp; Sight Distance Considerations, Specifications, References, Appendix A</td>
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<td>29/05/08</td>
<td>Format &amp; OI # changes (formally OI 2.9)</td>
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<td>Altered to allow trees in any median provided clear zone requirements are met.</td>
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<td>18/12/17</td>
<td>Amended to achieve balance between road users’ safety and the community expectations</td>
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[Signature]

Chief Operating Officer, Safety and Service Division

18/12/17

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1. **Scope**

This Operational Instruction has been developed to provide direction to traffic engineering practitioners, landscape architects and planners when considering tree planting in raised medians and roadsides within DPTI road corridors.

These guidelines aim to balance the safety risk to road users with the community expectations of enhancement of the public realm through planting of trees and other vegetation.

2. **Background**

The *National Road Safety Strategy 2011 – 2020* sets a target of at least a 30% reduction in deaths and serious injuries. This strategy is founded on the internationally recognised ‘Safe System’ approach formally endorsed by the Organisation for Economic Cooperation and Development (OECD). A Safe System recognises human factors and human frailty and the need to provide forgiving engineered systems as part of a shared responsibility.

South Australia’s *Road Safety Strategy 2020 – Towards Zero Together* sets the direction for reducing serious casualties during the decade by at least 30%, stressing that those engaged in designing, building and managing roads have a responsibility to provide a safe road network.

It is important that any interpretation of this Operational Instruction aligns with the *Road Safety Strategy 2020 - Towards Zero Together*.

Previous versions of this Operational Instruction focussed primarily on the mitigation of hazards within the clear zone as defined in *Austroads Guide to Road Design - Part 6* (2009) Section 4.3.2.

3. **Principle Considerations**

This document aims to satisfy the key principles listed below for establishment of trees in road reserves.

To achieve an appropriate balance between road users’ safety and community expectations of providing trees within road reserves, a multi-criteria analysis (MCA) process has been conducted to develop an approach which identifies the appropriate placement of trees in urban road corridors to satisfy these principles.

3.1 **Safe System Principle**

The main objective of the Safe System is to ensure that in the event of a crash, the impact forces are within the boundaries of human tolerance. Figure 3.1 illustrates the estimated crash impact speeds based on the safest vehicles, where the forces are likely to exceed the tolerance of a human body and where chances of survival decrease rapidly beyond this impact speed. Safe System speed threshold for car/pedestrian crash and car/tree are 30 km/h and 40 km/h respectively.
The five year crash history (2011-2015) within the Adelaide Metropolitan area indicates the following:

- Vehicles colliding with fixed objects account for about 10% of total casualty crashes, i.e. approximately 500 casualty crashes per year.

- Compared to all objects hit, hitting trees alone represent about 3-4% of total hitting objects casualty crashes (approximately 170 casualty crashes per year), however it is the most severe crash type compared with other object types (i.e. 35-40% of hitting trees crashes result in a fatality or serious injury).

Decisions regarding the placement of new trees in medians and roadsides should be informed by a risk assessment which takes into consideration road users' exposure, crash likelihood and severity outcomes in the event of a crash; and appropriately weighs up the risk to pedestrians against vehicle occupant safety in various urban road environments.

Source: Fact Sheet, RTA, NSW, 2011

**Figure 3.1** Safe System speed thresholds

### 3.2 Community Values and Expectations

The *30 Year Plan for Greater Adelaide* (2016) outlines key directions to create a greener city through an increase in tree canopy by 20% across metropolitan Adelaide by 2045.
DPTI’s *Functional Hierarchy for South Australia’s Land Transport* describes policies to provide safe and attractive streetscapes through tree planting. Providing these improvements along road reserves create a more liveable urban environment that can encourage active travel including walking, cycling and public transport use and have a cooling effect on neighbourhoods and nearby buildings.

Tree plantings within road reserves have often been the result of DPTI, local Council, community desires, or a combination of these to improve the aesthetics and environmental quality of the road environment.

There is often a community expectation for large and visually dominant trees to fulfil aesthetic requirements in streetscapes, however, trees with a mature trunk diameter of 100 mm or more are considered non-frangible.

Effort should be made to provide the appropriate balance between road user safety, community wellbeing, and environmental benefits and values within the road reserve.

### 3.3 Sight Distance and Visibility Requirements

The design of streetscapes should ensure safe sight distances are achieved and good visibility is provided to Traffic Control Devices, particularly in the vicinity of high risk locations such as intersections, curves and driveways.

Clear sight lines shall also be provided along walking and cycling routes.

### 3.4 Maintenance

Trees must be planted and maintained to minimise any adverse impact on the safe and efficient operation of the road, thereby reducing any potential maintenance costs.

Where trees are planted in close proximity to road infrastructure, tree tanks or root barriers shall be used to minimise the potential impact of tree roots. Formative pruning of young trees must be carried out routinely to ensure that clearance envelopes are achieved and visibility is maintained.

Refer to *Operational Instruction 20.1 Care, Control and Maintenance of Roads by the Commissioner of Highways* ([http://www.dpti.sa.gov.au/?a=71793](http://www.dpti.sa.gov.au/?a=71793)) for maintenance responsibilities.

### 3.5 Environmental Sustainability

Consideration should be given to the environmental benefits that trees can offer, such as restoring ecosystems, improving ambient temperatures, filtering air pollution and dust, storing carbon, reducing storm water run-off and providing wildlife corridors, habitat and food for native fauna species.

### 4. Tree Offsets

Decisions regarding the placement of new trees should be based on a risk assessment that takes into consideration road users’ exposure, crash likelihood and severity.
outcomes in the event of crash, and appropriately weighs up the risk of pedestrian against vehicle occupant safety in various urban road environments.

Table 4.1 presents the minimum tree offsets adopted by DPTI. Lateral offset shall be measured from the face of kerb or the edge line (if there is no kerb) to the expected face of the tree trunk at maturity. If there is both a kerb and an edge line, the lateral offset is the distance measured from the face of kerb. In the absence of an edge line the lateral offset is the distance measured from the edge of road pavement. Refer to Figures 11.1 to 11.4.

In addition, consideration must be given to the following points when determining minimum tree planting offsets along the road reserve:

- offset figures relate to distance to anticipated face of tree trunk at maturity,
- trees must not adversely impact sight distance requirements, and
- measures must be taken to minimise the risk of tree roots damaging road infrastructure. Appendix A is provided as a tree planting offset list to minimise damage to road infrastructure based on DPTI field observations. If the minimum lateral offset recommended in Table 4.1 is less than the lateral offset shown in Appendix A, root control measures shall be installed.
Table 4.1 Minimum Tree Offsets in Urban Environments

<table>
<thead>
<tr>
<th>Speed limit</th>
<th>Verge</th>
<th>Intersection without slip lane</th>
<th>Median</th>
<th>Slip/merging lanes</th>
<th>Driveways</th>
<th>Minimum tree offsets from edge line or edge of pavement without kerb</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Lateral</td>
<td>Lateral</td>
<td>Longitudinal</td>
<td>Lateral</td>
<td>Longitudinal</td>
<td>Lateral</td>
</tr>
<tr>
<td>≤ 50 km/h</td>
<td>0.6m</td>
<td>0.6m</td>
<td>10m from the tangent point</td>
<td>1.0m (= median width of 2.0m + tree diameter)</td>
<td>10m from the edge of nose</td>
<td>Greater of 10m from edge of nose OR total length of tapered section</td>
</tr>
<tr>
<td>60 km/h</td>
<td>0.6m</td>
<td>Gentle = 0.8m</td>
<td>Sharp = 1.1m</td>
<td>0.6m</td>
<td>10m from the tangent point</td>
<td>1.25m (= median width of 2.5m + tree diameter)</td>
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<tr>
<td>≥ 70 km/h</td>
<td>Refer Austroads Guide to Road Design - Part 6: Clear zone distances</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1 Refer to Section 11 for figures indicating these offsets
2 If required sight distance envelope requires greater offsets than listed, sight distance overrides the listed offset distances
3 Trees shall be planted at the centre of the median, staggered planting (i.e. varying offsets) along the median is not permitted
4 Gentle curve ≥ 300m radius and sharp curve < 300m radius
5. **Pedestrian Safety**

In areas of high pedestrian activity it is desirable for street trees to be located between the kerb and footpath to provide pedestrians with some protection from vehicle traffic (refer to Figure 11.5).

Areas with high pedestrian activity include shopping precincts, outdoor dining spaces and areas supporting active transportation modes such as walking and cycling where pedestrian safety is paramount. Refer *A Functional Hierarchy for South Australia’s Land Transport Network* ([http://www.sa.gov.au/?a=10609](http://www.sa.gov.au/?a=10609)) for locations of pedestrian precincts.

6. **Maintenance of Clearance Envelopes**

Under Section 26A of the *Highways Act 1926*, local Councils are responsible for the maintenance of vegetation on most urban arterial roadsides. The Act requires Councils to coordinate activities to minimise adverse impacts on the safe and efficient operation of the road and the environment.

*Operational Instruction 20.1 Care, Control and Maintenance of Roads by the Commissioner of Highways* ([http://www.dpti.sa.gov.au/?a=71793](http://www.dpti.sa.gov.au/?a=71793)) sets out the responsibilities of Councils and DPTI in relation to roadside vegetation.

DPTI shall not bear any costs associated with the maintenance of any vegetation proposed and installed by Council or a third party within the medians of roads under the care and control of the Commissioner of Highways. Refer to *Operational Instruction 20.1 – Section 9 Vegetation Control* for the maintenance responsibilities of trees in road reserves.

Trees must also be maintained to achieve sight distances on the approaches of signalised intersections to ensure clear visibility of lanterns, refer to *Operational Instruction 14.2 Traffic Signal Faces – Section 4 Vehicle Displays – Aiming Distance Requirements* ([http://www.dpti.sa.gov.au/?a=40178](http://www.dpti.sa.gov.au/?a=40178)).

7. **Other Considerations**

The location, height, depth and extent of underground services should be considered when determining the location and selection of tree species.

Over-dimensional vehicle routes may require wider offsets and greater clearance.

8. **Alternative Vegetation Options**

In situations where tree planting cannot be achieved in the verge or median, the following landscape options may be considered to improve streetscape amenity:

- frangible small trees or large shrub species with a mature trunk diameter of less than 100 mm;
- low ground covers and frangible shrubs with a mature height of 0.5 m where sight lines are to be preserved;
- native grasses;
- turf grass (e.g. kikuyu); or
- other low maintenance hard surface treatments.

A minimum width of 0.6 m is required between vegetation and the kerb to enable a pedestrian or small child to observe the traffic from the refuge of the verge or median and so that the pedestrian can also be seen by other road users. Pedestrians will also require unobstructed head room around and near any verge or median vegetation for both visibility and injury prevention. The volume of pedestrian activity should be taken into consideration when selecting plant species for verges or medians.

9. Exceptions

Any variances from offsets listed in Table 4.1 will be subject to assessment and approval on a case-by-case basis. A comprehensive road safety risk assessment would need to be completed taking into consideration the principles outlined in Section 3.

10. Approvals

In accordance with Operational Instruction 20.1 local Councils are required to seek approval from DPTI prior to planting trees along and within DPTI road corridors. This applies to both new planting and replacement planting. Approval is generally only withheld on the basis of road safety, or if major works are proposed in the foreseeable future.

Councils may contact DPTI’s Traffic Operations on 08 8226 8222 for further information in relation to approval of tree planting in DPTI road corridors.
11. Tree Placement and Offset Scenarios

Figures 11.5 to 11.10 should be read in conjunction with offsets (lateral and longitudinal) described in Table 4.1.

![Diagram](image)

**Figure 11.1** Lateral offset with kerb and edge line

![Diagram](image)

**Figure 11.2** Lateral offset with kerb and no edge line
Figure 11.3 Lateral offset with no kerb and edge line

Figure 11.4 Lateral offset with no kerb and no edge line
Figure 11.5 Minimum lateral offset on roads with a speed limit ≤ 60 km/h and desirable tree placement in areas of high pedestrian activity.

Figure 11.6 Desirable tree placement on roads with a speed limit ≤ 60 km/h and minimal pedestrian activity.
Figure 11.7 Minimum offsets (lateral and longitudinal) at an intersection without slip lane

Figure 11.8 Minimum offsets (lateral and longitudinal) in medians with median opening

Figure 11.9 Minimum lateral offsets at slip lane and merging lane
12. References

- Burnside Council, South Australia, Tree Management Strategy
- Department of Planning Transport and Infrastructure, South Australia, 30-Year Plan for Greater Adelaide-Draft, 2016
- Department of Planning Transport and Infrastructure, South Australia, *OI 20.1 – Care, Control and Management of Roads (Highways) by the Commissioner of Highways (Section 26 of the Highway Act)* http://www.dpti.sa.gov.au/?a=71793

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**Figure 11.10** Minimum offsets (lateral and longitudinal) at driveway
- Mainroads, Western Australia, *Environmental Guideline, Vegetation Placement within the Road Reserve*, 2013
- Saaty, L Thomas, *Decision making with the Analytic Hierarchy Process*, 2008, Pittsburgh, USA
### Appendix A  Street Tree Species Suitable for Adelaide Streetscapes

<table>
<thead>
<tr>
<th>Scientific Name</th>
<th>Common Name</th>
<th>Lateral offset from face of tree trunk to vertical face of kerb to minimise damage (metres)</th>
<th>Trunk Diameter (metres)</th>
<th>Height (metres)</th>
<th>Canopy Span (metres)</th>
<th>Spacing (metres)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Large Trees</strong> (Height 12+ metres)</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Angophora costata</td>
<td>Smooth-barked Apple</td>
<td>1.0</td>
<td>0.5</td>
<td>20</td>
<td>10</td>
<td>10</td>
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<td>Celtis australis</td>
<td>Southern Hackberry</td>
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<td>0.5</td>
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<td>Corymbia maculata</td>
<td>Spotted Gum</td>
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<td>Eucalyptus leucoxylon</td>
<td>SA Blue Gum</td>
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<td>0.5</td>
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<td>Fraxinus angustifolia 'Raywood'</td>
<td>Claret Ash</td>
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<td>0.5</td>
<td>12</td>
<td>9</td>
<td>12</td>
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<tr>
<td>Ginkgo biloba</td>
<td>Maidenhair Tree</td>
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<td>0.4</td>
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<td>Hymenosperum flavum</td>
<td>Native Frangipani</td>
<td>0.6</td>
<td>0.3</td>
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<td>Jacaranda mimosifolia</td>
<td>Jacaranda</td>
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<td>0.5</td>
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<td>8</td>
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<td>Platanus X acerifolia 'Liberty'</td>
<td>Plane Tree</td>
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<td>10</td>
<td>12</td>
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<tr>
<td>Platanus orientalis</td>
<td>Oriental Plane Tree</td>
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<td>0.5</td>
<td>15</td>
<td>10</td>
<td>15</td>
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<td>Quercus palustris</td>
<td>Pin Oak</td>
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<td>0.5</td>
<td>15</td>
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<td>12</td>
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<td>Quercus palustris ' Green Pillar'</td>
<td>Green Pillar Pin Oak</td>
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<td>0.35</td>
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<td>Zelkova serrata 'Green Vase'</td>
<td>Japanese Elm</td>
<td>0.6</td>
<td>0.3</td>
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<td>Zelkova serrata 'Mushashino'</td>
<td>Japanese Elm</td>
<td>0.6</td>
<td>0.3</td>
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<td><strong>Medium Trees</strong> (Height 8 to 12 metres)</td>
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<td>Cupaniopsis anacardiodes</td>
<td>Tuckeroo</td>
<td>0.8</td>
<td>0.3</td>
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<td>10</td>
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<td>Fraxinus ornus</td>
<td>Manna Ash</td>
<td>0.8</td>
<td>0.2</td>
<td>10</td>
<td>7</td>
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<tr>
<td>Fraxinus pennsylvanica ‘Urbanite’</td>
<td>Urbanite Ash</td>
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<td>0.3</td>
<td>11</td>
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<td>10</td>
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<td>Koelreuteria bipinnata</td>
<td>Chinese Flame Tree</td>
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<td>0.4</td>
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<td>10</td>
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<tr>
<td>Koelreuteria paniculata</td>
<td>Golden Rain Tree</td>
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<td>0.4</td>
<td>7</td>
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<td>10</td>
</tr>
<tr>
<td>Melia azedarach ‘Elite’</td>
<td>White Cedar</td>
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<td>0.35</td>
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<td>9</td>
<td>12</td>
</tr>
<tr>
<td>Scientific Name</td>
<td>Common Name</td>
<td>Lateral offset from face of tree trunk to vertical face of kerb to minimise damage (metres)</td>
<td>Trunk Diameter (metres)</td>
<td>Height (metres)</td>
<td>Canopy Span (metres)</td>
<td>Spacing (metres)</td>
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<tr>
<td>Pistacia chinensis</td>
<td>Chinese Pistachio</td>
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<td>0.35</td>
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<tr>
<td>Pyrus calleryana 'Capital'</td>
<td>Ornamental Pear</td>
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<td>0.3</td>
<td>11</td>
<td>3</td>
<td>6</td>
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<tr>
<td>Pyrus calleryana 'Chanticleer'</td>
<td>Ornamental Pear</td>
<td>0.6</td>
<td>0.35</td>
<td>11</td>
<td>6</td>
<td>10</td>
</tr>
<tr>
<td>Pyrus ussuriensis</td>
<td>Manchurian Pear</td>
<td>0.8</td>
<td>0.4</td>
<td>12</td>
<td>10</td>
<td>12</td>
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<tr>
<td>Sapium sebiferum</td>
<td>Chinese Tallow</td>
<td>0.6</td>
<td>0.3</td>
<td>8</td>
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<tr>
<td>Sophora japonica</td>
<td>Japanese Pagoda Tree</td>
<td>0.8</td>
<td>0.3</td>
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<tr>
<td>Quercus rubra</td>
<td>Red Oak</td>
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<td>0.3</td>
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<td>9</td>
<td>10</td>
</tr>
</tbody>
</table>

**Small Trees** (Height 5 to 8 metres)

<table>
<thead>
<tr>
<th>Common Name</th>
<th>Lateral offset from face of tree trunk to vertical face of kerb to minimise damage (metres)</th>
<th>Trunk Diameter (metres)</th>
<th>Height (metres)</th>
<th>Canopy Span (metres)</th>
<th>Spacing (metres)</th>
</tr>
</thead>
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<tr>
<td>Callistemon 'Harkness'</td>
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<td>0.2</td>
<td>6</td>
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<td>4</td>
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<td>Callistemon viminalis</td>
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<td>0.3</td>
<td>6</td>
<td>4</td>
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<tr>
<td>Cercis siliquastrum</td>
<td>0.6</td>
<td>0.2</td>
<td>6</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>Eucalyptus leucoxylon 'Euky Dwarf'</td>
<td>S.A. Blue Gum - Dwarf variety</td>
<td>0.6</td>
<td>0.2</td>
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<td>Eucalyptus torquata</td>
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<td>0.2</td>
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<td>8</td>
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<tr>
<td>Fraxinus griffithii</td>
<td>0.6</td>
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<td>7</td>
<td>4</td>
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