Arboricultural report

for

Malmsbury Cemetery Trust

Tree inspection for risk mitigation

Site
Malmsbury Cemetery,
Malmsbury Victoria

Submission date
19 September 2012

Prepared for
Malmsbury Cemetery Trust

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Treetec reference
Malm0912.3.mc
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1 Introduction

Treetec has been engaged to inspect and assess the tree population at the Malmsbury Cemetery to ensure risk associated with the tree population is minimised.

All trees within reach of the grave monuments and some nearby trees were inspected from a risk perspective.

Trees of higher risk have been identified and recommendations for management of those trees are included within this report.

The degree of risk associated with individual trees is based on the premise that the area will be used by the public regularly but not in large numbers except during irregular ceremonies. This report also considers the risk of damage to the monuments and recommendations will consider both people and infrastructure.

2 Key objectives

1- Determine all trees on site or nearby that pose a higher than ‘acceptable’ risk
2- Provide relevant details on the subject trees including their species, location, amenity value, health, structure, size and risk rating
3- Provide recommendations regarding the ongoing management of hazardous trees
4- Provide recommendations regarding general management of the tree population to reduce problems in the future

3 Methodology

3.1 Site inspection

An arboricultural assessment of Malmsbury Cemetery was undertaken by M. Cashmore in June 2012 and another in September 2012.

Data collected is set out in section 4- Tree Assessments (below) and relevant definitions are found in Appendix 1.
3.2 Inspection method

- All observations were taken at ground level, using the Visual Tree Assessment (VTA) method (Mattheck and Breloer 1994)
- Excavation at the site was not undertaken
- Aerial examination (climbing) of the tree structures was not required
- Heights and canopy widths have been estimated
- The site was not surveyed
- Subject trees have been numbered and tagged
- Data and location was recorded using a GPS/GIS enabled handheld computer (accurate to ±5m)

4 Tree assessments

4.1 Condition of roots

Excavations were not undertaken for this report therefore root condition has not been included unless above ground signs, such as soil heaving or cracking were observed.

4.2 Hazards and risk

Risk assessment of trees relies on an appraisal of the structural integrity of a tree or population of trees in conjunction with the likelihood of tree sections hitting or adversely impacting something (people or property).

This risk assessment is based on the premise that the cemetery and surround area will be used for public access by small numbers of people regularly and by groups irregularly.

Currently there is minimal chance of someone being impacted as there is relatively little use of the area however recommendations will also consider the protection of the grave monuments.

Trees are dynamic structures and change over time, a risk assessment will be required regularly, ideally every twelve months.
### 4.3 Data

<table>
<thead>
<tr>
<th>SPECIES</th>
<th>COMMON NAME</th>
<th>CALLIPER</th>
<th>HEIGHT</th>
<th>WIDTH</th>
<th>AGE</th>
<th>STRUCTURE</th>
<th>HEALTH</th>
<th>AMENITY</th>
<th>HAZARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Quercus robur</td>
<td>English Oak</td>
<td>45</td>
<td></td>
<td></td>
<td>Mature</td>
<td>Good</td>
<td>Good</td>
<td>High</td>
<td>Medium</td>
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<tr>
<td><strong>Notes</strong></td>
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<td></td>
</tr>
<tr>
<td>2 Eucalyptus globulus</td>
<td>Southern Blue Gum</td>
<td>160</td>
<td>22</td>
<td>16</td>
<td>Mature</td>
<td>Poor</td>
<td>good</td>
<td>High</td>
<td>High</td>
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<td><strong>Notes</strong></td>
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<tr>
<td>3 Quercus robur</td>
<td>English Oak</td>
<td>58</td>
<td></td>
<td></td>
<td>Mature</td>
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<td>low</td>
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<td><strong>Notes</strong></td>
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<tr>
<td>4 Acacia melanoxylon</td>
<td>Blackwood</td>
<td>40</td>
<td>8</td>
<td>10</td>
<td>Semi-</td>
<td>Fair</td>
<td>Fair</td>
<td>Medium</td>
<td>Medium / low</td>
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<tr>
<td><strong>Notes</strong></td>
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<td></td>
<td></td>
<td>mature</td>
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<tr>
<td>5 Eucalyptus globulus</td>
<td>Group of large old</td>
<td>up to 150</td>
<td></td>
<td></td>
<td>Mature/</td>
<td>Poor</td>
<td>High</td>
<td>High</td>
<td></td>
</tr>
<tr>
<td>(Group)</td>
<td>and dead trees</td>
<td></td>
<td></td>
<td></td>
<td>senescent</td>
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</tbody>
</table>

- **Notes** - Dead limb has broken off and is now hanging in canopy
- **recommendations** - Remove hanger

- **Notes** - Large significant tree, bees nest observed in a cavity, some over extended limbs and large sections of deadwood.
- **recommendations** - Load reduce limb hanging over nearby historic monument and remove any deadwood from over the public areas. Beware of bee hive during works.

- **Notes** - The second last tree in the row however there are nearby trees with similar issues and they should also be actioned. Due to the low use of this area the priority on this work is low.
- **recommendations** - Damaged or lopped lower limbs on this tree and nearby trees should be pruned back to a pruning point or the trunk, remove deadwood.

- **Notes** - Though structurally poor, as with the trees above, use of the area is low and this is a medium priority only.
- **recommendations** - Remove large lower limb and deadwood canopy

- **Notes** - A row of Blue Gums, some have died however the remaining trees as well as the dead stags provide high ecological value and will be supporting a number of nesting native fauna species. These trees are however hazardous and the immediate area should be used minimally to reduce risk.
- **recommendations** - Restrict access to area, plant with native / indigenous shrubs
<table>
<thead>
<tr>
<th>SPECIES</th>
<th>COMMON NAME</th>
<th>CALLIPER</th>
<th>HEIGHT</th>
<th>WIDTH</th>
<th>AGE</th>
<th>STRUCTURE</th>
<th>HEALTH</th>
<th>AMENITY</th>
<th>HAZARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>Eucalyptus globulus</td>
<td></td>
<td>45</td>
<td>15</td>
<td>5</td>
<td>Juvenile</td>
<td>Poor</td>
<td>Good</td>
<td>Medium</td>
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<tr>
<td></td>
<td>Southern Blue Gum</td>
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<td></td>
<td></td>
<td>Medium</td>
<td>Medium</td>
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</tbody>
</table>

**Notes** - Young tree with poor structure and one of three leaders has died back, will have poor structure in the longer term and will represent a high risk.

**Recommendations** - Remove tree

<table>
<thead>
<tr>
<th>7</th>
<th>Acacia dealbata (group)</th>
<th>Silver Wattles (7 of)</th>
<th>Dead</th>
<th>Low</th>
<th>Medium</th>
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</tbody>
</table>

**Notes** - Group of young dead Wattles

**Recommendations** – Remove

<table>
<thead>
<tr>
<th>8</th>
<th>Acacia melanoxylon (group)</th>
<th>Blackwood</th>
<th>Juvenile</th>
<th>Poor</th>
<th>Low</th>
<th>Low</th>
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</table>

**Notes** - Group of young Blackwoods, the stems being so close together will inhibit good tree form and longer term the tree/trees will become structurally unsound.

**Recommendations** – Remove

<table>
<thead>
<tr>
<th>9</th>
<th>Acacia melanoxylon (group)</th>
<th>Blackwood</th>
<th>Juvenile</th>
<th>Poor</th>
<th>Low</th>
<th>Low</th>
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</table>

**Notes** - Coppice regrowth, see notes as for Tree 8 above

**Recommendations** – Remove

<table>
<thead>
<tr>
<th>10</th>
<th>Acacia melanoxylon</th>
<th>Blackwood</th>
<th>35</th>
<th>11</th>
<th>7</th>
<th>Mature</th>
<th>Poor</th>
<th>Good</th>
<th>Medium</th>
<th>High</th>
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</table>

**Notes** - Large failure at 5m leaving a wound and high probability of upper canopy failure.

**Recommendations** - Remove tree
<table>
<thead>
<tr>
<th>SPECIES</th>
<th>COMMON NAME</th>
<th>CALLIPER</th>
<th>HEIGHT</th>
<th>WIDTH</th>
<th>AGE</th>
<th>STRUCTURE</th>
<th>HEALTH</th>
<th>AMENITY</th>
<th>HAZARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>Acacia melanoxylon</td>
<td>Blackwoods</td>
<td>Medium</td>
<td></td>
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<tr>
<td>Notes</td>
<td>- Scattered self-seeded Blackwoods within memorial sites or immediately adjacent. These trees can become large and where a trunk is near a monument it can push and break concrete. (see images)</td>
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<tr>
<td>Recommendations</td>
<td>- Remove trees from grave sites or if immediately adjacent.</td>
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<tr>
<td>12</td>
<td>Eucalyptus radiata</td>
<td>Narrow-leaved Peppermint</td>
<td>36</td>
<td></td>
<td></td>
<td></td>
<td>Dead</td>
<td></td>
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<tr>
<td>Notes</td>
<td>- All dead trees including this one (except habitat stags) should be removed unless there is minimal use of the area (fall zone)</td>
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<tr>
<td>Recommendations</td>
<td>- Remove or reduce to a safer height and retain as a habitat stag</td>
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<tr>
<td>13</td>
<td>Eucalyptus radiata</td>
<td>Narrow-leaved Peppermint</td>
<td>24</td>
<td></td>
<td></td>
<td></td>
<td>Poor</td>
<td></td>
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<tr>
<td>Notes</td>
<td>- Dying tree - as above.</td>
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<tr>
<td>Recommendations</td>
<td>- Remove or reduce to a safer height and retain as a habitat stag</td>
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<tr>
<td>14</td>
<td>Eucalyptus radiata</td>
<td>Narrow-leaved Peppermint</td>
<td>60</td>
<td>11</td>
<td>12</td>
<td>Mature</td>
<td>Poor</td>
<td>Fair</td>
<td>Medium</td>
</tr>
<tr>
<td>Notes</td>
<td>- Tree with included bark union near ground, appears stable currently, may become hazardous medium term.</td>
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<tr>
<td>Recommendations</td>
<td>- Monitor union for any signs of movement (splitting) if movement is observed tree should be removed immediately.</td>
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<tr>
<td>15</td>
<td>Eucalyptus radiata</td>
<td>Narrow-leaved Peppermint</td>
<td>Variable</td>
<td>Medium</td>
<td>Medium</td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>Notes</td>
<td>- Group of trees, many with poor form, some with decay or sections of deadwood or poor unions</td>
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<tr>
<td>Recommendations</td>
<td>- Prune out or load reduce sections of highest risk, establish indigenous vegetation (shrubs and understory) within the fall zone and discourage use of the immediate area. This could be a very localised patch which does not restrict access to the surrounding site. Where trees or individual leaders require removal trunk sections could be retained as habitat stags of 4 to 8m with introduced cavities.</td>
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<tr>
<td>SPECIES</td>
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<td>HEIGHT</td>
<td>WIDTH</td>
<td>AGE</td>
<td>STRUCTURE</td>
<td>HEALTH</td>
<td>AMENITY</td>
<td>HAZARD</td>
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</tr>
<tr>
<td>Pinus radiata</td>
<td>Monterey Pine</td>
<td>100</td>
<td>29</td>
<td>17</td>
<td>Mature</td>
<td>Poor</td>
<td>Good</td>
<td>Medium</td>
<td>Medium</td>
</tr>
</tbody>
</table>

**Notes** - Very large tree; appears to be an included bark union at 11m. Tree is leaning and if it were to fail would damage nearby monuments.

**Recommendations** - Remove  (see also general notes on cemetery Pines)

<table>
<thead>
<tr>
<th>SPECIES</th>
<th>COMMON NAME</th>
<th>CALLIPER</th>
<th>HEIGHT</th>
<th>WIDTH</th>
<th>AGE</th>
<th>STRUCTURE</th>
<th>HEALTH</th>
<th>AMENITY</th>
<th>HAZARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pinus radiata (row)</td>
<td>Monterey Pine</td>
<td>Mature</td>
<td>High</td>
<td>High</td>
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</tbody>
</table>

**Notes** - This is a row of large pines running along the southern boundary of the property. They are old trees and mostly of fair to good health. Due to their size and age there are some large sections of deadwood and limbs that are likely to fail, there are hangers and some poor unions. Though for the most part they are not highly hazardous this is likely to change over the medium term and removal and replacement should be considered. They should be treated as a group; if more than one or two are removed they should all be removed due to the change in wind loadings that would be experienced when adjacent trees are removed.

**Recommendations** - Plan for replacement, restrict use of fall zone due to large limbs and deadwood failures

<table>
<thead>
<tr>
<th>SPECIES</th>
<th>COMMON NAME</th>
<th>CALLIPER</th>
<th>HEIGHT</th>
<th>WIDTH</th>
<th>AGE</th>
<th>STRUCTURE</th>
<th>HEALTH</th>
<th>AMENITY</th>
<th>HAZARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eucalyptus radiata</td>
<td>Narrow-leaved Peppermint</td>
<td>25</td>
<td>13</td>
<td>5</td>
<td>Mature</td>
<td>Poor</td>
<td>Poor</td>
<td>Low</td>
<td>Medium / high</td>
</tr>
</tbody>
</table>

**Notes** - Poor condition with decay in the base, shoots regenerating from old stump

**Recommendations** - Remove or reduce to a safer height and retain as a habitat stag/stags

<table>
<thead>
<tr>
<th>SPECIES</th>
<th>COMMON NAME</th>
<th>CALLIPER</th>
<th>HEIGHT</th>
<th>WIDTH</th>
<th>AGE</th>
<th>STRUCTURE</th>
<th>HEALTH</th>
<th>AMENITY</th>
<th>HAZARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eucalyptus radiata</td>
<td>Narrow-leaved Peppermint</td>
<td>68</td>
<td>11</td>
<td>12</td>
<td>Mature</td>
<td>Poor</td>
<td>poor</td>
<td>Medium / High</td>
<td>High</td>
</tr>
</tbody>
</table>

**Notes** - Tree has been lopped, there is deadwood in the canopy and decay in the base however it remains a viable tree and should be retained in the medium term.

**Recommendations** - Remove deadwood from canopy and monitor tree for any signs of movement at ground level or worsening of decay. Avoid extending the burial sites into the fall zone of this tree, whole tree failure is possible.
<table>
<thead>
<tr>
<th>SPECIES</th>
<th>COMMON NAME</th>
<th>CALLIPER</th>
<th>HEIGHT</th>
<th>WIDTH</th>
<th>AGE</th>
<th>STRUCTURE</th>
<th>HEALTH</th>
<th>AMENITY</th>
<th>HAZARD</th>
<th>Notes</th>
<th>Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>Eucalyptus sp</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Dead</td>
<td></td>
<td>High</td>
<td>Notes - Nil</td>
<td>Remove</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>Recommendations - Remove</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>Pinus radiata</td>
<td>Monterey Pine</td>
<td>96</td>
<td>26</td>
<td>16</td>
<td>Mature</td>
<td>Fair</td>
<td>Good</td>
<td>High</td>
<td>Notes - Large old tree at corner of property, a large limb has split out and is now hanging in the canopy. The limb that remains now has a large wound and is likely to fail at some point.</td>
<td>Remove hanger and either load reduce or remove the remaining, damaged limb.</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>Recommendations - Remove hanger and either load reduce or remove the remaining, damaged limb.</td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>Quercus robur</td>
<td>English Oak</td>
<td>73</td>
<td>13</td>
<td>13</td>
<td>Mature</td>
<td>Poor</td>
<td>Fair /</td>
<td>High</td>
<td>Notes - Part of row, hangs over entrance / vehicle gate, has cavities / hollows, broken limbs (hanger) and decay</td>
<td>Prune back damaged limbs, hanger and any deadwood. Plan for replacement in 10 - 20 years</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>good</td>
<td></td>
<td></td>
<td>Recommendations - Prune back damaged limbs, hanger and any deadwood. Plan for replacement in 10 - 20 years</td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>Eucalyptus globulus</td>
<td>Southern Blue Gum</td>
<td>&gt;110</td>
<td></td>
<td></td>
<td>Senescing</td>
<td>Very Poor</td>
<td>High</td>
<td>Low / Medium</td>
<td>Notes - Row of large old trees beside access drive. These trees have significant structural issues and large sections will continue to fail and fall. Use of the surrounding area is low therefore risk is reduced. Due to the species and high number of hollows the trees provide significant habitat value and retention of the trees for as long as possible is recommended.</td>
<td>Remove deadwood hanging over road, also load reduce live limbs hanging over road; depending on the limb it may be just the end weight or possibly the entire limb, for example tree 24 (see image) should have the live lower limb reduced by 30%.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Recommendations - Remove deadwood hanging over road, also load reduce live limbs hanging over road; depending on the limb it may be just the end weight or possibly the entire limb, for example tree 24 (see image) should have the live lower limb reduced by 30%.</td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>Pinus radiata</td>
<td>Monterey Pine</td>
<td>&gt;120</td>
<td></td>
<td></td>
<td>Senescing</td>
<td>Poor</td>
<td>Poor</td>
<td>High</td>
<td>Notes - Though tree is a feature with high amenity the upper crown is dead or dying and decay will spread quickly, limbs and tree sections will fall regularly.</td>
<td>Remove</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Recommendations - Remove</td>
<td></td>
</tr>
</tbody>
</table>
4.4 Site plan

Figure 1 - Location of Subject Trees
Tree Inspection for Risk Mitigation

Legend
- Hazard Trees
- Roadways
- Site Boundary
- Parcel Boundaries
4.5 Photographs

Tree 2

Tree 4

Tree within area 5

Tree within area 5 – high habitat value
Tree 7 (group of dead wattles)

Tree 10 – large wound

11 – self-seeded trees amongst monuments

15 – Group of Eucalypts
17 – row of large Pines

Tree 19

Tree 21

Oak avenue
5 Observations / discussions

5.1 Trees not listed

Only those trees found to present a higher than acceptable risk (in the author’s opinion) have been detailed within this report.

There are some trees that require risk mitigation work that have not been listed individually; this is because they are dead or contain deadwood within the canopy, though they have not been listed they should be actioned by the Cemetery Trust.

5.2 Large Eucalypts and Pine along entrance road

Larger trees such as those along the entrance drive are more likely to drop large limbs and deadwood, although there is a greater chance of a limb failure the area below these trees is occupied for such a small percentage of the time that the associated risk is low. Deadwood is the main hazard and where large sections of deadwood are observed above the road then this should be pruned out, at least every one to two years. While contractors are accessing the tree canopy the trees should be inspected for limbs that are highly likely to impact users of the driveway.
5.3 Trees and monuments

(See Tree 11 in Tree Data section) Where trees are growing immediately next to or from within a monument the gradual expansion of the tree will raise, crack and damage the structure. Shaving (slicing the trunk) or cutting roots is not appropriate as it introduces wounds and decay and compromises structural stability. Where a tree is likely to impact a monument the tree should be removed.

5.4 Site habitat significance

The faunal habitat significance of most trees observed was low, the exception being the larger trees that provide nesting habitat for a range of arboreal and avian species and the Eucalypts that provide nesting and feeding habitat. The very old Eucalypts in the northwest corner exhibit decay and cavities which provide structural value for nest building for arboreal mammals.

5.5 Oak Avenue

The Oaks that line the front entrance to the cemetery are an important feature and of very high amenity, mostly they are in good health however the conditions, particularly the soil, are not ideal and where possible stress factors should be minimised.

Currently there is vehicle access within the drip line of these trees which encourages people to drive and park over the root plates; this would be particularly prevalent on hot sunny days when the Oak’s provide the only shade. Driving over or parking on root plates will significantly worsen growing conditions and should be avoided.

Placement of bollards or a fence to protect the root zone is recommended, the dripline would be a reasonable minimum exclusion zone. Placement of organic material, mulch, additional water, landscaping to capture water runoff would also help. The benefits of improvements to growing conditions will not be obvious immediately however the structural integrity and useful life expectancy of the trees could be significantly increased, this in turn would maintain amenity and reduce management costs.

5.6 Monterey Pines

The Pines at the back (west) side of the cemetery are old and large and effectively a part of the Pine plantation (belonging to Coliban Water Authority). Some of these trees have failed, others are likely to in the short to medium term. Removal of the neighbouring plantation will expose these trees to unfamiliar wind loadings and more failures are predictable.

The Pines should be removed, ideally as part of the Coliban Water Authority plantation harvesting. This will provide some economy of scale, also reducing the number of times large machinery and site disturbance necessary.

The Pines along the South boundary are slightly removed and could possibly be retained in the short term however they are also close to the end of their useful life expectancy and for those reasons outlined above their removal is also recommended.
5.7 Site details

**Number of trees inspected**
All trees on site

**Location of trees**
See site map - Section 4.4 (above)

**Slope**
Not significant
Less than 10 degrees

**Soil moisture**
Medium / low

**Soil compaction**
High

**Target exposure**
Low / medium

**Water course within 30m**
Yes

5.8 General comments

5.8.1 Potential for failure
Any tree can fail and all trees present a risk.

Trees are dynamic structures that change in response to their growing conditions, state of maturity and in accordance with the species. This changing nature also changes their potential to fail and therefore the risk they present.

Failure potential will be increased with:
- Poor tree structure
- Poor tree health
- Increased wind or changes in wind loadings such as those experienced after the removal of nearby trees or structures
- Drought or rain, particularly saturating rains
- Interference with root systems including compaction, disturbance, contamination, trenching or removal (excavations)
- Changes in water regimes such as those experienced when drainage patterns are changed
- Inappropriate pruning of a tree

Different species and provenances of species will influence the likelihood of a failure event as will the siting of a specimen. Also a tree may shed limbs or fail for no apparent reason. Therefore it’s important to be aware of the characteristics of a species and monitor any changes in structural or environmental conditions and manage trees accordingly to reduce risk.

All trees present a hazard; predominantly the hazard will be associated with failure potential however other hazards exist such as the production of allergens. Trees may impact on structures through changes in soil moisture content.

Risk assessment will determine the degree of risk associated with a hazard and risk control is the process of implementing appropriate measures to reduce the risk to an acceptable level.
5.8.2 Controlling risk

Each owner/manager of a tree will need to determine for themselves what level of risk is appropriate for their given situation. They will need to decide how they manage that risk; measures may include:

- Pruning to remove weak or damaged components of a tree
- Complete tree removal
- Relocation of targets such as seating or playgrounds
- Fencing of an area to exclude targets from under trees
- Erecting a structure over a target that can withstand a tree failure
- Appropriate signage

Where recommendations are supplied as part of this document, the manager of a tree will need to determine if those recommendations are appropriate to the situation. The manager will need to determine their own level of acceptable risk and act accordingly.

Though branch shedding and tree failure cannot be eliminated, by implementing regular arboricultural inspections as well as risk assessment and control; failure events and therefore risk, will be significantly reduced.

Any works undertaken such as pruning and tree removal should be undertaken by a suitably qualified contractor.

In some circumstances landscaping such as the introduction of garden beds or thick shrubbery may reduce risk. Thick plantings of shrubs such as Rosemary Grevillea (G. rosmarinifolia) or Dagger Hakea (H. teretifolia) which are both prickly, may sufficiently keep people from dangerous areas.

Any signage in relation to tree safety should be designed and placed in conjunction with legal consultation.

5.8.3 Included bark unions

Where a branch union is tight or ‘V’ crotched often there will be included bark; that is the bark is trapped between two limbs or leaders, often of similar size, and the potential for failure at this point is much higher than for a good sound union. These unions are considered more likely to fail and should be monitored regularly, though a close regular inspection by an arborist is recommended also the manager of a tree should be watching those unions for any signs of splitting or separation particularly during windy conditions.

It is possible to install hardware (cables, slings) in a tree that reduce the chance of poor unions failing and/or ‘catch’ a limb if it does fail.

Because a union has included bark does not mean it is going to fail in the short to medium term but it does indicate that closer attention and possibly action is warranted depending on the size of limbs, degree of inclusion and particularly the use of the area under the tree.
5.8.4 Soil compaction

Soil compaction reduces the number and size of soil pores, subsequently reducing the available water and oxygen to a tree, this then impedes a tree’s ability to respire (consume reserved energy supplies) and increases stress. Subsequent symptoms may include thinning or dying crown, reduced or no seasonal extension growth, limb shed or death of the tree. Insect infestation may increase as a tree’s natural ability to withstand pests is diminished.

5.8.5 Physical / mechanical damage to trees

Physical damage to tree parts, particularly the trunk, is unsightly and provides entry points for pests and diseases such as fungal infections. This may cause long-term decay and can lead to partial or complete tree failure and death.

5.8.6 Alteration of soil levels

Alteration of soil levels around trees will affect the root zone and stability of a tree as well as tree metabolism. This may result in reduced tree health, excessive deadwood, thinning foliage and poor vigour; it can take some years for the impact to become evident at which time it is normally irreversible.

5.8.7 Damage to structures

Trees impact on structures such as buildings or cemetery monuments in a number of ways including exerting a mechanical force on foundations via lifting or pushing.

They may also cause damage in reactive (clay) soils by their ability to uptake moisture from the soil and subsequently dehydrate and shrink the soil profile.

When structures are damaged in this manner, signs may include sinking foundations and cracked wall sections.

5.8.8 Pruning standards / Lopping

An Australian standard exists to give guidance on pruning of trees. It is important that all remedial works are carried out by a competent contractor in accordance with the Australian Standard.

(AS. 4373 2007 - Pruning of Amenity Trees)

Lopping as defined within the standard, is detrimental to trees, often resulting in decay and poorly attached epicormic shoots. Natural Target Pruning methods should be used wherever possible when removing sections from trees.
6 Conclusions / recommendations

The Malmsbury Cemetery is planted with a mix of exotic, native and indigenous species, many of the trees on site are old and/or in poor condition and the likelihood of ongoing tree failures (partial or whole) is highly likely. The low usage of the area reduces risk to people however the monuments on site are very likely to be impacted. The recent failure of a leaning Pine is evidence of this risk.

There are a number of trees or groups of trees on site that pose an immediate hazard to users of the cemetery, action should be taken as soon as is practicable to mitigate the risk:

- Remove* all dead trees – Tree 20, and others not listed individually
  Note - in some cases dead or dangerous trees can be reduced to a safer height and retained as habitat stags with introduced cavities.
- Remove hangers from tree canopies – Trees 1, 21, 22 and others not listed
- Restrict or discourage access to the old Eucalypts (Group 5) and Patch 15: fall zones should be designated ‘restricted access areas’ and managed through landscaping/planting, fencing or signage or a combination.
- Remove Tree 10, 13, 18 and 28 (or reduce to a safer height)
- Prune limbs and deadwood from road side of trees 23 - 27
- Prune out deadwood* hanging over public access areas – various trees, not listed individually.
  Note – as with dead trees, deadwood can provide valuable habitat value and should be retained if there is scope for cavity formation and the retained stub does not interfere with the structural integrity of the tree (callus formation on ‘at risk’ trees)
- A number of Pine trees require removal for risk mitigation, they have not been listed individually as there is some discussion with Coliban Water Authority regarding their management – they are a weed species and any Pines observed to have poor structure should be removed as soon as practicable.

The likelihood of tree failures at the site is very high, these failure events may be tomorrow or in 5 years, it is not possible to accurately predict the timing.

All other itemised trees and tree groups should be actioned in the short to medium term including the removal of some or all Pinus radiata on site.

Many of the trees on site are mature or in poor condition and there are limited juvenile or semi-mature trees. To maintain tree related amenity in the longer term a planting program should be initiated.

Growing conditions for all trees are poor, where possible trees should be protected from stress factors, damage or wounding and any new plantings should consider the conditions and species be selected accordingly.

Some trees have been lopped and damaged during pruning operations. Where tree works are undertaken the work should be performed by a suitably qualified arborist and in line with the Australian Standard on Pruning of Amenity trees.
**Specific tree recommendations**
Detailed within section 4.3 - Data / Tree assessments.

**Site recommendations**
To protect the feature row of English Oaks at the front of the cemetery vehicles should be excluded from the root zones.

Areas with large and/or dangerous trees should be avoided by the public and contractors, particularly during windy conditions.

A tree planting plan should be designed to replace those trees that are likely to be removed over the next 20 years

New grave sites should be selected with tree related risk in mind keeping workers and the public away from fall zones.

**General tree recommendations**
Dead trees may fail partially or completely and pose a significant risk, Dead wood within trees will fall and may cause serious injury.

- Dead trees and deadwood should be managed as set out above (previous page)
- Any other trees found on site to be structurally poor or pose a serious hazard should be removed, pruned or lopped to minimize that hazard
- Where large old trees are to be retained make the fall zone around these trees low use areas

**General site recommendations**
Addressing tree health issues is likely to reduce dieback and limb failures, measures that can improve tree health include:

- Regular pruning to remove dead or damaged material from the canopy
- Minimise compaction or disturbance of root zones
- Protect trees from mechanical damage to trunks and surface roots
- Do not alter soil levels around tree trunks or over root plates
- Where appropriate take measures to aerate soil and apply a thin layer (7cm) of mulch, keeping that mulch away from the trunk / bark
- Minor landscaping works to create banks or berms to reduce rain runoff and increase soil moisture uptake
- The addition of indigenous shrubs, grasses and herbs can improve the health of nearby native trees.
7 References


Costermans, L. 1981, Native trees and shrubs of south-eastern Australia, New Holland publishers (Australia) Pty Ltd, Sydney

Standards Australia. 2009, AS 4970-2009 Protection of trees on development sites

Standards Australia, 2007, AS 4373-2007 Pruning of amenity trees

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11. Information in this report covers only those items that were examined in accordance with the Terms of Reference, and reflects the condition of those items that were examined at the time of the inspection.

12. The inspection is limited to visual examination of accessible components unless otherwise stated in the “Method of Inspection”.

13. There is no warranty or guarantee, expressed or implied, that the problems or deficiencies of the plants or property in question may not arise in the future.
## Appendix 1. Glossary

### ACCEPTABLE RISK
Hazards and risk documented in this report are as perceived by the consulting arborist. All owners and managers of subject trees are responsible for making the final decision on the risk presented and what is or is not ‘acceptable’ as well as the most appropriate management of that risk.

### AGE CATEGORY
The age of the tree is represented as Juvenile, Semi-mature, Mature or Senescent.

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Juvenile</td>
<td>A young tree, given normal environmental conditions for that tree it will not yet flower or fruit.</td>
</tr>
<tr>
<td>Semi-mature</td>
<td>Able to reproduce but not yet nearly the size of a mature specimen in that location.</td>
</tr>
<tr>
<td>Mature</td>
<td>Has reached or nearly reached full size and spread for that species in the given location.</td>
</tr>
<tr>
<td>Senescent</td>
<td>Has passed maturity, tree health in a state of decline.</td>
</tr>
</tbody>
</table>

### AMENITY VALUE
A judgment of amenity and/or utility the tree provides based on factors such as species, size, age, health and local environment. Amenity may be based on ecological or landscape value or both. Documented as Low, Medium or High. Amenity value does not consider the degree of risk associated with a tree.

### BRANCH ATTACHMENT
Relates to the quality or apparent strength of a union.

### CALLIPER (DBH)
The diameter of the trunk measured at or near 1.4m above ground level. Where there is more than 1 stem originating below 1.4m the measurement recorded is calculated as described in AS 4970-2009.

### CANOPY SPREAD
Overall size of the canopy as looking from a plan view. Recorded at the widest point.

### CO-DOMINANT STEMS
Two stems of approximately the same thickness and height originating from the same position in the tree.

### COMMON NAME
A non-scientific name commonly used for that tree.

### COPPICE GROWTH
Re-growth arising after a tree or shrub is cut back to near ground level.

### CROWN WIDTH
See ‘Canopy spread’

### DBH
See ‘Calliper’

### DEAD (AS DEAD)
Cessation of all metabolic processes (or very soon to be)

### EPICORMIC SHOOTS
Re-growth from the trunk or branches, originating from dormant buds under the bark, usually poorly attached, often an indicator of tree stress.

### EXPOSURE
The amount of time a target is exposed to risk from tree failure.

### FALL ZONE
Area below or near a tree where a risk exists from a tree failure event. The fall zone will be large for a tree that may fail at ground level while a tree with deadwood as the only hazard will have a ‘fall zone’ that extends to the edge of the drip-line only.

### FORM
Reference to the symmetry of the crown as observed from all angles and in accordance with the morphology of that species, and documented as Poor, Fair or Good.

### FUNGAL FRUITING BODY
The fruit of fungi often observed growing on the trunk and branches of trees or from the root zone.
**HAZARD RATING**

The risk the tree presents to people or assets (targets) and takes into consideration potential for failure, the likelihood and extent of injury or damage it may cause, and documented as Low, Medium or High.

<table>
<thead>
<tr>
<th>Rating</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>Good structure or unlikely to cause damage or injury from failure.</td>
</tr>
<tr>
<td>Medium</td>
<td>Structural defects or history of failure present, and likely to cause damage or Injury.</td>
</tr>
<tr>
<td>High</td>
<td>Structural defects identified, may also have a history of failures, and likely to cause damage or Injury, also either exhibiting active signs of failure and / or target occupancy is high.</td>
</tr>
</tbody>
</table>

**HEALTH**

A trees vigour as exhibited by the crown density, leaf colour, seasonal extension growth, presence of stress indicators, ability to withstand diseases and pests, and the degree of dieback.

<table>
<thead>
<tr>
<th>Rating</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dead</td>
<td>Cessation or near cessation of all metabolic processes</td>
</tr>
<tr>
<td>Poor</td>
<td>Indicating symptoms of extreme stress such as minimal foliage, or extensively damaged leaves from pests and diseases. Death probable if condition of tree deteriorates.</td>
</tr>
<tr>
<td>Fair</td>
<td>Not nearly of ‘Good’ condition (see below)</td>
</tr>
<tr>
<td>Good</td>
<td>Usual for that species given normal environmental conditions – full canopy with only minor deadwood, normal leaf size and extension growth, minimal pest or disease damage</td>
</tr>
<tr>
<td>Excellent</td>
<td>Better than usual for that species under normal conditions</td>
</tr>
</tbody>
</table>

**INCLUDED BARK UNION**

A union within a tree that has included bark (bark pressing on bark), these unions are usually poorly attached and more likely to fail as the included bark is equivalent to a split. Often characterized by an acute angle and sometimes forming ribs or flaring immediately below the union where the tree reacts to the weakness by placing secondary growth. Though these unions are weaker than a ‘good’ union, the risk of failure cannot be calculated.

**LOPPING / TOPPING**

The removal of parts of a tree giving no consideration to the trees natural defence systems.

**PRUNING**

Systematic removal of branches of a plant whilst giving consideration to the trees natural defence systems.

**STRUCTURE**

Reference to the structural integrity of the tree with consideration of the crown, trunk and roots. Determined using the Visual Tree Assessment (VTA) method (Matheck and Breloer 1994). The failure of small (<60mm calliper) live or dead limbs is normal and not considered here.

<table>
<thead>
<tr>
<th>Rating</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very poor</td>
<td>Clear indications that a significant failure is likely in the near future</td>
</tr>
<tr>
<td>Poor</td>
<td>Signs of structural weakness obvious and failure likely, one might expect a significant failure event within the next 5 years, possibly tomorrow</td>
</tr>
<tr>
<td>Fair</td>
<td>Signs of weakness present though not obviously significant, likely to become worse over time</td>
</tr>
<tr>
<td>Good</td>
<td>No obvious signs of structural weakness</td>
</tr>
</tbody>
</table>

**TREE NUMBER**

Identifying number allocated to individual trees or groups of trees, may be used to locate trees using site plans or tags on trees.

**TREE PROTECTION ZONE (TPZ)**

An exclusion area that allows for protection of canopy and roots; both the structural roots that give the tree stability and the smaller absorption roots. The radius of the TPZ is normally calculated for each tree by multiplying the DBH × 12. The minimum distance will be 2m and maximum 15 as stipulated in the Australian Standard 4970-2009 – Protection of trees on development sites.