13th April 2018

bowden
expertise in urban tree science

Ian McCallum
Building Manager
Ventura iD & Multi Living Developments
L7 20 Walters Drive
OSBORNE PARK WA 6017

Dear Ian,

ARBORICULTURAL ASSESSMENT AT GUNBAR WAY KALAMUNDA

Please find enclosed the results of the arboricultural assessment undertaken recently for the trees within the residential lot at Gunbar Way, Kalamunda.

Where recommendations for remedial arboricultural work have been made, it is imperative that it is undertaken as outlined in the Australian Standard 4373-2007: Pruning of Amenity Trees and/ or Australian Standard 4970-2009: Protection of Trees on Development Sites. It is also strongly advised that any remedial pruning works be undertaken by, or supervised by, a qualified arborist (AQF Level 3 in Arboriculture).

If you have any questions regarding the assessment or if I can be of service to you again in the future, please feel free to contact me.

Yours sincerely,

Brad Bowden
Principal
Bowden Tree Consultancy®

B.Sc. Sustainable Forestry
Dip. Arboriculture & Parks Management
ISA Certified Arborist – Municipal Specialist AU-0020AM & Tree Risk Assessment Qualified (TRAQ)

1.0 Introduction

1.1 Scope of Report

1.2 The purpose of this report is to summarise the results of the walkby arboricultural survey and provide recommendations/ retention value for the 47 trees of mixed age-class and species located within the vacant residential lot known as Lot 4 Gunbar Way, Kalamunda. The site visits, tree tagging and visual tree assessments were undertaken from ground level on the 27th and 29th March and the 3rd and 11th April 2018, and were accurate at the time of inspection. Concern has been raised by the City of Kalamunda regarding the tree condition at the property, and subsequently by Ventura ID regarding the potential for tree retention as part of the proposed development.

1.3 No detailed tree assessment, soil excavation or below ground inspection was undertaken unless specified. Viewing conditions were fine. Weedy species such as the Brazilian pepper, Queensland silver wattle, black wattle, cedar wattle, tagasaste, dead trees, and trees with a trunk diameter less than 20cm were not assessed. Local native understorey vegetation included grass trees (approximately 12) less than 1m in height and also parrot bush.

1.4 Executive Summary

1.5 The assessed trees identified within this report provide a range of benefits to the ecosystem, to human beings for environmental and health reasons, and to the climate. The assessment has identified varying tree health and structural conditions for the 47 trees throughout the site and each tree has been allocated a retention value class of high, medium or low. Trees assessed as having a high retention value have a good/ high health and structural condition, a long useful life expectancy, the capacity to contribute significant shade and other benefits to the site and could be considered a material consideration and subsequently retained as part of the proposed development. Such trees with a high retention value should be incorporated into the final design and where possible, adequate tree protection measures utilised as outlined in the Australian Standard 4970 (2009): Protection of Trees on Development Sites.

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2.0 Site Investigation

2.1 Tree Locations



Figure 1. **Aerial photo of site with the tree numbering T1-47 allocated to the 47 trees within the vacant property known as Lot 4 Gunbar Way, Kalamunda.**

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Tree Number: 1	**Botanical Name:** *Corymbia calophylla*
Common Name:	marri
Location:	9m from south boundary
Height:	16.2m
DBH:	56cm
TPZ radius:	6.7m
Structure:	Good
Health:	High
Age-class:	Mature
Retention Value:	High
Comments:	Typical marri canker infection, naturally occurring dead branches to 30mm diameter visible; no work required at present



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Tree Number: 2	**Botanical Name:** *Eucalyptus marginata*
Common Name:	jarrah
Location:	Southwest corner
Height (m):	12.2m
DBH (cm):	32cm
TPZ radius:	3.8m
Structure:	Poor
Health:	High
Age-class:	Early mature
Retention Value:	Medium
Comments:	Bifurcation evident at 3.5m above ground level and into two codominant stems however union assessed as sound at present, naturally occurring dead branches to 70mm visible predominantly within the lower crown; consider deadwooding to remove the dead branches greater than 50mm diameter



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Tree Number: 3	**Botanical Name:** *Corymbia calophylla*
Common Name:	marri
Location:	Southwest corner
Height (m):	12.6m
DBH (cm):	21cm
TPZ radius:	2.5m
Structure:	Poor
Health:	Average
Age-class:	Semi mature
Retention Value:	Low
Comments:	Suppressed with significant lean towards the northwest, sparse crown density, branch failures evidenced by broken branch stubs in the lower crown



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Tree Number: 4	**Botanical Name:** *Corymbia calophylla*
Common Name:	marri
Location:	Southwest corner
Height (m):	12.7m
DBH (cm):	29cm
TPZ radius:	3.5m
Structure:	Poor
Health:	High
Age-class:	Early mature
Retention Value:	Low
Comments:	Suppressed with lean towards the north, bifurcation of the trunk section into two codominant stems evident at 3m, high centre of mass observed i.e. foliage predominantly within the upper crown of the tree



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Tree Number: 5	**Botanical Name:** *Eucalyptus marginata*
Common Name:	jarrah
Location:	Southwest corner
Height (m):	10.4m
DBH (cm):	26cm
TPZ radius:	3.1m
Structure:	Poor
Health:	High
Age-class:	Early mature
Retention Value:	Low
Comments:	Extensive degradation evident at the trunk basal area and adjacent to the attachments of the codominant stems, previous branch failures visible; consider removal of tree to ground level and grind stump



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Tree Number: 6	**Botanical Name:** *Eucalyptus marginata*
Common Name:	jarrah
Location:	West side
Height (m):	16.1m
DBH (cm):	41cm
TPZ radius:	4.9m
Structure:	Fair
Health:	High
Age-class:	Mature
Retention Value:	Medium
Comments:	Wounding evident at the trunk basal area now near-occluded, previous branch failure resulting in a tear-out wound, dead branches to 50mm diameter visible, suppressed crown development has resulted in branches with excessive elongation



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Tree Number: 7	**Botanical Name:** *Corymbia calophylla*
Common Name:	marri
Location:	West side
Height (m):	15.6m
DBH (cm):	47cm
TPZ radius:	5.6m
Structure:	Fair
Health:	Average
Age-class:	Mature
Retention Value:	Medium
Comments:	A significant number of epicormic regrowth branches evident on the trunk section and indicative of a previous period of tree stress, large dead branches to 100mm diameter visible within the lower crown, minor regrowth stem observed <1m from assessed tree on the north side



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Tree Number: 8	**Botanical Name:** *Corymbia calophylla*
Common Name:	marri
Location:	Adjacent west boundary power pole
Height (m):	14.6m
DBH (cm):	41cm
TPZ radius:	4.9m
Structure:	Fair
Health:	High
Age-class:	Mature
Retention Value:	Low
Comments:	Asymmetrical crown evident due to extensive reduction pruning to maintain clearance from low voltage powerlines, large diameter pruning wounds and resulting epicormic regrowth branches visible



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Tree Number: 9	**Botanical Name:** *Corymbia calophylla*
Common Name:	marri
Location:	Adjacent west boundary power pole
Height (m):	14.8m
DBH (cm):	59cm
TPZ radius:	7.1m
Structure:	Poor
Health:	High
Age-class:	Mature
Retention Value:	Low
Comments:	Asymmetrical crown evident due to extensive reduction pruning to maintain clearance from low voltage powerlines, significant degradation and cavity opening observed at the trunk basal area subsequently compromising the trunk cross section, large diameter pruning wounds and extensive marri canker (with resulting kino) visible on the trunk and into the lower crown; remove tree to ground level and grind stump



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Tree Number: 10	**Botanical Name:** *Corymbia calophylla*
Common Name:	marri
Location:	Northwest corner
Height (m):	14.2m
DBH (cm):	65cm (basal)
TPZ radius:	7.8m
Structure:	Fair
Health:	High
Age-class:	Mature
Retention Value:	Medium
Comments:	Codominant stems evident at the trunk basal area however the stem union assessed as sound at present, naturally occurring dead branches to 50mm diameter observed, minor rubbing branch conflicts visible within the lower crown



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Tree Number: 11	**Botanical Name:** *Corymbia calophylla*
Common Name:	marri
Location:	Northwest corner
Height (m):	10.6m
DBH (cm):	76cm
TPZ radius:	9.1m
Structure:	Poor
Health:	Average
Age-class:	Mature
Retention Value:	Low
Comments:	Asymmetrical crown development and significant lean towards the northeast attributable to previous pruning to clear powerlines, lopped branch stubs with large weakly attached epicormic regrowth branches visible



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Tree Number: 12	**Botanical Name:** *Corymbia calophylla*
Common Name:	marri
Location:	10.9m from boundary to the north
Height (m):	23.1m (south stem)
DBH (cm):	65cm (south stem)
TPZ radius:	7.8m
Structure:	Poor
Health:	Average
Age-class:	Mature
Retention Value:	Low
Comments:	Three stems evident arising from ground level with degradation visible at the basal area, dead upper section observed for the southern stem with large failed d and branch lodged in the lower crown



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Tree Number: 13	**Botanical Name:** *Eucalyptus marginata*
Common Name:	jarrah
Location:	West side
Height (m):	12.8m
DBH (cm):	31cm
TPZ radius:	3.7m
Structure:	Fair
Health:	Average
Age-class:	Early mature
Retention Value:	Medium
Comments:	Close spacing has resulted in a high centre of mass and foliage predominantly within the upper crown, dead branches minor in size and amount



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Tree Number: 14	**Botanical Name:** *Corymbia calophylla*
Common Name:	marri
Location:	West side
Height (m):	15.9m
DBH (cm):	52cm (basal)
TPZ radius:	6.2m
Structure:	Poor
Health:	High
Age-class:	Early mature
Retention Value:	Low
Comments:	Three regrowth branches evident arising from a previously cut stump, decay visible and likely to compromise structural integrity



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Tree Number: 15	**Botanical Name:** *Eucalyptus marginata*
Common Name:	jarrah
Location:	West side
Height (m):	12.2m
DBH (cm):	26cm
TPZ radius:	3.1m
Structure:	Poor
Health:	Average
Age-class:	Early mature
Retention Value:	Low
Comments:	Significant degradation evident at the trunk basal area that is likely to compromise the structural integrity, dead branches within the lower crown and attributable to close spacing



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Tree Number: 16	**Botanical Name:** *Eucalyptus marginata*
Common Name:	jarrah
Location:	Central section
Height (m):	16.8m
DBH (cm):	28cm
TPZ radius:	3.4m
Structure:	Fair
Health:	Average
Age-class:	Early mature
Retention Value:	Low
Comments:	Suppressed crown development and lean towards the northwest due to the close spacing, naturally occurring dead branches to 30mm, significant marri canker infection observed at the trunk basal area



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Tree Number: 17	**Botanical Name:** *Corymbia calophylla*
Common Name:	marri
Location:	Central section
Height (m):	20.6m
DBH (cm):	58cm
TPZ radius:	7m
Structure:	Fair
Health:	Average
Age-class:	Mature
Retention Value:	Medium
Comments:	Suppressed on the south side due to the close proximity of the adjacent trees and which is likely to have resulted (due to shading) in the large dead and broken branches to 150mm diameter within the lower and middle crown, significant lean north



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Tree Number: 18	**Botanical Name:** *Corymbia calophylla*
Common Name:	marri
Location:	14.1m from northern boundary
Height (m):	9m
DBH (cm):	41cm
TPZ radius:	4.9m
Structure:	Fair
Health:	High
Age-class:	Early mature
Retention Value:	Medium
Comments:	Codominant stems evident arising from an acutely-angled stem attachment at 1.2m above ground level, dead branches nominal in size and amount



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Tree Number: 19	**Botanical Name:** *Corymbia calophylla*
Common Name:	marri
Location:	5.8m from the boundary to the north
Height (m):	11.6m
DBH (cm):	33cm
TPZ radius:	4m
Structure:	Poor
Health:	High
Age-class:	Early mature
Retention Value:	Low
Comments:	Three regrowth stems evident arising from a previously felled or damaged/ burnt stump



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Tree Number: 20	**Botanical Name:** *Corymbia calophylla*
Common Name:	marri
Location:	Northeast corner
Height (m):	12.1m
DBH (cm):	36cm
TPZ radius:	4.3m
Structure:	Fair
Health:	High
Age-class:	Early mature
Retention Value:	Medium
Comments:	Codominant stems evident within the lower crown, minor broken branches lodged in the lower crown



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Tree Number: 21	**Botanical Name:** *Corymbia calophylla*
Common Name:	marri
Location:	Northeast corner
Height (m):	11.2m
DBH (cm):	29cm
TPZ radius:	3.5m
Structure:	Fair
Health:	High
Age-class:	Early mature
Retention Value:	Medium
Comments:	Two stems evident arising from ground level, previous branch breakage visible within the lower crown, dead branches nominal in size and amount



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Tree Number: 22	**Botanical Name:** *Corymbia calophylla*
Common Name:	marri
Location:	Northeast corner
Height (m):	10.2m
DBH (cm):	30cm
TPZ radius:	3.6m
Structure:	Fair
Health:	Average
Age-class:	Early mature
Retention Value:	Low
Comments:	Significant marri canker fungal infection evident including within the branch union of the codominant stems



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Tree Number: 23	**Botanical Name:** *Corymbia calophylla*
Common Name:	marri
Location:	East side 9m from fence
Height (m):	15.2m
DBH (cm):	90cm (combined)
TPZ radius:	10.8m
Structure:	Poor
Health:	High
Age-class:	Mature
Retention Value:	Low
Comments:	Extensive degradation and wood decay evident at the trunk basal area of the regrowth stems



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Tree Number: 24	**Botanical Name:** *Corymbia calophylla*
Common Name:	marri
Location:	East side 15m from fence
Height (m):	15.4m
DBH (cm):	63cm
TPZ radius:	7.6m
Structure:	Fair
Health:	High
Age-class:	Mature
Retention Value:	High
Comments:	Codominant stems evident at 3m above ground level however union assessed as sound at present, large dead branches to 150mm diameter visible throughout the lower crown and would require removal where occupancy is expected to increase



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Tree Number: 25	**Botanical Name:** *Corymbia calophylla*
Common Name:	marri
Location:	East side 3m from fence
Height (m):	15.2m
DBH (cm):	45cm
TPZ radius:	5.4m
Structure:	Fair
Health:	High
Age-class:	Mature
Retention Value:	Medium
Comments:	Two main codominant stems evident arising from ground level, suppressed crown development due to proximity of adjacent large tree to the southwest, dead branches to 50mm diameter observed, minor jarrah tree within close proximity



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Tree Number: 26	**Botanical Name:** *Corymbia calophylla*
Common Name:	marri
Location:	East side 6m from fence
Height (m):	26.6m
DBH (cm):	70cm
TPZ radius:	8.4m
Structure:	Good
Health:	High
Age-class:	Mature
Retention Value:	High
Comments:	Minor damage to the topside of surface roots evident, dead branches to 50mm diameter observed, marri canker infection visible typical for the species and age class of tree



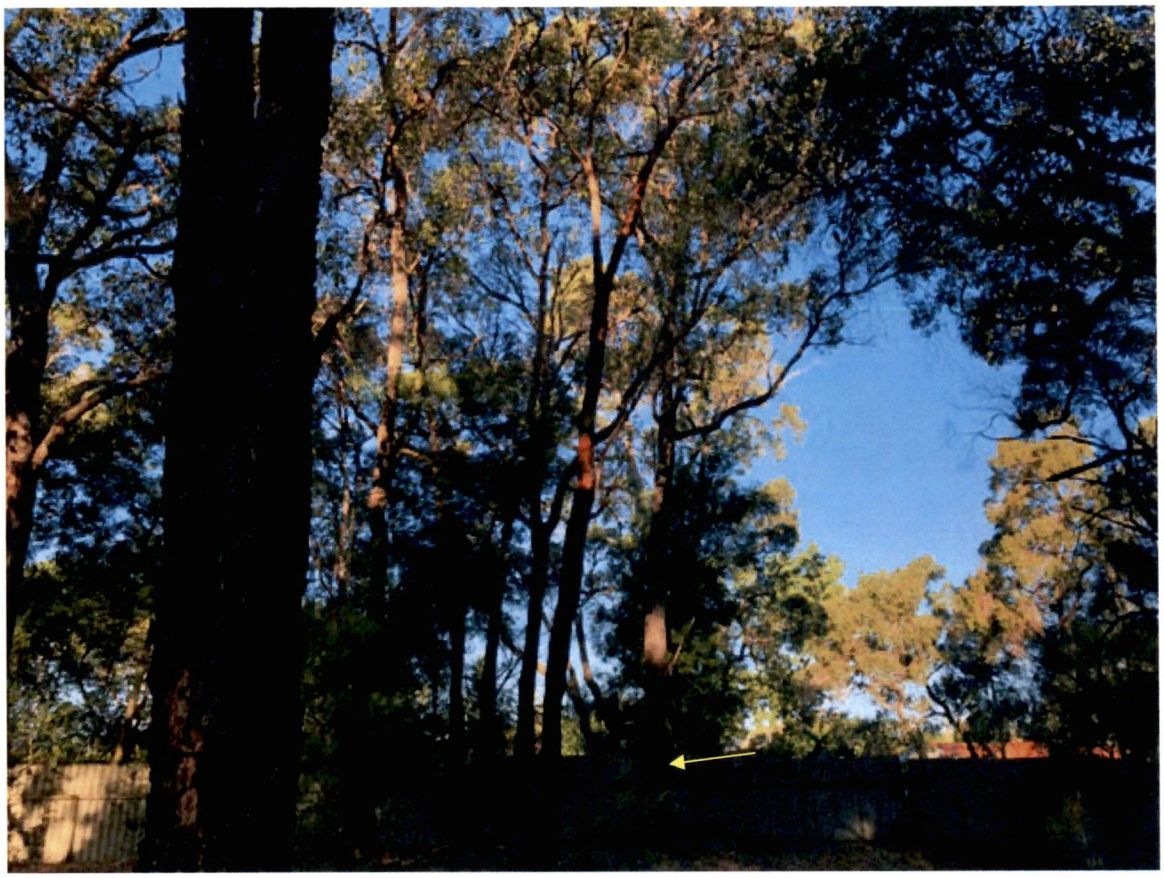
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Tree Number: 27	**Botanical Name:** *Corymbia calophylla*
Common Name:	marri
Location:	East side 2m from fence
Height (m):	26m
DBH (cm):	46cm
TPZ radius:	5.5m
Structure:	Fair
Health:	High
Age-class:	Mature
Retention Value:	Medium
Comments:	Degradation evident at the trunk basal area and on the tensile (load-bearing) side of the leaning trunk, dead branches nominal in size and amount



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Tree Number: 28	**Botanical Name:** *Corymbia calophylla*
Common Name:	marri
Location:	Southeast corner 0.5m from fence
Height (m):	27.6m
DBH (cm):	55cm
TPZ radius:	6.6m
Structure:	Fair
Health:	High
Age-class:	Mature
Retention Value:	High
Comments:	Extensive marri canker infection evident at the trunk basal area typical for the species and age class of tree, dead branches to 40mm diameter visible, codominant stems observed within the middle crown



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Tree Number: 29	**Botanical Name:** *Corymbia calophylla*
Common Name:	marri
Location:	Southeast corner 6m from east boundary fence
Height (m):	16.1m
DBH (cm):	60cm
TPZ radius:	7.2m
Structure:	Fair
Health:	High
Age-class:	Early mature
Retention Value:	Medium
Comments:	Two stems evident arising from ground level within close proximity, dead branches to 50mm diameter observed



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Tree Number: 30	**Botanical Name:** *Allocasuarina fraseriana*
Common Name:	WA sheoak
Location:	Southeast corner 0.5m from south fence
Height (m):	6m
DBH (cm):	80cm
TPZ radius:	9.6m
Structure:	Fair
Health:	Average
Age-class:	Mature
Retention Value:	Low
Comments:	Suppressed, dead branches evident throughout the upper crown likely to have been shaded and subsequently declined



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Tree Number: 31	**Botanical Name:** *Corymbia calophylla*
Common Name:	marri
Location:	Southeast corner 3m from south boundary
Height (m):	24m
DBH (cm):	100cm
TPZ radius:	12m
Structure:	TBA
Health:	High
Age-class:	Mature
Retention Value:	High
Comments:	Regrowth stems probable from a previously cut stump, degradation evident and would require further investigation to confirm extent of residual solid wood, naturally occurring dead branches to 150mm diameter observed



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Tree Number: 32	**Botanical Name:** *Corymbia calophylla*
Common Name:	marri
Location:	Southeast corner 12m from south boundary
Height (m):	23.8m
DBH (cm):	90cm
TPZ radius:	10.8m
Structure:	Poor
Health:	High
Age-class:	Mature
Retention Value:	Low
Comments:	Codominant stems evident at the trunk basal area with structurally compromised v-shaped unions visible, naturally occurring dead branches to 50mm diameter observed



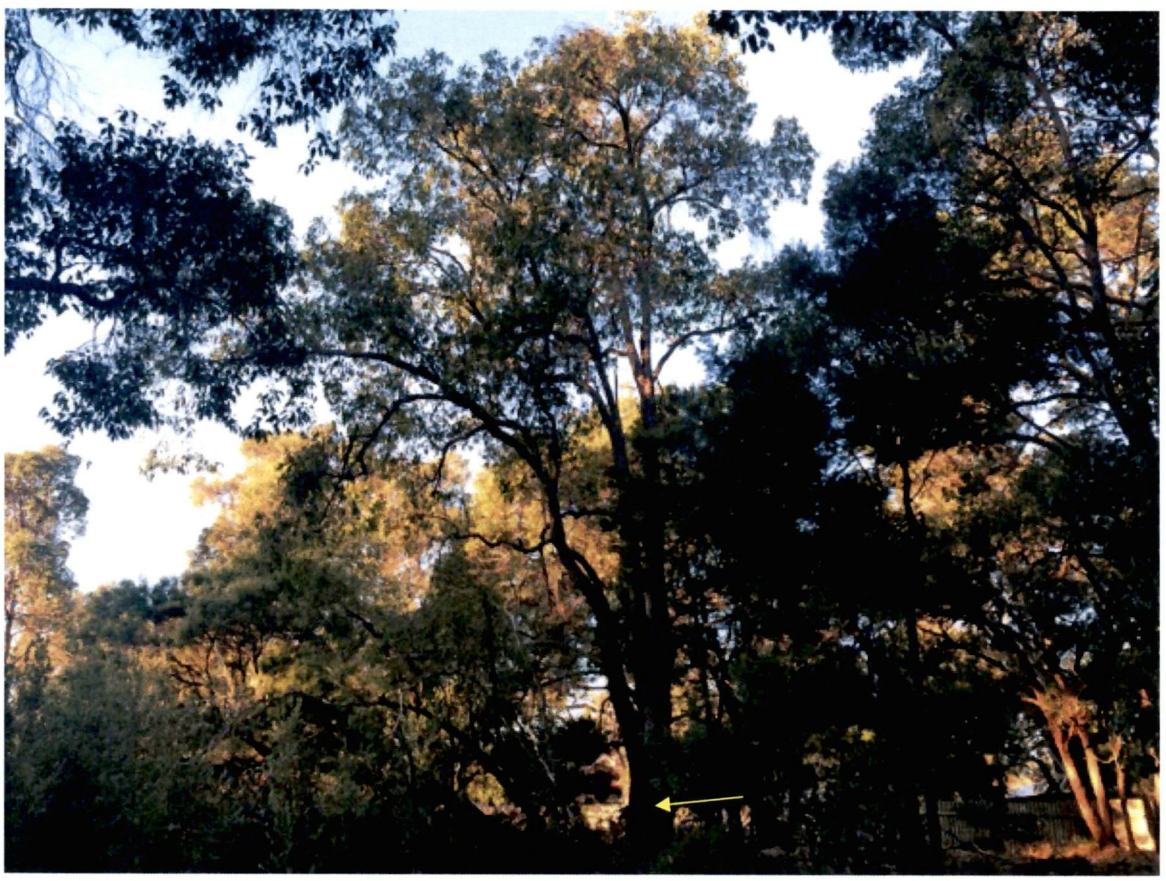
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Tree Number: 33	**Botanical Name:** *Corymbia calophylla*
Common Name:	marri
Location:	Southeast corner 13m from south boundary
Height (m):	19m
DBH (cm):	35cm
TPZ radius:	4.2m
Structure:	Poor
Health:	Average
Age-class:	Early mature
Retention Value:	Low
Comments:	Extensive degradation resulting from marri canker infection evident at the trunk basal area, codominant stems visible with suppressed crown development observed on the southeast side



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Tree Number: 34	**Botanical Name:** *Corymbia calophylla*
Common Name:	marri
Location:	Southeast corner 20m from fence to the south
Height (m):	17m
DBH (cm):	80cm
TPZ radius:	9.6m
Structure:	Fair
Health:	High
Age-class:	Mature
Retention Value:	Medium
Comments:	Codominant stems evident at the trunk basal area, suppressed crown development on the south side, dead branches nominal in size and amount, minor suppressed jarrah tree within close proximity on the north side



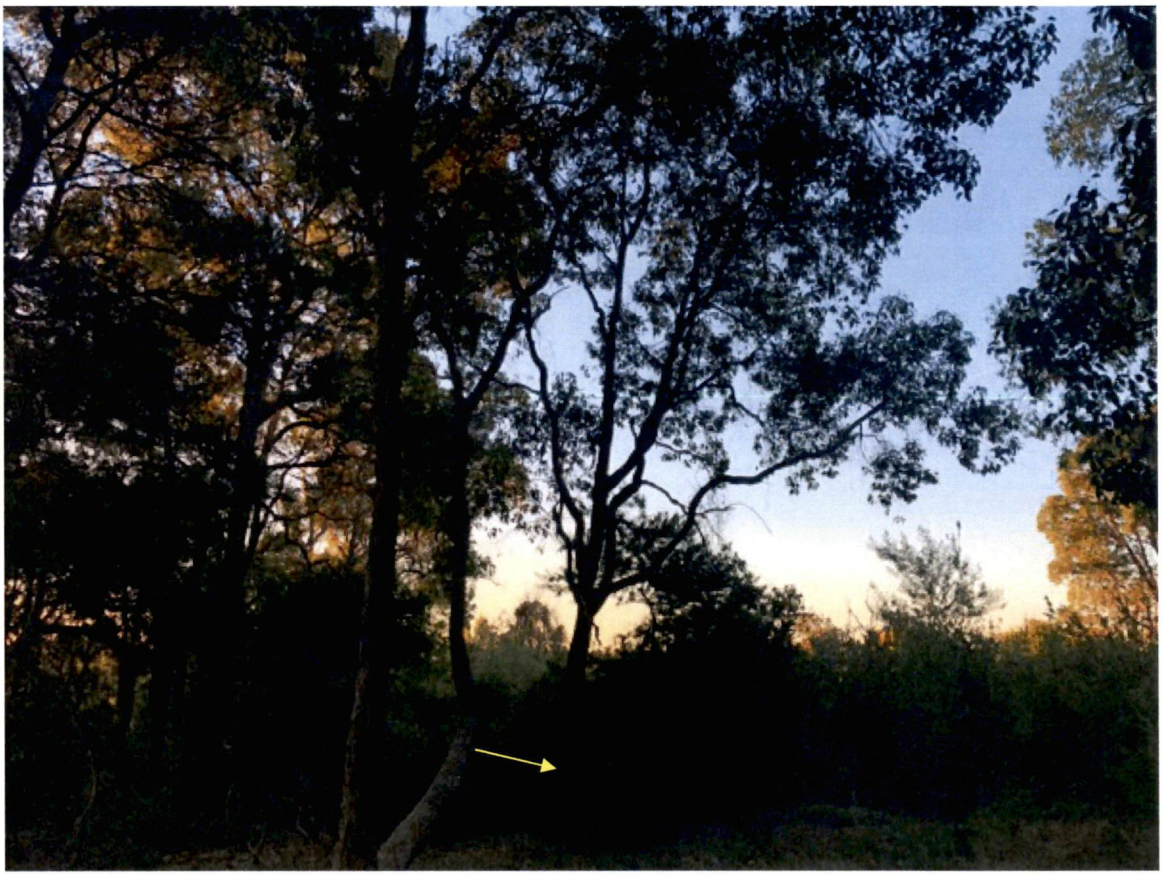
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Tree Number: 35	**Botanical Name:** *Corymbia calophylla*
Common Name:	marri
Location:	4m from south boundary
Height (m):	15.4m
DBH (cm):	55cm
TPZ radius:	6.6m
Structure:	Good
Health:	High
Age-class:	Mature
Retention Value:	Medium
Comments:	Marri canker infection evident at the trunk basal area resulting in missing bark and exposed sapwood, naturally occurring dead branches to 150mm diameter visible predominantly within the lower crown, several low branches observed on the north side



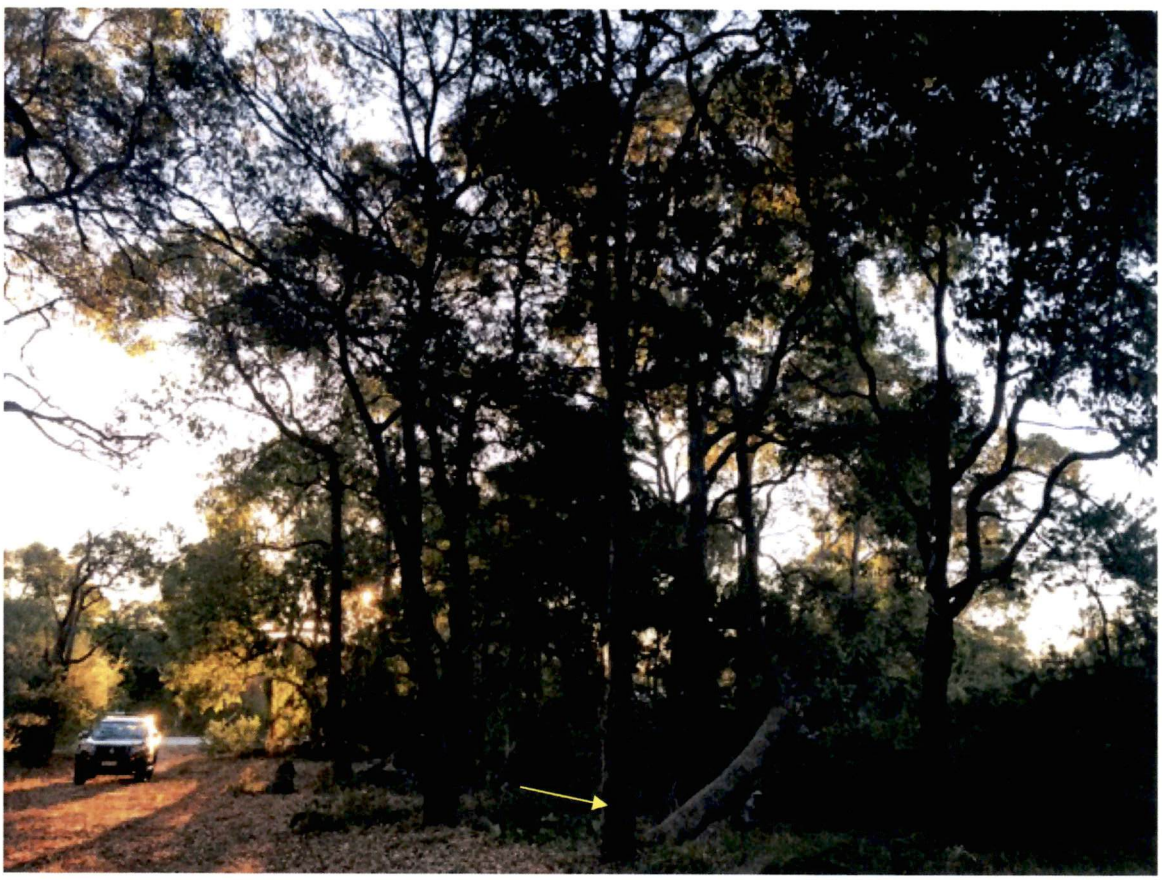
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Tree Number: 36	**Botanical Name:** *Corymbia calophylla*
Common Name:	marri
Location:	16m from the south boundary
Height (m):	14.5m
DBH (cm):	41cm
TPZ radius:	4.9m
Structure:	Fair
Health:	High
Age-class:	Early mature
Retention Value:	Medium
Comments:	Codominant stems evident at 2m above ground level, dead broken and lodged branches to 40mm diameter visible



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Tree Number: 37	**Botanical Name:** *Corymbia calophylla*
Common Name:	marri
Location:	10m from boundary to the south
Height (m):	15.1m
DBH (cm):	50cm
TPZ radius:	6m
Structure:	Poor
Health:	High
Age-class:	Early mature
Retention Value:	Low
Comments:	Codominant stems evident arising from ground level with significant lean towards the north for the northern stem, dead branches to 40mm diameter visible



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Tree Number: 38	**Botanical Name:** *Corymbia calophylla*
Common Name:	marri
Location:	Central section 16m from southern fence
Height (m):	19.8m
DBH (cm):	65cm
TPZ radius:	7.8m
Structure:	Fair
Health:	High
Age-class:	Mature
Retention Value:	High
Comments:	Large swollen trunk basal area evident, codominant stems with an acutely angled union visible within the middle crown, dead branches to 50mm diameter observed



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Tree Number: 39	**Botanical Name:** *Corymbia calophylla*
Common Name:	marri
Location:	South part 11m from fence
Height (m):	17.6m
DBH (cm):	59cm
TPZ radius:	7.1m
Structure:	Good
Health:	High
Age-class:	Mature
Retention Value:	High
Comments:	Broken branch stubs with minor epicormic growth evident within the lower crown, dead branches to 100mm observed



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Tree Number: 40	**Botanical Name:** *Corymbia calophylla*
Common Name:	marri
Location:	8m from fence
Height (m):	16.2m
DBH (cm):	39cm
TPZ radius:	4.7m
Structure:	Fair
Health:	High
Age-class:	Mature
Retention Value:	Medium
Comments:	Near occluded wound evident at the trunk basal area, suppressed crown development visible on the northeast side due to the close proximity of the adjacent large tree (T39), dead branches nominal in size and amount



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Tree Number: 41	**Botanical Name:** *Corymbia calophylla*
Common Name:	marri
Location:	19m from south fence
Height (m):	14.9m
DBH (cm):	44cm
TPZ radius:	5.3m
Structure:	Fair
Health:	High
Age-class:	Mature
Retention Value:	Medium
Comments:	Suppressed on the south side with resulting long extended branches evident, dead branches to 40mm diameter visible



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Tree Number: 42	**Botanical Name:** *Corymbia calophylla*
Common Name:	marri
Location:	22m from south fence
Height (m):	15.4m
DBH (cm):	41cm
TPZ radius:	4.9m
Structure:	Fair
Health:	High
Age-class:	Mature
Retention Value:	Medium
Comments:	Suppressed on the south side, naturally occurring dead branches to 40mm diameter visible predominantly within the lower crown



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Tree Number: 43	**Botanical Name:** *Corymbia calophylla*
Common Name:	marri
Location:	21m from south fence
Height (m):	16.1m
DBH (cm):	45cm
TPZ radius:	5.4m
Structure:	Fair
Health:	High
Age-class:	Mature
Retention Value:	Medium
Comments:	Codominant stems evident at the trunk basal area, suppressed crown development visible on the northeast side, dead branches to approximately 50mm diameter observed throughout the crown



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Tree Number: 44	**Botanical Name:** *Corymbia calophylla*
Common Name:	marri
Location:	14m from south fence
Height (m):	15.2m
DBH (cm):	29cm
TPZ radius:	3.5m
Structure:	Good
Health:	High
Age-class:	Early mature
Retention Value:	Medium
Comments:	Codominant stems evident however assessed as sound at present, dead branches nominal in size and amount



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Tree Number: 45	**Botanical Name:** *Corymbia calophylla*
Common Name:	marri
Location:	11m from south fence
Height (m):	8m
DBH (cm):	36cm
TPZ radius:	6m
Structure:	Poor
Health:	High
Age-class:	Mature
Retention Value:	Low
Comments:	Upper stem section has failed and minor epicormic regrowth branches visible



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Tree Number: 46	**Botanical Name:** *Corymbia calophylla*
Common Name:	marri
Location:	12m from southern fence
Height (m):	14.2m
DBH (cm):	63cm
TPZ radius:	7.6m
Structure:	Fair
Health:	High
Age-class:	Mature
Retention Value:	Low (Further investigation required)
Comments:	Large wound and degradation evident at the trunk basal area and large branch failure visible within the lower crown, dead broken and lodged branches to 120mm diameter



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Tree Number: 47	**Botanical Name:** *Eucalyptus marginata*
Common Name:	jarrah
Location:	1m from south fence
Height (m):	9.2m
DBH (cm):	55cm
TPZ radius:	6.6m
Structure:	Fair
Health:	Low
Age-class:	Early mature
Retention Value:	Low
Comments:	Codominant stems evident at the trunk basal area, upper crown decline evident with large dead branches to 200mm diameter observed and east stem mortality visible



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2.2 Assessment Summary

Tree #	Common Name	TPZ radius	Retention Value
1	marri	6.7m	High
2	jarrah	3.8m	Medium
3	marri	2.5m	Low
4	marri	3.5m	Low
5	jarrah	3.1m	Low
6	jarrah	4.9m	Medium
7	marri	5.6m	Medium
8	marri	4.9m	Low
9	marri	7.1m	Low
10	marri	7.8m	Medium
11	marri	9.1m	Low
12	marri	7.8m	Low
13	jarrah	3.7m	Medium
14	marri	6.2m	Low
15	jarrah	3.1m	Low
16	jarrah	3.4m	Low
17	marri	7.0m	Medium
18	marri	4.9m	Medium
19	marri	4.0m	Low
20	marri	4.3m	Medium
21	marri	3.5m	Medium
22	marri	3.6m	Low
23	marri	10.8m	Low
24	marri	7.6m	High
25	marri	5.4m	Medium
26	marri	8.4m	High
27	marri	5.5m	Medium
28	marri	6.6m	High
29	marri	7.2m	Medium
30	WA sheoak	9.8m	Low
31	marri	12.0m	High
32	marri	10.8m	Low
33	marri	4.2m	Low
34	marri	9.6m	Medium
35	marri	6.6m	Medium
36	marri	4.9m	Medium
37	marri	6.0m	Low
38	marri	7.8m	High
39	marri	7.1m	High
40	marri	4.7m	Medium
41	marri	5.3m	Medium
42	marri	4.9m	Medium
43	marri	5.4m	Medium
44	marri	3.5m	Medium
45	marri	6.0m	Low
46	marri	7.6m	Low
47	jarrah	6.6m	Low

Table 1. **Summary of the retention value and TPZ radius for each of the 47 assessed trees, with specific details located in the comments section for each individual tree.**

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2.3 Tree Retention Value



Figure 2. **Aerial photo of site with the tree protection zone (TPZ) radius displayed for the six trees assessed as a high retention value.**

3.0 Discussion and Recommendations

3.1 Discussion

3.2 Tree root plate: Root plate composition for most tree species consists of a structural root zone and an absorbing root zone, responsible respectively for the stability/ anchorage of the tree and the uptake of water/ mineral solutes from the soil. Severance of the large diameter woody roots within the structural root zone (the root plate area immediately adjacent to the tree and generally determined as trunk diameter x 5) can compromise tree stability and must be avoided. It can also result in the loss of a significant proportion of the fine, water-absorbing roots, subsequently placing considerable stress on the tree in the short term and may initiate a decline in health condition and/ or tree mortality. The severance of large diameter roots also provides an entry opportunity for infection by wood decay fungi and infestation by wood-destroying insects, increasing the potential for the degradation of wood tissue at the root collar and trunk basal area and compromising tree stability in the long term.

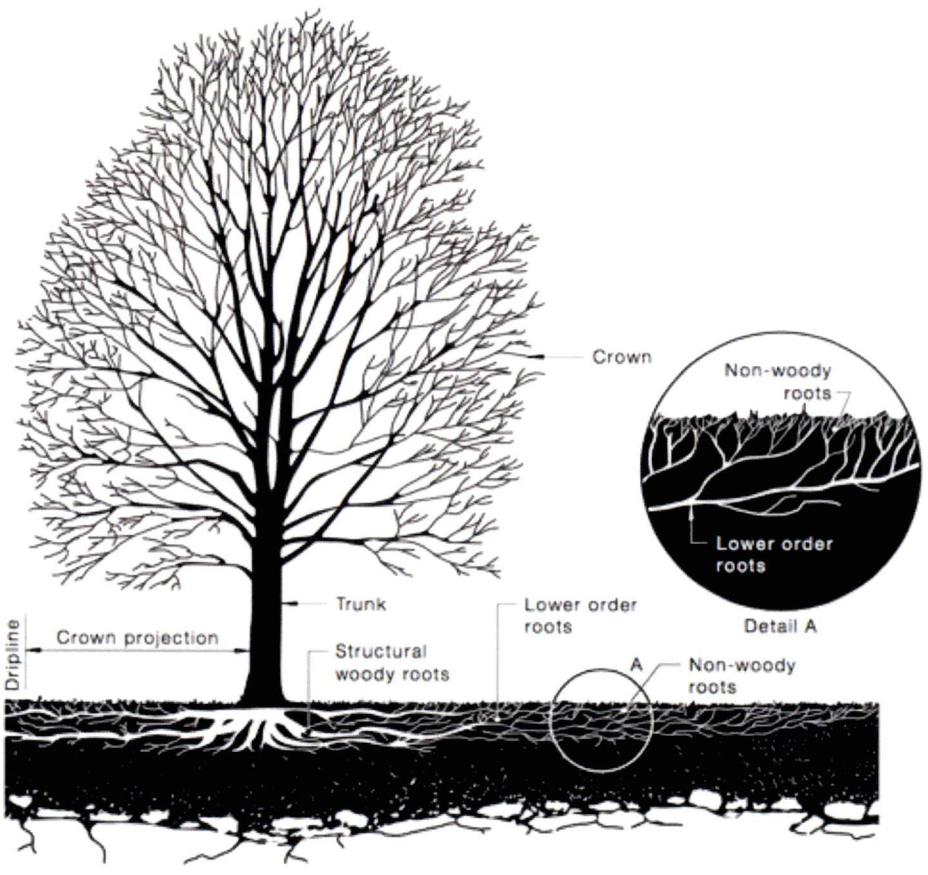


Figure 3. Typical tree structure above and below ground for cultivated urban trees. Source: AS4970-2009: Protection of Trees on Development Sites.

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3.3 Tree preservation during construction: The most important goal of tree preservation on construction/ development sites or where construction activities occur within close proximity of mature trees is the long-term survival and stability of the tree/ s. To achieve this goal, three core principles must be recognised, and they include:

- To preserve existing trees, the planning/ design/ construction process must respect patterns of tree growth and development, both the above ground crown section and the below ground rootplate.
- Tree preservation must focus on preventing construction injury to trees which includes mitigating soil cut/ fill, restricting continuous open trenching and root damage, and avoiding collision injury to trunks and branches.
- Mature trees require an undisturbed space to retain a healthy root system and growth of the crown.

3.4 Tree protection measures include a range of activities and structures and should be in place prior to any site works including demolition (AS4970, 2009). Protective fencing comprised of 1.8m high chain-wire mesh panels should be erected at the periphery of the Tree Protection Zone radius (trunk diameter x 12) for each tree assessed as a material constraint and subsequently retained as part of the project. Where this is not possible due to the constrained size of the verge area, four sheets of fence in a square configuration should be deemed the minimum.



Figure 4. Protective fencing comprised of 1.8m high chain-wire mesh panels (and signage providing information regarding access within the fencing) should be erected prior to the commencement of construction activities that involve machinery that have the potential for collision injury to the trunk and branches.

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Figure 5. **Where mechanical excavation is used outside the tree protection zone the selection of a toothless bucket (a) and use of a spotter can alleviate the extent of damage to the roots are they are revealed, compared with the toothed bucket (b) type which can significantly tear and damage roots.**

3.5 **Fill soil:** Raising the ground level in the **absorbing root zone** by 200mm+ with the addition of fill soil has the potential to create aeration, water movement, temperature, and root growth problems. For mature trees, a new (adventitious) root system often develops in the fill soil as the original root system subsequently declines due to anaerobic conditions. The new adventitious root system may be adequate to keep the tree looking green and healthy however as the original root system decays, the stability of the tree may be compromised. Fill soil within the **structural root zone** only is of a lower concern and where increases to the existing grade cannot be avoided the use of a low retaining wall installed in a root sensitive method (avoiding continuous open trenching and root severance) is recommended to keep soil off the trunk and root collar sections of the tree.

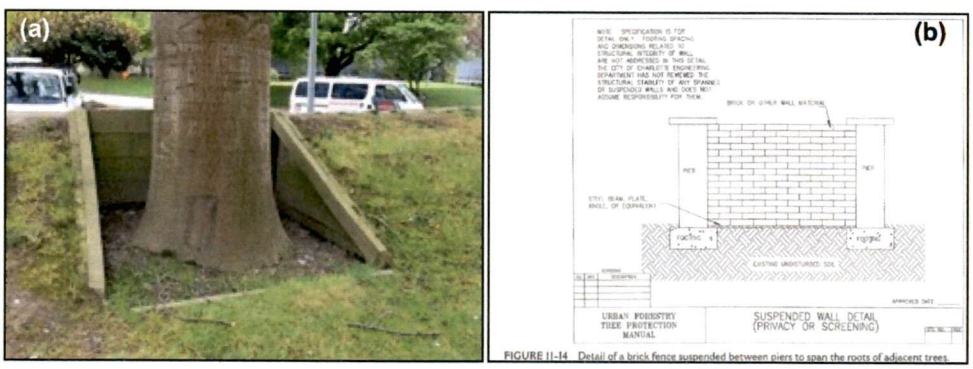


Figure 6. **(a) Fill soil within the structural root zone, where it cannot be avoided, should be kept off the trunk and root collar area by use of a retaining wall installed in a root sensitive manner i.e. no continuous trenching and/ or root severance; (b) The pier and beam/ post and intel construction techniques provide options for spanning a structure such as a suspended slab across the root plate of a tree without the requirement for continuous open trenching that can significantly damage the tree rootplate.**

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Figure 7. **Where hard surfacing is proposed adjacent to mature existing trees the use of permeable paving provides an option where possible to mitigate the negative impacts of reduced water infiltration and aeration to the absorbing roots (that are responsible for the uptake of the water and nutrients).**

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3.6 Where the objective is to retain for the long term the trees assessed as having a high retention value the following is advised:

- Excavation or root severance should not occur within the TPZ radius section of the rootplate for each tree to avoid compromising tree health and stability by loss of absorbing roots and large woody roots respectively; or where this is not possible due to the constrained size of the lot, it must be excluded from the structural root zone (SRZ), with the approximate SRZ radius measurement calculated from the trunk diameter (DBH) x 5 i.e. 40cm DBH x 5 = 2m SRZ radius

- Beyond the SRZ but still within the TPZ, excavation where/ if required should be undertaken using root sensitive excavation techniques such as hand-digging or soil vacuum to avoid damaging tree roots

- All tree roots greater than 30mm in diameter revealed in excavation works beyond the SRZ should be retained and not severed, as loss of these roots can compromise tree stability and result in a decline in tree health in subsequent years (mortality spiral)

- Where construction activities are proposed during the hot, dry months any current irrigation regime must be maintained; alternatively consider a drip irrigation system at the TPZ periphery of each mature tree where the existing irrigation system requires shut down/ relocation

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4.0 Appendix I

4.1 Arboricultural Terminology

4.2 Crown – the leaves and branches of a tree measured from the lowest branch on the trunk to the top of the tree, whilst crown lifting involves pruning of the lower branches to improve clearance for buildings, pedestrians, vehicles etc.

4.3 DBH - diameter of the main trunk, measured at breast height approximately 1.4m above ground level for urban trees.

4.4 Deadwooding – the removal of dead, diseased or damaged branch wood from the crown of the tree.

4.5 Dripline – the width of the crown of the tree measured by the lateral extent of the foliage, with the crown spread measurement indicating the widest part.

4.6 Fall zone – is the area in which the tree or tree part is likely to fall when it fails, often calculated as 1.5 times the tree height where brittle dead branches etc. may break up and scatter debris.

4.7 First order structural branch – the large branches arising from the trunk that form the main structure of the crown.

4.8 Reduction prune – pruning to reduce the extension of a branch, back to a lateral branch that is at least one-third the diameter of the branch being removed.

4.9 Root collar – area at the base of the tree were the roots and trunk merge.

4.10 Second order branch – a branch arising from a first order structural branch.

4.11 Targets – an object, person or structure that would be damaged or injured in the event of tree or branch failure is referred to as the target or target area. The hazard evaluation of the target area is relative to the expected use and occupancy of that area.

4.12 Topping and Lopping – deleterious tree height and branch reduction work often at indiscriminate points and generally resulting in weakly-attached regrowth branches prone to failure as subsequent growth occurs.

4.13 Tree Protection Zone (TPZ) – the zone of the root plate most likely to contain roots that are critical for anchorage and stability (structural root zone - SRZ) and the absorbing roots responsible for the uptake of water and nutrients collectively; calculated as trunk diameter (DBH) x 12.

4.14 V-shaped union – ingrown bark from adjacent parts of the tree that are in contact with each other; usually branch forks, acutely-angled branch attachments or basal stems – often a high failure potential.

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4.15 Tree Structure and Health

4.16 The structural condition ('Structure') for each tree or group of trees has been assessed using the following qualitative criteria:

- Good – generally free of structural defects
- Fair – defects evident that may be typical for the species and age class, and which could be corrected through remedial pruning works
- Poor – significant defects that are not likely to be corrected through remedial pruning or arboricultural works
- TBA – to be assessed, requiring further investigation to evaluate tree structural condition

4.17 The vitality ('Health') for each tree or group of trees has been assessed using the following qualitative criteria:

- High – consistent crown density and foliage colour, good shoot extension and an insignificant number of naturally-occurring internal dead branches
- Average – crown condition that may representative for the species and/ or seasonal, possessing satisfactory shoot extension and/ or minimal decline and dead branches
- Low – poor shoot extension, sparse crown density and not likely to be corrected through improvement of site resources and plant nutrition
- Moribund – final stages of a decline spiral

4.18 Retention Value

4.19 The retention value for each tree has been based on a qualitative assessment of current tree structure and health condition, the useful life expectancy, and the potential for the tree or group of trees to contribute benefits such as shade to the site as part of the proposed works i.e. trees assessed that are of good structure, high vitality, broad-crowned and assessed as having a long useful life expectancy without the requirement for extensive management works to maintain the tree/s, are subsequently allocated a high retention value. Retention value classes include high, medium, low.

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5.0 Appendix II

5.1 Author Formal Qualifications

5.2 Bachelor of Science (Sustainable Forestry) – 2012
Edith Cowan University, Joondalup & Murdoch University, Murdoch, WA.

5.3 Diploma of Applied Science (Horticulture) – 2000
Major studies Arboriculture and Parks/ Gardens management
University of Melbourne, Burnley campus, VIC.

5.4 Certificate IV (TAE40110) in Training & Assessment – 2014
Plenty Training, Robina, QLD.

5.5 Certificate of Horticultural Practice – 1994
Challenger TAFE, Murdoch campus, WA.

5.6 Additional Certifications

5.7 ISA Certified Arborist Municipal Specialist (AU-0020AM) - 2012
International Society of Arboriculture
www.isa-arbor.com/certification/benefits/credentialsExplained.aspx

5.8 ISA Tree Risk Assessment Qualification (TRAQ) - 2013
International Society of Arboriculture
http://www.isa-arbor.com/certification/becomequalified/becomequalified.aspx

5.9 Limitation of Liability

5.10 Bowden Tree Consultancy are tree specialists who use their qualifications, education, knowledge, training, diagnostic tools and experience to examine trees, recommend measures to enhance the beauty and health of trees, and attempt to reduce the risk of living near trees. Clients may choose to accept or disregard the recommendations of this assessment and report.

5.11 Bowden Tree Consultancy cannot detect every condition that could possibly lead to the structural failure of a tree. Trees are living organisms that fail in ways that the arboriculture industry does not fully understand. Conditions are often hidden within trees and below ground. Unless otherwise stated, observations have been visually assessed from ground level. Bowden Tree Consultancy cannot guarantee that a tree will be healthy or a low risk of harm under all circumstances, or for a specified period of time. Likewise, remedial treatments cannot be guaranteed.

5.12 Treatment, pruning and removal of trees may involve considerations beyond the scope of Bowden Tree Consultancy's service, such as property boundaries and ownership, disputes between neighbours, sight lines, landlord-tenant matters and other related incidents. Bowden Tree Consultancy cannot take such issues into account unless complete and

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accurate information is given prior or at the time of the site inspection. Likewise Bowden Tree Consultancy cannot accept responsibility for the authorisation or non-authorisation of any recommended treatment or remedial measures undertaken.

5.13 In the event that Bowden Tree Consultancy recommends retesting or inspection of trees at stated intervals, or installs any cable/s, bracing systems and support systems, Bowden Tree Consultancy must inspect the system installed at intervals of not greater than 12 months, unless otherwise specified in written reports. It is the client's responsibility to make arrangements with Bowden Tree Consultancy to conduct the re-inspection.

5.14 Trees can be managed, but they cannot be controlled. To live or work near a tree involves a degree of risk. All written reports must be read in their entirety; at no time shall part of the written assessment be referred to unless taken in full context with the whole written report. If this written report is to be used in a court of law, or any other legal situation, Bowden Tree Consultancy must be advised in writing prior to the written assessment being presented in any form to any other party.

5.15 Business Details

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