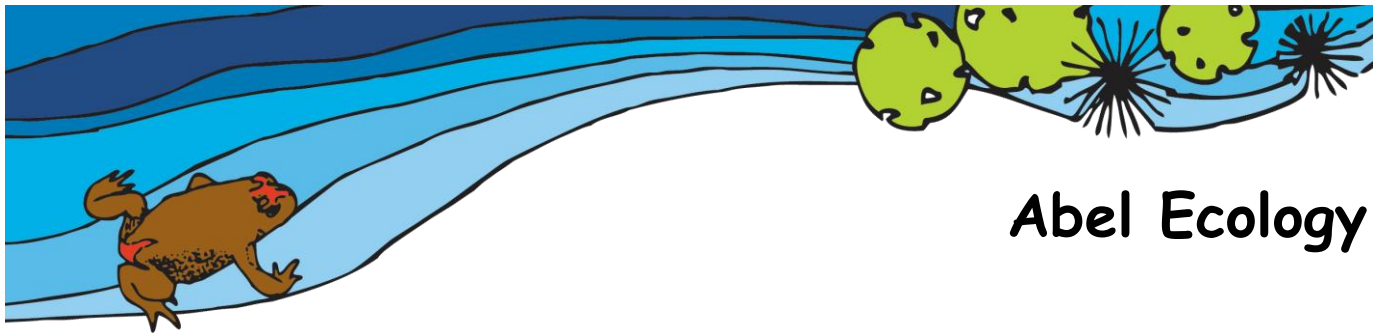




Abel Ecology

Tree assessment report

for

Stage 3 works - South Course Bonnie Doon Golf Club

Date: 23 July 2014

Document No: 1308-REP-102-ISS-2

Prepared for: Bonnie Doon Golf Club

Prepared by: Abel Ecology



Disclaimer

No tree is entirely without hazard potential. No responsibility is accepted for any damage or injury that may be caused by any trees on the site. All measures outlined should minimise damage inflicted on the trees if carefully implemented

Document history

Report	Version	Prepared by	Checked by	Submission	
				Method	Date
Draft report	Draft A	Dr Daniel McDonald Mark Sherring	Jane Gentles Dr Danny Wotherspoon	Email	16 Jul 14
Final	Issue 1	Dr Daniel McDonald	Jane Gentles	Email	22 Jul 14
Final	Issue 2	Dr Daniel McDonald	Jane Gentles	Email	23 Jul 14



Table of Contents

Executive Summary	7
1. Introduction	8
2. Site description	8
3. Methodology	8
4. Survey Results	8
4.1 Condition and vitality of trees on site	8
4.2 Tree Schedule	10
5. Anticipated impact of the development to trees on site.....	32
5.1 Items to address in project design and construction	32
5.2 Irrigation	32
6. Recommendations	32
7. References	32
Appendix 1. Tree assessment terminology and rationale	34
Appendix 2. Tree protection guidelines	35
Appendix 3. Tree protection zone and structural root zone	37
Appendix 4. Encroachment into tree protection zone	38
Appendix 5. Company Profile	39

Table of Figures

Figure 1. Locality map for Bonnie Doon Golf Course	4
Figure 2. Proposal diagrams with numbered trees	6

List of Abbreviations

d.b.h.	Diameter at breast height (~1.4 metres)
VTA	Visual Tree Assessment
TPZ	Tree Protection Zone

Note regarding maps in this report

The diagrams/site maps used in this report have been supplied by and are used with the permission of Ogilvy Clayton Cocking Mead.

With regard to maps provided by the Land Information Centre, Topographic maps used with the permission of © Land and Property Information, NSW www.lpi.gov.au

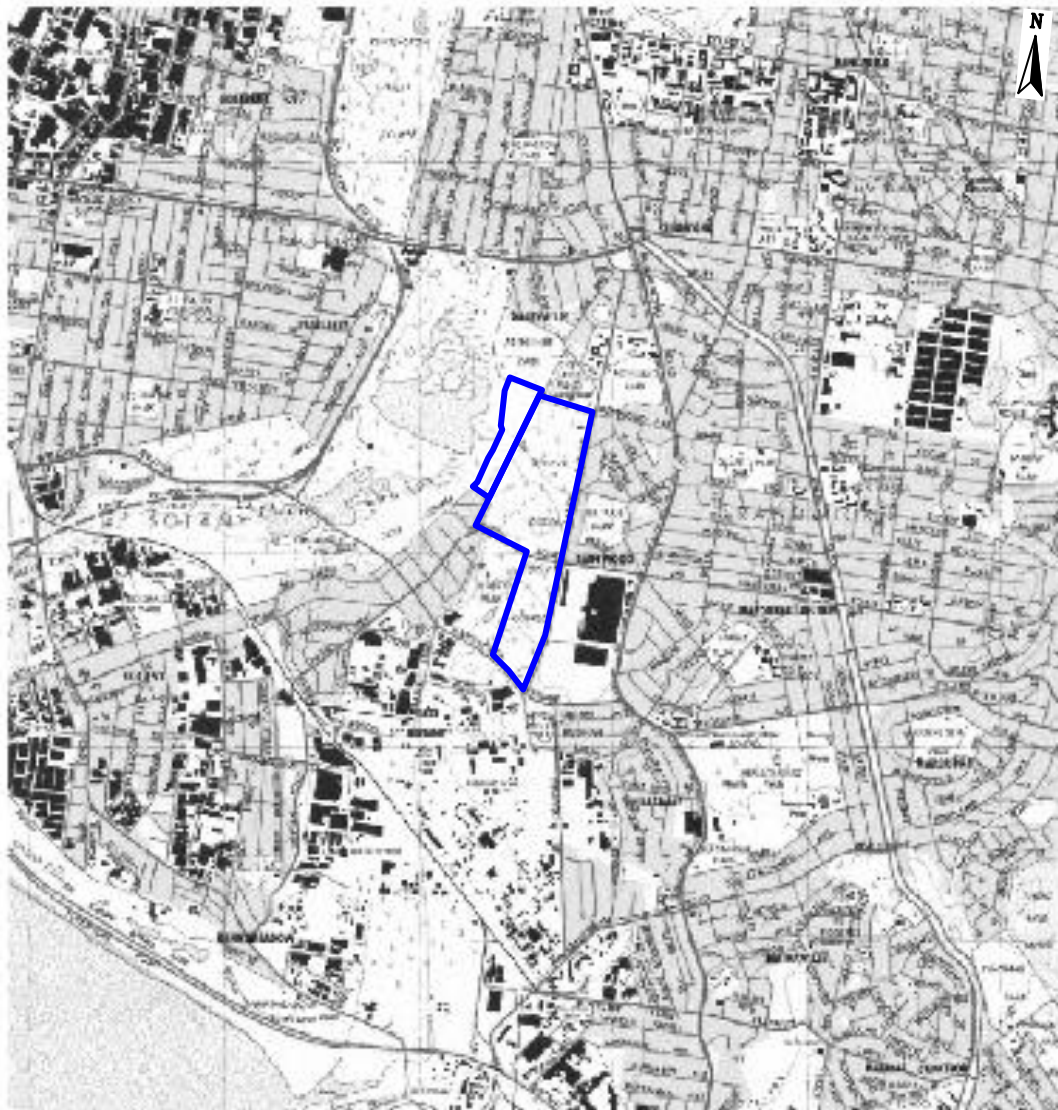


Figure 1. Locality map for Bonnie Doon Golf Course

 Site Locality

Scale: grid spacing = 1 km

Topographic maps used with permission; © Land and Property Information NSW (Combining the Land Information Centre, Land Titles Office and Valuer General's Office). Botany Bay 9130-3S, Third edition





Figure 2. Proposal diagrams with numbered trees



Executive Summary

The proposal is to upgrade the southern Course of Bonnie Doon Golf Course as Stage 3.

A tree assessment was carried out at the site for Course redesign, and address the issues pertaining to tree removal or protection.

Most of the trees assessed were mature plantings including Pine, Eucalyptus, Casuarina and Corymbia. Several small trees / large shrubs were also included where they were part of a planted area.

Recommendations for this proposal include:

- a) Protective fencing is to be placed at a minimum of the TPZ radius distance around trees that are to be retained.
- b) All site activity must be excluded from tree protection zones during demolition and construction phases (see 'Tree protection guidelines' in Appendix 2).
- c) All irrigation trenches must be routed outside the TPZs of retained trees. Any underground boring within this zone must be supervised by an arborist.
- d) Advice must be sought from a suitably skilled and experienced project arborist wherever roots over 40 mm diameter are encountered during excavation. The tearing of roots must be avoided and root pruning undertaken as directed by the nominated arborist.
- e) Remove all Pine trees (*Pinus* spp.) where they are not essential to the site. This will include, for example, trees 23, 24, 25, and 72, 73, 75, 76, 77, 78.



1. Introduction

A survey of the proposed Stage 3 development area at Bonnie Doon Golf Course, Pagewood, 'the site', was undertaken on 7th, 8th and 10th of July 2014.

The aim of this survey was to assess the trees on the site and prepare a report that addresses issues pertaining to the proposal.

This report provides a description of individual trees and shrubs, and assesses the anticipated impact of the development on these.

2. Site description

Bonnie Doon Golf Course is located approximately 9 km south of the Sydney CBD in the suburb of Pagewood (Figure 1). The course and associated amenities occupy an area of approximately 47 ha, of which is approximately 2.5 ha ESBS, comprising remnant areas and individual plants. The site is surrounded by developed land and is bordered by roads and a park. Landscaping has resulted in changes to the micro-topography of the site particularly around greens and tees. No permanent water bodies occur on the site. Bore water is used for irrigation purposes. Bonnie Doon Golf Club has been located at the current site since 1947.

3. Methodology

Tree assessments were undertaken on 7th, 8th and 10th July 2014.

The vitality and condition of trees were assessed from ground level using the VTA (Visual Tree Assessment) method (Mattheck and Breloer 1999). Tree heights were determined by visual estimation.

Numbers identifying the trees are indicated in the following table and displayed on Figure 2.

4. Survey Results

4.1 Condition and vitality of trees on site

The vitality and condition of trees is variable (Table 1). The majority of the trees are in good or better condition.



During calm, non-windy weather, the majority of the trees represent a low risk, as while many have structural imperfections, they are not close to any stationary target. A stationary target is defined as a building or other valuable asset.

The vitality and condition of most trees is generally good. Trees of low vitality and/or poor structural integrity that have a limited safe useful life include the following:

No hollow-bearing trees were observed on the site.

Of the native species planted, most are not part of ESBS, with the exception of *Angophora costata* and *Corymbia gummifera*. No remnants trees will be removed.



4.2 Tree Schedule

Table 1: Tree schedule.

Tree no.	Species	Age class	Height (m)	d.b.h. (cm)	Diam. at base (cm)	Canopy Radius	Vitality	Condition	TPZ radius (m)	SRZ radius (m)	Comments
T1	Smooth-barked Apple <i>Angophora costata</i>	M	10	35	46	N 4 S 3 E 2 W 5	G	G	4.20	2.39	Double trunk @ 3m. Remove.
T2	Coast Banksia <i>Banksia integrifolia</i>	M	5	9,5	18	N 2 S 2 E 3 W 2	G	G	2.0	1.61	Remove.
T3	Old-Man Banksia <i>Banksia serrata</i>	M	5	6	12	N 1 S 1 E 1 W 1	G	G	2.0	1.5	Remove.
T4	Smooth-barked Apple <i>Angophora costata</i>	M	10	25,28, 22	46,28	N 2 S 6 E 6 W 6	G	G	5.28	2.55	Two trunks at ground TI. Remove.
T5	Old-Man Banksia <i>Banksia serrata</i>	M	5	9,6	13,10	N 2 S 1 E 1 W 2	G	G	2.0	1.53	Remove.
T6	Swamp Oak <i>Casuarina glauca</i>	M	8	21	27	N 2 S 2 E 2 W 2	G	G	2.52	1.91	Remove.



Tree no.	Species	Age class	Height (m)	d.b.h. (cm)	Diam. at base (cm)	Canopy Radius	Vitality	Condition	TPZ radius (m)	SRZ radius (m)	Comments
T7	Swamp Oak <i>Casuarina glauca</i>	M	8	18	21	N 4 S 2 E 4 W 3	G	G	2.16	1.72	Remove.
T8	Swamp Oak <i>Casuarina glauca</i>	M	8	27	43	N 3 S 3 E 2 W 3	G	G	3.24	2.32	Remove.
T9	Swamp Oak <i>Casuarina glauca</i>	M	6	8	16	N 2 S 2 E 2 W 2	G	G	2.0	1.53	Remove.
T10	Swamp Oak <i>Casuarina glauca</i>	M	8	22	35	N 3 S 4 E 3 W 3	G	G	2.64	2.13	Remove.
T11	Swamp Oak <i>Casuarina glauca</i>	M	8	11	20	N 3 S 3 E 3 W 3	G	G	2.0	1.68	Remove.
T12	Swamp Mahogany <i>Eucalyptus robusta</i>	M	8	29	40	N 5 S 3 E 5 W 5	G	G	3.48	2.25	Double trunk @ 3m. Remove.
T13	Swamp Mahogany <i>Eucalyptus robusta</i>	M	8	22,25, 17,34	62	N 5 S 4 E 5 W 4	G	G	6.12	2.71	Double trunk @ 1m. Remove.



Tree no.	Species	Age class	Height (m)	d.b.h. (cm)	Diam. at base (cm)	Canopy Radius	Vitality	Condition	TPZ radius (m)	SRZ radius (m)	Comments
T14	Smooth-barked Apple <i>Angophora costata</i>	M	8	27,19	42	N 4 S 3 E 5 W 5	G	G	3.96	2.3	Double trunk @ 1m. Remove.
T15	Corymbia sp. (West Australian species)	M	8	19,26 24	48,28	N 5 S 4 E 5 W 6	G	G	4.8	2.59	Two base trunks Central limb failure. Remove.
T16	Swamp Mahogany <i>Eucalyptus robusta</i>	M	8	27,18, 19	41	N 6 S 5 E 5 W 6	G	G	4.56	2.28	Triple trunk @ 1m. Remove.
T17	Swamp Mahogany <i>Eucalyptus robusta</i>	M	8	28,36	60	N 9 S 3 E 9 W 5	G	G	5.52	2.67	TL CB. Remove.
T18	Swamp Mahogany <i>Eucalyptus robusta</i>	M	10	39,28	63	N 4 S 10 E 6 W 5	G	G	5.76	2.73	Double trunk 1.5m. Remove.
T19	Swamp Mahogany <i>Eucalyptus robusta</i>	M	8	40	56	N 9 S 6 E 3 W 6	G	G	4.80	2.59	Double trunk @ 2m. Remove.
T20	Swamp Mahogany <i>Eucalyptus robusta</i>	M	8	27,31	52	N 9 S 8 E 10 W 6	G	G	4.92	2.51	CB TL. Remove.



Tree no.	Species	Age class	Height (m)	d.b.h. (cm)	Diam. at base (cm)	Canopy Radius	Vitality	Condition	TPZ radius (m)	SRZ radius (m)	Comments
T21	Ribbon Gum <i>Eucalyptus viminalis</i> subsp. <i>cygnetensis</i>	M	14	67	116	N 10 S 10 E W	G	G	8.04	3.52	DW. Remove.
T22	Ribbon Gum <i>Eucalyptus viminalis</i> subsp. <i>cygnetensis</i>	M	14	49,33, 43	135	N 7 S 9 E 6 W 9			8.76	3.75	Triple trunk @ 1m. Remove.
T23	Radiata Pine <i>Pinus radiata</i>	M	8	36,60	74	N 6 S 4 E 6 W 6	F	P	8.4	2.92	DW. Remove.
T24	Radiata Pine <i>Pinus radiata</i>	M	8	52	73	N 4 S 4 E 4 W 4	F	P	6.24	2.90	DW dw tip dieback. Remove.
T25	Radiata Pine <i>Pinus radiata</i>	M	6	50	56	N 3 S 5 E 5 W 4	F	P	6.0	2.59	DW dw tip dieback. Remove.
T26	Ribbon Gum <i>Eucalyptus viminalis</i> subsp. <i>cygnetensis</i>	M	12	60	87	N 4 S 6 E 5 W 5	F	P	7.2	3.12	Bracket fungus to N Exposed roots, missing bark. Remove.
T27	Ribbon Gum <i>Eucalyptus viminalis</i> subsp. <i>cygnetensis</i>	M	14	86	146	N 7 S 7 E 7 W 7	G	G-F	10.32	3.88	Bark splitting from wet conditions Exposed roots, missing bark mown roots. Remove.



Tree no.	Species	Age class	Height (m)	d.b.h. (cm)	Diam. at base (cm)	Canopy Radius	Vitality	Condition	TPZ radius (m)	SRZ radius (m)	Comments
T28	Smooth-barked Apple <i>Angophora costata</i>	J	4	6,10, 12	35	N 1.5 S 1.5 E 1.5 W 1.5	G	G	2.04	2.13	Healthy tree Small vertical split in N trunk at 40cm. Remove.
T29	Smooth-barked Apple <i>Angophora costata</i>	J	4.5	16	21	N 1.5 S 1.5 E 1 W 2	G	G	2.0	1.72	Remove.
T30	Old-Man Banksia <i>Banksia serrata</i>	M	6	10	20	N 1.5 S 1.5 E 2 W 1.5	G	G	2.0	1.68	Planted 2 stems. Remove.
T31	Coast Tea-Tree <i>Leptospermum laevigatum</i>	M	5.5	10 stems 5-12	45	N 3 S 3 E 1 W 3	G	G		2.37	Multi stemmed Spreading, beside another L. laevigatum T32 Planted. Remove.
T32	Coast Tea-Tree <i>Leptospermum laevigatum</i>	M	5.5	11 stems 4-20	45	N S E W	G	G		2.37	As for T31 Planted. Remove.
T33	Old-Man Banksia <i>Banksia serrata</i>	M	5	15,12, 10,10	~40	N 2 S 2 E 2 W 2	G	G	2.88	2.25	Planted. Remove.
T34	Old-Man Banksia <i>Banksia serrata</i>	M	6	25	35	N 2 S 1 E 1 W 1	G	G	3.0	2.13	Planting. Remove.



Tree no.	Species	Age class	Height (m)	d.b.h. (cm)	Diam. at base (cm)	Canopy Radius	Vitality	Condition	TPZ radius (m)	SRZ radius (m)	Comments
T35	Coast Tea-Tree <i>Leptospermum laevigatum</i>	M	3.5	~ 17 Stems 5-12	55	N 2 S 2.5 E 4 W 3	G	G		2.57	Planted About 17 stems. Remove.
T36	Coast Tea-Tree <i>Leptospermum laevigatum</i>	M	1.2	~ 7 Stems 5-12	~55	N 2 S 0.5 E 2 W 2	G	F		2.57	Planted About 7 stems. Remove.
T37	Tree Broom-Heath <i>Monotoca elliptica</i>	M	3	~ 8 Stems 15-5	30	N 2 S 1.5 E 0.5 W 2	G	F		2.0	Remnant About 8 main branches. Remove.
T38	Tick Bush <i>Kunzea ambigua</i>	M	3.5	~ 10 Stems	~30	N 2 S 2 E 2 W 2	G	G		2.0	Remove.
T39	Old-Man Banksia <i>Banksia serrata</i>	SM	5	3,4,5	18	N 0.5 S 1 E 0.5 W 0.5	G	G	2.0	1.61	Remove.
T40	Smooth-barked Apple <i>Angophora costata</i>	J	5	11,10	30	N 2 S 2 E 2 W 2	G	G	2.0	2.0	Split in trunk at about 1m. Remove.
T41	Old-Man Banksia <i>Banksia serrata</i>	SM	5	~ 6 Stems 5-10	40	N 1 S 1.5 E 1 W 1.5	G	G		2.25	Planted. Remove.



Tree no.	Species	Age class	Height (m)	d.b.h. (cm)	Diam. at base (cm)	Canopy Radius	Vitality	Condition	TPZ radius (m)	SRZ radius (m)	Comments
T42	Smooth-barked Apple <i>Angophora costata</i>	J	5	11	13	N 1 S 1 E 1 W 1	G	G	2.0	1.5	Planted. Remove.
T43	Old-Man Banksia <i>Banksia serrata</i>	SM	5	5,4,11, 20	30	N 1 S 1.5 E 1 W 2	G	G	2.88	2.0	Planted. Remove.
T44	<i>Acacia sophorae</i>	SM	2.5	7 stems	30	N 2 S 1.5 E 1 W 1.5	G	G		2.0	Remove.
T45	Old-Man Banksia <i>Banksia serrata</i>	M	5	~ 6 Stems 9 -15	50	N 1.5 S 1.5 E 2 W 1.5	G	G		2.47	Planted. Remove.
T46	Scrub She-Oak <i>Allocasuarina distyla</i>	M	2	Multi stemmed	15	N 0.5 S 0.5 E 0 W	G	G		1.5	Shrub. Remove.
T47	Prickly-leaved Paperbark <i>Melaleuca nodosa</i>	M	2	2 stems 8,8	15	N 1 S 0.5 E W	G	G		1.5	Planted. Remove.
T48	Tree Broom-Heath <i>Monotoca elliptica</i>	M	1.8	10	16	N 0.5 S 0.5 E 0.5 W 0.5	F	F	2.0	1.53	Senescent Remnant. Remove.



Tree no.	Species	Age class	Height (m)	d.b.h. (cm)	Diam. at base (cm)	Canopy Radius	Vitality	Condition	TPZ radius (m)	SRZ radius (m)	Comments
T49	<i>Acacia sophorae</i> X2	M	2	3 stems	10,8	N 2 S 1 E 0.6 W 2	G	G		1.5	2 plants. Remove.
T50	<i>Acacia sophorae</i>	M	1.8	8,6	12	N 1.2 S 2.2 E 1 W 2	G	G	2.0	1.5	Healthy, no gall. Remove.
T51	Coast Tea-Tree <i>Leptospermum laevigatum</i>	M	2.5	~ 10 Stems	50	N 1.5 S 1.5 E 1.5 W 1.5	G	G		2.47	Dense shrub. Remove.
T51a	<i>Kunzea ambigua</i>	M	2	5,3	12	N 0.5 S 1.5 E 1 W 0.5	G	G	2.0	1.5	Remove.
T51b	<i>Acacia sophorae</i>	M	2	5,5	30	N 3 S 0.5 E 1.5 W 0.5	G	G	2.0	2.0	Remove.
T52	Coast Banksia <i>Banksia integrifolia</i>	M	5	12	25	N 1.5 S 1.5 E 1.2 W 2	G	G	2.0	1.85	Planted. Remove.
T52a	Coast Tea-Tree <i>Leptospermum laevigatum</i> X2	M	2.5	Multi	50	N 2 S 2 E 2 W 2 Each	G	G		2.47	Remove.



Tree no.	Species	Age class	Height (m)	d.b.h. (cm)	Diam. at base (cm)	Canopy Radius	Vitality	Condition	TPZ radius (m)	SRZ radius (m)	Comments
T53	Scrub She-Oak <i>Allocasuarina distyla</i> Photo		2.5	~ 3 Stems 5-9cm	30	N S E W				2.0	Remove.
T54	<i>Monotoca elliptica</i>	M	1.5	15 @ 50cm	15	N 1 S 0.8 E 0 W 1 Each	G	P		1.5	Senescent. Remove.
T55	Coast Banksia <i>Banksia integrifolia</i>	M	6.5	12,10	35	N 1.5 S 1.5 E 1.5 W 1	G	G	2.0	2.13	Healthy. Remove.
T55a	Tick Bush <i>Kunzea ambigua</i>	M	3.2	Multi	35	N S E W	G	G		2.13	Shrub (Not tagged), adjacent to T55. Remove.
T55b	<i>Acacia sophorae</i>	M	3.2	~ 7 Stems 3-4cm	9	N S E W	G	G		1.5	Shrub (Not tagged), adjacent to T55. Remove.
T56	<i>Acacia sophorae</i> 5 stems	M	2- 2.2	6,5,9,6,6	30- 40cm	N S E W	G	G			Healthy. Remove.
T56a	Scrub She-Oak <i>Allocasuarina distyla</i>	M	3	~ 10 Stems 1-8cm	40	N 1.5 S 1.5 E 1.5 W 1.5	G	G		2.25	(Not tagged), shrub. Remove.



Tree no.	Species	Age class	Height (m)	d.b.h. (cm)	Diam. at base (cm)	Canopy Radius	Vitality	Condition	TPZ radius (m)	SRZ radius (m)	Comments
T57	Black She-Oak <i>Allocasuarina littoralis</i>	M	9	16,16,20	65	N 2 S 2 E 3 W 4	G	G	3.6	2.76	Healthy. Remove.
T58	Hard leaved Scribbly Gum <i>Eucalyptus Sclerophylla</i>	SM	8	17,12,8,6,5	40	N 3 S 2.5 E 2.5 W 2	G	G	2.88	2.25	Splits in trunk to 1.5m One side branch from base. Remove.
T59	Old-Man Banksia <i>Banksia serrata</i>	M	6	12,12,8	35	N 1 S 1.5 E 1 W 1	G	G	2.28	2.13	Healthy. Remove.
T60	Coast Tea-Tree <i>Leptospermum laevigatum</i>	M	3.5	6 stems 13,10,12	35	N S E W	G	G		2.13	Above/ behind sand pit. With Acacia sophorae in front of it (N side). Remove.
T61	<i>Acacia sophorae</i>	M	2	18	25	N 2 S 2 E 2 W 2	G	G	2.16	1.85	Healthy Edge of sand pit. Probably ESBS remnant. Remove.
T62	<i>Acacia sophorae</i>	M	3			N S E W	G	G			Borers in lower trunk. Healthy foliage. Remove.
T63	<i>Acacia sophorae</i>	M	3.5	9,10	20	N 2.5 S 2 E 2.5 W 2	G	G	2.0	1.68	Remove.



Tree no.	Species	Age class	Height (m)	d.b.h. (cm)	Diam. at base (cm)	Canopy Radius	Vitality	Condition	TPZ radius (m)	SRZ radius (m)	Comments
T64	<i>Eucalyptus</i> sp.	M	13	37,34,33, 35	135	N 8 S 5 E 6 W 7	G	G	8.4	3.75	Healthy. Remove.
T65	<i>Eucalyptus</i> sp.	M	14	43,8	55	N 4.5 S 2 E 5 W 3	G	G	5.28	2.57	Healthy. Remove.
T66	<i>Acacia sophorae</i>	M	3.2	5 stems	30	N 2.5 S 1 E 2 W 1	G	F		2.0	Remove.
T67	<i>Acacia sophorae</i>	S	3.5	3 stems	35	N 2.5 S 1 E 1 W 1.5	F	P		2.13	Senescent – N Branch alive only (declining). Remove.
T68	<i>Acacia sophorae</i>	S	3.5	15,11,11,4	35	N 3 S 2.5 E 4 W 2.5	F	P	2.64	2.13	Senescent, spreading Next to (south of) T67. Remove.
T69	Smooth-barked Apple <i>Angophora costata</i>	J	7	18	30	N 2 S 2 E 2 W 1.5	G	G	2.16	2.0	Healthy S of T68, planted. Remove.
T70	<i>Acacia sophorae</i>	M	3.5	5 stems One broken 15,15,20, 10	~80	N 6 S 3 E 5 W 3	G	F	3.72	3.01	Healthy foliage, some decumbent, dead branches. Remove.



Tree no.	Species	Age class	Height (m)	d.b.h. (cm)	Diam. at base (cm)	Canopy Radius	Vitality	Condition	TPZ radius (m)	SRZ radius (m)	Comments
T71	<i>Acacia sophorae</i>	M	3.5	18,16	35	N 1 S 2 E 2 W 0.8	G	G	2.88	2.13	Healthy (No gall) Decumbent. Remove.
T72	Radiata Pine <i>Pinus radiata</i>	M	11	Trunk branching at 1.2m (7 stems)	58,71	N 4 S 3.5 E 6 W 5.5	G	F		3.2	Minor dead branches. Remove.
T73	Radiata Pine <i>Pinus radiata</i>	M	13	65	72	N 4 S 2.5 E 5 W 5	G	F	7.8	2.88	Minor dead branches. Remove.
T74	<i>Eucalyptus</i> sp Stringybark - <i>E. capitellata</i> ?	M	5.5	29,33,27	67	N 3.5 S 2.2 E 2.2 W 3.5	G	G	6.12	2.8	Branching at 0.5m, 3 trunks, leaning N. Remove.
T75	<i>Pinus pinaster</i> ?	M	18	63	76	N 5 S 6 E 5 W 8	G	F	7.56	2.95	Minor/medium deadwood. Remove. Remove.
T76	<i>Pinus pinaster</i> ?	M	18	78	93	N 4 S 6 E 4 W 10	G	F	9.36	3.21	Minor/medium deadwood. Remove.
T77	<i>Pinus pinaster</i> ?	M	18	58	71	N 6 S 0.5 E 0.3 W 8	G	F	6.96	2.87	Minor/medium deadwood. Remove.



Tree no.	Species	Age class	Height (m)	d.b.h. (cm)	Diam. at base (cm)	Canopy Radius	Vitality	Condition	TPZ radius (m)	SRZ radius (m)	Comments
T78	<i>Pinus pinaster?</i>	M	18	73	94	N 4.5 S 8 E 7 W 4	G	F	8.76	3.22	Minor/medium deadwood. Remove.
T79	Swamp Mahogany <i>Eucalyptus robusta</i>	M	6.5	26,29,27, 24	47	N 4 S 6.5 E 5 W 5.5	G	G-F	2.53	2.41	Healthy, Leaning to W Overshadowed by T80 from N side. Remove.
T80	Radiata Pine <i>Pinus radiata</i>	M	15	120	162	N 8 S 6 E 6 W 7	G	G	15.0	4.05	Leaning NW. Remove.
T81	<i>Eucalyptus</i> sp. (?E. botyroides)	M	18	58	103	N 6 S 6 E 6 W 6	G-E	G-E	6.96	3.35	Healthy, good form. Remove.
T82	Tallowwood <i>Eucalyptus microcorys</i>	SM	14.5	46	92	N 6 S 5 E 4.5 W 3	E	E	5.52	3.2	Spreading form. Remove.
T83	Grey gum <i>Eucalyptus punctata</i>	SM	15	55	114	N 5 S 5 E 6 W 6	E	E	6.6	3.5	Spreading form. Remove.
T84	Black She-Oak <i>Allocasuarina littoralis</i>	SM	10	23	52	N 0.5 S 3 E 3 W 3.5	E	F	2.76	2.51	Canopy bias to South away from T85 on its N side (E. robusta). Roots damaged (mown). Remove.



Tree no.	Species	Age class	Height (m)	d.b.h. (cm)	Diam. at base (cm)	Canopy Radius	Vitality	Condition	TPZ radius (m)	SRZ radius (m)	Comments
T85	Swamp Mahogany <i>Eucalyptus robusta</i>	SM	10	40	97	N 4 S 2.5 E 4 W 4	E	G	4.8	3.27	Lower branches inhibited by T84. Remove.
T86	Radiata Pine <i>Pinus radiata</i>	M	12	120	165	N 5 S 7 E 6 W 7	E	F	14.4	4.08	Healthy Trunk fork at 1.2m Root damage (mown). Remove.
T87	Radiata Pine <i>Pinus radiata</i>	M	15	95	135	N 8 S 5 E 6 W 7	F	P	11.4	3.75	Several large dead branches on N & W sides. Root damage Remove.
T88	Broad-leaved Paperbark <i>Melaleuca quinquenervia</i>	SM	7.5	28	40	N 1.5 S 1.3 E 1.5 W 1.2	E	G	3.36	2.25	Solitary. Near S end of large ESBS remnant. Remove.
T89	Broad-leaved Paperbark <i>Melaleuca quinquenervia</i>	SM	8	36	57	N 2 S 1.5 E 1 W 1.5	E	G	4.32	2.61	Root damage (mown) Remove.
T90	Old-Man Banksia <i>Banksia serrata</i>	M	7	30	55	N 1.5 S 2 E 1 W 1	E	E	3.6	2.57	Next to T91 (melaleuca). Fruit. Remove.
T91	Broad-leaved Paperbark <i>Melaleuca quinquenervia</i>	SM	8	35	50	N 2 S 1.5 E 2 W 1.3	E	G	4.2	2.47	Remove.



Tree no.	Species	Age class	Height (m)	d.b.h. (cm)	Diam. at base (cm)	Canopy Radius	Vitality	Condition	TPZ radius (m)	SRZ radius (m)	Comments
T92	Broad-leaved Paperbark <i>Melaleuca quinquenervia</i>	SM	8.5	37	55	N 2.2 S 2 E 2 W 1.5	E	G	4.44	2.57	Remove.
T93	Broad-leaved Paperbark <i>Melaleuca quinquenervia</i>	SM	8	28	40	N 1.5 S 1.5 E 1 W 0.5	F	F	3.36	2.25	Root damage (mown) Foliage loss. Remove.
T94	Brush Box <i>Lophostemon confertus</i>	SM	7	45	60	N S E 2.5 W	E	E	5.4	2.67	W side of T93. Remove.
T95	Smooth-barked Apple <i>Angophora costata</i>	J	6.5	18,16	35	N 2 S 2 E 2 W 2	E	E	2.88	2.13	Fork at 20cm. Remove.
T96	Smooth-barked Apple <i>Angophora costata</i>	J	6.5	18,8	30	N 1.2 S 2 E 2.2 W 2	E	E	2.4	2.0	Fork at ground. Remove.
T97	Smooth-barked Apple <i>Angophora costata</i>	J	6.5	15,18	40	N 1.5 S 2.5 E 1.5 W 2	E	E	2.76	2.25	Remove.
T98	Smooth-barked Apple <i>Angophora costata</i>	J	4	12,10	18	N 1 S 1 E 1 W 1	E	E	2.0	1.61	Remove.



Tree no.	Species	Age class	Height (m)	d.b.h. (cm)	Diam. at base (cm)	Canopy Radius	Vitality	Condition	TPZ radius (m)	SRZ radius (m)	Comments
T99	Red bloodwood <i>Corymbia gummifera</i>	J	4.5	8,6,7	25	N 2 S 1.5 E 1 W 1	E	G	2.0	1.85	Forked trunk at 40cm. Remove.
T100	Smooth-barked Apple <i>Angophora costata</i>	J	8	15,16,18	40	N 3 S 2 E 3 W 2.5	E	G	3.36	2.25	Forks at 60cm and 101cm. Remove.
T101	Smooth-barked Apple <i>Angophora costata</i>	J	8	18,18,8	40	N 3 S 2.5 E 1.5 W 2	E	G	3.24	2.25	Forks at 60cm. Remove.
T102	Smooth-barked Apple <i>Angophora costata</i>	J	5	12	20	N 1.5 S E W	E	G	2.0	1.68	Few branches on S, W. Remove.
T103	Coast Banksia <i>Banksia integrifolia</i>	M	6.5	15,10,12,7	35	N 1 S 2 E 1.5 W 2	E	G	2.76	2.13	Fruiting Beside sand. Remove.
T103a	Coast Banksia <i>Banksia integrifolia</i>	M	6	8	15	N 1 S 0 E 0.3 W 1	E	F	2.0	1.5	1.5 m E of T103. Remove.
T104	Smooth-barked Apple <i>Angophora costata</i>	SM	8	17,18	45	N 2.5 S 1 E 2 W 2	E	E	3.0	2.37	Fork at 30cm. Remove.



Tree no.	Species	Age class	Height (m)	d.b.h. (cm)	Diam. at base (cm)	Canopy Radius	Vitality	Condition	TPZ radius (m)	SRZ radius (m)	Comments
T105	<i>Acacia sophorae</i>	M	2.5	11,16 @ 0.5m Above ground		N 3 S 1 E 0 W 5	G	F			Borer in trunk Decumbent, trunk rooting along ground for about 1m to W. Remove.
T106	Smooth-barked Apple <i>Angophora costata</i>	SM	11	30	60	N 4 S 2 E 3 W 2	E	G	3.6	2.67	Remove.
T107	Spotted Gum <i>Corymbia maculata</i>	SM	16	43	60	N 5 S 4 E 5 W 5	E	G	5.16	2.67	Good form. Remove.
T108	Smooth-barked Apple <i>Angophora costata</i>	J	17	9,15,18, 11	42	N 2.5 S 1 E 2 W 2.5	E	G	3.24	2.3	Multi-stemmed from near at ground – 4 stems Planted. Remove.
T109	Old-Man Banksia <i>Banksia serrata</i>	M	4	~ 8 Stems <10 cm	30	N 2 S 1.5 E 2 W 0.5	E	G		2.0	Remove.
T110	Smooth-barked Apple <i>Angophora costata</i>	SM	7.5	6 stems 20,20,12, 10,10,10	40	N 2.2 S 3 E 2.5 W 2	G	G	4.2	2.25	W side of planted area. Remove.
T111	Smooth-barked Apple <i>Angophora costata</i>	SM	7.5	18	22	N 2 S 2 E 2 W 1	G	G	2.16	1.75	Centre of planted area. Remove.



Tree no.	Species	Age class	Height (m)	d.b.h. (cm)	Diam. at base (cm)	Canopy Radius	Vitality	Condition	TPZ radius (m)	SRZ radius (m)	Comments
T112a	2 x Old-Man Banksia <i>Banksia serrata</i>	M	4	5 stems 12,12,12, 10,10	30	N 1.5 S 2 E 2.8 W 1.5	G	G	3.0	2.0	Remove.
T112b	Old-Man Banksia <i>Banksia serrata</i>	M	4	3 stems	20	N 0.5 S 1.3 E 2 W 1	G	F		1.68	3 stems at 10/20cm Growth suppressed by adjoining trees (banksia and Angophora costata T113). Remove.
T113	Smooth-barked Apple <i>Angophora costata</i>	SM	5	11,11	30	N 0.5 S 1.5 E 1.5 W 2	G	G	2.0	2.0	Fork at base. Remove.
T114	Smooth-barked Apple <i>Angophora costata</i>	SM	9	28,26	40	N 1.3 S 2 E 2 W 2.8	G	G	4.56	2.25	Fork at 40cm. Remove.
T115a	Old-Man Banksia <i>Banksia serrata</i>	M	4	7,8,5	20	N 0.8 S 2 E 0.6 W 1.5	G	G	2.0	1.68	Remove.
T115b	Other Old-Man Banksia <i>Banksia serrata</i>	M	3	9	25	N 1 S 1 E 0.6 W 2	G	F	2.0	1.85	Remove.
T116	Old-Man Banksia <i>Banksia serrata</i>	M	3.2	10,12,12, 5	40	N 0.8 S 2 E 2 W 1	G	G	2.4	2.25	At SE edge of planted area. Remove.



Tree no.	Species	Age class	Height (m)	d.b.h. (cm)	Diam. at base (cm)	Canopy Radius	Vitality	Condition	TPZ radius (m)	SRZ radius (m)	Comments
T117	Hard-leaved Scribbly Gum <i>Eucalyptus sclerophylla</i>	M	13.5	48	60	N 5 S 5 E 4 W 5	E	E-G	5.76	2.67	Fork at 1.2m Minor dieback. Remove.
T118	Swamp Oak <i>Casuarina Glauca</i>	M	11	35	34	N 3 S 3 E 3 W 2	E	G	4.2	2.10	Fork at 90 cm. Remove.
T119	Swamp Oak <i>Casuarina Glauca</i>	M	12	22	28	N 2 S 1.8 E 2 W 3	E	G	2.64	1.94	Fork at 110 cm. Remove.
T120	Swamp Oak <i>Casuarina Glauca</i>	M	6	5 stems 5,8,11,6, 13	22	N 2 S 1.7 E 1.6 W 2	E	G	2.4	1.75	5 stems at 1.1m Remove.
T121	Old-Man Banksia <i>Banksia serrata</i>	M	5.5	6 stems 13,17,13, 8,7,11	35	N 2.5 S 1.8 E 2.5 W 2.2	E	G	3.48	2.13	Solitary, densely branched. Remove.
T122	Old-Man Banksia <i>Banksia serrate</i>	M	5	12,10,8, 8,9,6	35	N 1.8 S 2 E 1.2 W 1.5	E	F	2.64	2.13	Densely branched. Remove.
T123	Swamp Oak <i>Casuarina Glauca</i>	SM	6	6,6	13	N 1.5 S 0.5 E 1.5 W 1	E	G	2.0	1.5	Fork at 0.7m. Remove.



Tree no.	Species	Age class	Height (m)	d.b.h. (cm)	Diam. at base (cm)	Canopy Radius	Vitality	Condition	TPZ radius (m)	SRZ radius (m)	Comments
T124	Swamp Oak <i>Casuarina Glauca</i>	SM	7	23	25	N 1 S 1.5 E 1.3 W 1.5	E	G	2.76	1.85	Remove.
T125	Old-Man Banksia <i>Banksia serrate</i>	M	5	8,11,8,7, 5,4,4,3	40	N S E W	E	G	2.28	2.25	Densely branched. Remove.
T126	Swamp Oak <i>Casuarina Glauca</i>	SM	3	11	15	N 1.5 S E W	E	P	2.0	1.5	Low tree in shrub form (previously damaged and grown outwards). Remove.
T127	<i>Acacia sophorae</i>	M	1.5			N 3.5 S 3.5 E 3 W 3	E	G			Clump 3.5 long (N-S) 3 wide (E-W) Stem at N end. Remove.
T128	<i>Eucalypt Sp.</i> (WA?)	SM	7	17,19,14	40	N S 2.3 E 2 W	E	F	3.48	2.25	Multi-trunked at 30cm and 100cm. Remove.
T129	Swamp Oak <i>Casuarina Glauca</i>	M	8	26	35	N 2 S 2 E 1.5 W 2.2	E	E	3.12	2.13	Good form, Male tree, dense foliage. Remove.
T130	Swamp Oak <i>Casuarina Glauca</i>	M	5	28	33	N 1.5 S 1.3 E 1.5 W 2.2	G-F	G	3.36	2.08	Large witches broom on W side at 1.5-2.5m. Remove.



Tree no.	Species	Age class	Height (m)	d.b.h. (cm)	Diam. at base (cm)	Canopy Radius	Vitality	Condition	TPZ radius (m)	SRZ radius (m)	Comments
T131	Coast Banksia <i>Banksia integrifolia</i>	M	7	20,14,12,8	33	N 3 S 3 E 2.5 W 3	E	E-G	3.36	2.08	Wedge of planted mound. Healthy (no gall). Remove.
T132	Swamp Oak <i>Casuarina Glauca</i>	M	8	21	26	N 1.5 S 1.5 E 2 W 2	E	G	2.52	1.88	Damage to root zone from mowing. Remove.
T133	Coast Banksia <i>Banksia integrifolia</i>	M	9.5	38,17,9	61	N 2.2 S E 3.5 W 1	E	F	5.16	2.69	Pruned on N side. Heavy canopy bias to E&S. Large section of lower trunk missing on N side. Remove.
T134	Coast Banksia <i>Banksia integrifolia</i>	M	6.5	16	25	N 2.2 S 2 E W 1.5	E	F	2.0	1.85	Lean to SW, canopy bias to SW. Next to T133 on its N side. Remove.
T135	Coast Tea-Tree <i>Leptospermum laevigatum</i>	M	2.5	13	26	N S 2 E 2 W 0			2.0	1.88	Lean to E. 4 trunks removed near base. Remove.
T136	Coast Banksia <i>Banksia integrifolia</i>	M	11	33,24	65	N 3 S 1.5 E 3.5 W 3.2	E	G	4.92	2.76	Dense foliage, healthy. Mature tree (large) Fork at 25cm. Pruned on W side. Remove.
T137	Coast Banksia <i>Banksia integrifolia</i>	M	11	47,16,16,11,10,30	70	N 1 S 3 E 3.2 W 3	E	G	7.44	2.85	Dense foliage. Large tree, suppressing foliage of T136. Remove.



Tree no.	Species	Age class	Height (m)	d.b.h. (cm)	Diam. at base (cm)	Canopy Radius	Vitality	Condition	TPZ radius (m)	SRZ radius (m)	Comments
T138	Smooth-barked Apple <i>Angophora costata</i>	SM		29	35	N 2.2 S 3 E 3 W 3	E	G	3.48	2.13	Original stake in tree trunk S side of mound, edge of plantings. Remove.
T142	<i>Casuarina glauca</i>	M	9	15,19	33	N 3 S 3 E 2 W 3	E-G	F	2.88	2.08	Union between two major stems appears poor. Remove.
T143	<i>Acacia saligna</i>	M	7	16,11,7	35	N 2.5 S 3 E 4 W 3	G-F	F	2.52	2.13	Some borers Co-dominant Included to base. Remove.
T144	<i>Acacia saligna</i>	M	7	12,10,10,8	35	N 3 S 3 E 3 W 2.5	G-F	F-P	2.4	2.13	Some borers Included co-dominant. Remove.

KEY

Age Class

J – juvenile
SM - semi-mature
M – mature
OM – over-mature

Vitality and condition

E - excellent
G - good
F - fair
P - poor

Comments

CD - codominant stems
CB - canopy bias
TL - trunk lean
EC - elevated crown
BI - bark inclusion
TW - trunk wound
TC - trunk cavity
ep - epicormic growth
dw - small diameter deadwood
DW - large diameter deadwood

d.b.h. - Trunk diameter at 1.4m



5. Anticipated impact of the development to trees on site

5.1 Items to address in project design and construction

Trees, in proximity to the proposed works are anticipated to sustain some root loss from excavation. The Australian Standard 4970-2009 specifies that an encroachment into the TPZ of 10% of the total area is allowable (see Appendix 4). We recommend that tree protection fencing be installed at minimum of the TPZ radius distance from retained trees (Table 1).

5.2 Irrigation

All excavated trenching is to be routed outside the tree protection zones. Where this is not achievable underboring may be an acceptable method after consultation with an arborist.

The establishment of generous protection areas and maintenance of stringent site controls and active supervision of contractors will be essential in preventing damage during construction. Trenching for irrigation must also accommodate existing roots and provide favourable conditions for normal root function.

6. Recommendations

The following recommendations apply:

- a. Protective fencing is to be placed at a minimum of the TPZ radius distance around trees that are to be retained.
- b. All site activity must be excluded from tree protection zones during demolition and construction phases (see 'Tree protection guidelines' in Appendix 2).
- c. All irrigation trenches must be routed outside the TPZs of retained trees. Any underground boring within this zone must be supervised by an arborist.
- d. Advice must be sought from a suitably skilled and experienced project arborist wherever roots over 40 mm diameter are encountered during excavation. The tearing of roots must be avoided and root pruning undertaken as directed by the nominated arborist.
- e. Remove all Pine trees (*Pinus* spp.) where they are not essential to the site. This will include, for example, trees 23, 24, 25, and 72, 73, 75, 76, 77, 78.

7. References

Ashton, (1975) The root and shoot development of *Eucalyptus regnans* F. Muell. *Australian Journal of Botany* 23: 867-87



- Bannerman, S. M. & Hazelton, P. A. (1990). *Soil Landscapes of the Penrith 1:100 000 Sheet*. Soil Conservation Service of NSW, Sydney.
- Barrell, J. (1995) 'Pre-development Tree Assessment' from *Trees and Building Sites, Proceedings of an International Conference held in the interest of developing a scientific basis for managing trees in proximity to buildings*, the International Society of Arboriculture, Illinois, USA, pp 132-142.
- Benson, D. and McDougall, L. (1998) Ecology of Sydney plant species Part 6: Dicotyledon family Myrtaceae. *Cunninghamia* 5(4): 809-983.
- Chapman, G.A., Murphy, C.L., Tille, P.J., Atkinson, G. and Morse, R.J. (1983). *Sydney Soil landscape series sheet 9130*. Soil Conservation Service of NSW, Sydney.
- Hadlington, P. and Johnston, J. (1988) *Australian Trees – Their Care and Repair*. NSW University Press, Kensington, NSW.
- Mattheck, C. and Breloer H. (1999) *The body Language of Trees - a handbook for failure analysis* 5th Ed., London: The Stationery Office, UK.
- Patch, D. and Holding, B. (2007) *Trees in Focus APN12 Through the trees to development*.
- Perry, T.O. (1982) The ecology of tree roots and the practical significance thereof. *Journal of Arboriculture* 8(8) 197-211.
- Roberts, J., Jackson, N. and Smith, M. (2006) *Tree roots in the built environment*. Norwich: The Stationary Office, UK.
- Shigo, A.L. (1989) *A New Tree Biology*. Shigo and Trees, Associates, Durham, New Hampshire USA.
- Standards Australia (2007) *Pruning of amenity trees (AS 4373 – 2007)*
- Standards Australia (2010) *Protection of trees on development sites (AS 4970-2009 – incorporating Amendment No. 1)*.



Appendix 1. Tree assessment terminology and rationale

Explanation of terminology

d.b.h. - Acronym for trunk diameter at breast height (1.4m from ground level)

Vitality - Indicates the energy reserves of the tree and is determined by the observed crown colour and density, the percentage of dead/dying branches and epicormic growth. The vitality of the canopy and that of the root system is interdependent; root damage or heavy pruning draws on a tree's energy reserves. The tree's ability to initiate internal defence systems (compartmentalisation of damage) is reduced and it can also become predisposed to attack by insects and pathogens.

Epicormic Growth - The production of epicormic growth from dormant buds is a response to stress. Epicormic growth may be initiated by various causes such as branch loss, excessive pruning, fire damage, drought, defoliation and/or disease.

Mycorrhizae/Rhizosphere - Mycorrhizae are fungi that grow in symbiotic association with tree roots (especially the fine root hairs) and are attributed with increasing the uptake of nutrients, particularly phosphorus, and reducing infection from soil borne pathogens. They greatly increase the surface area of a tree's root system. Mycorrhizae require aerobic soil conditions and are reduced in number by compaction, waterlogging and overuse of soil fertilisers. Forest litter or similar mulch provides ideal conditions for the proliferation of Mycorrhizae. Rhizosphere is a term describing the peripheral area of a tree's root system where this symbiotic association most commonly occurs.

Condition - An evaluation of the structural status of the tree including defects that may affect the useful life of an otherwise healthy specimen. Such influencing factors include cavities and decay, weak unions between scaffolds (major branches) or trunks and faults of form or habit.

Tree Hazard Potential - An assessment of the risks associated with retaining a tree in its existing or proposed surroundings. Factors to consider are the growth characteristics of the species, tree vitality, condition and the frequency and type of potential targets. The impact the proposed works can have on tree vitality can only be assumed.



Appendix 2. Tree protection guidelines

A Pre-construction/Demolition phase

The following methods are to be implemented to minimise potential damage to retained trees, e.g. from soil compaction and site activity. Trees are to be protected at all stages of the development, and growing conditions are to be improved within the Tree Protection Zone (TPZ). These guidelines are consistent with AS4970-2009 *Protection of trees on development sites*.

- A 1. All site workers are to be aware of relevant tree protection requirements. Nominated trees will be removed or transplanted as per the tree protection plan. An arborist is to supervise tree removal, pruning and transplanting and certify the completed works.
- A 2. All trees not nominated for retention are to be removed prior to any construction activity. Approved tree pruning and removal operations near retained trees are to be carried out in a way that avoids soil compaction and damage to canopy, trunk or roots. Works are to be supervised by an arborist or the person responsible for site management.
- A 3. Stumps are to be ground, not dozed or dug out, if in the vicinity of retained trees. Machinery (other than stump machines) is to be kept beyond the nominated protection zones of retained trees during all operations.
- A 4. Tree protection fencing is to be in place before the introduction of machinery or other materials to the site and before commencement of works. Fencing is to be located to *at least* the canopy dripline, be of sturdy construction and retained in-situ during works unless altered by the project arborist. All site activities are excluded from this zone. Refer to Appendix 2 for specific minimum setback distances. AS4687 specifies applicable fencing requirements.
- A 5. The TPZ is to be mulched using material compatible with 'AS4454-2003 Composts, soil conditioners and mulches', e.g. decomposed leaf litter, and maintained at 50-100 mm depth. Some areas, e.g. turf, may not require mulch. Temporary irrigation may be required. Weeds are to be removed and controlled.
- A 6. Pruning is to be undertaken by suitably qualified, skilled and insured people to comply with AS4373-2007, Australian Standard: Pruning of Amenity Trees. Initial pruning provides adequate clearances and general crown maintenance. Flexible branches are to be tied back, not pruned.



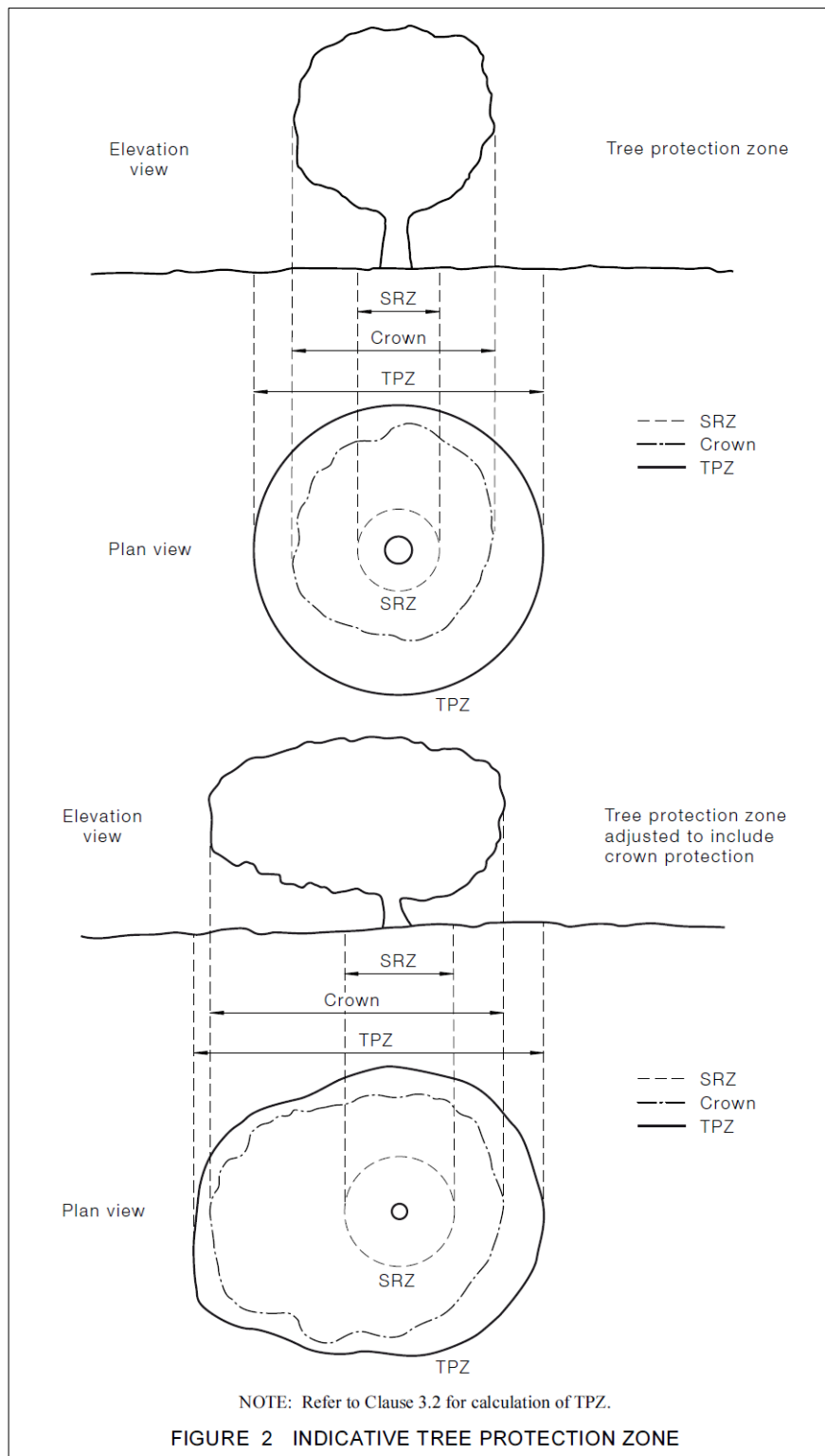
B Construction phase (Maintain tree protection fencing)

- B 1 Where access is required within a TPZ, temporary ground protection measures will be required (e.g. metal plates, rumble boards or exterior-grade ply over aggregate) capable of supporting the required load without deflection. Trunk protection may be required, e.g. battens wrapped around the trunk to a height of 2 m.
- B 2 Material stockpiles or dumps, parking, excavation, site sheds, preparation of chemicals, fires, wash down areas or similar are to be located clear of TPZs. Areas designated for such requirements are not to divert drainage water into tree protection areas.
- B 3 Machine trenching is to be excluded from the TPZ of retained trees. Any required root excavation inside a TPZ is to be done by hand and intact roots >40 mm in diameter are to be retained. Services are to be installed 100 mm clear of such roots. Damaged roots **must** be cut cleanly with sharp implements (backhoe blades and similar are excluded), with no root dressings or paints. Trenches are to be backfilled promptly to minimise soil desiccation. Underbore if no suitable alternative location is possible. All works within the TPZ are to be supervised by an arborist.



Appendix 3. Tree protection zone and structural root zone

Extract from Section 3 of AS 4970-2009

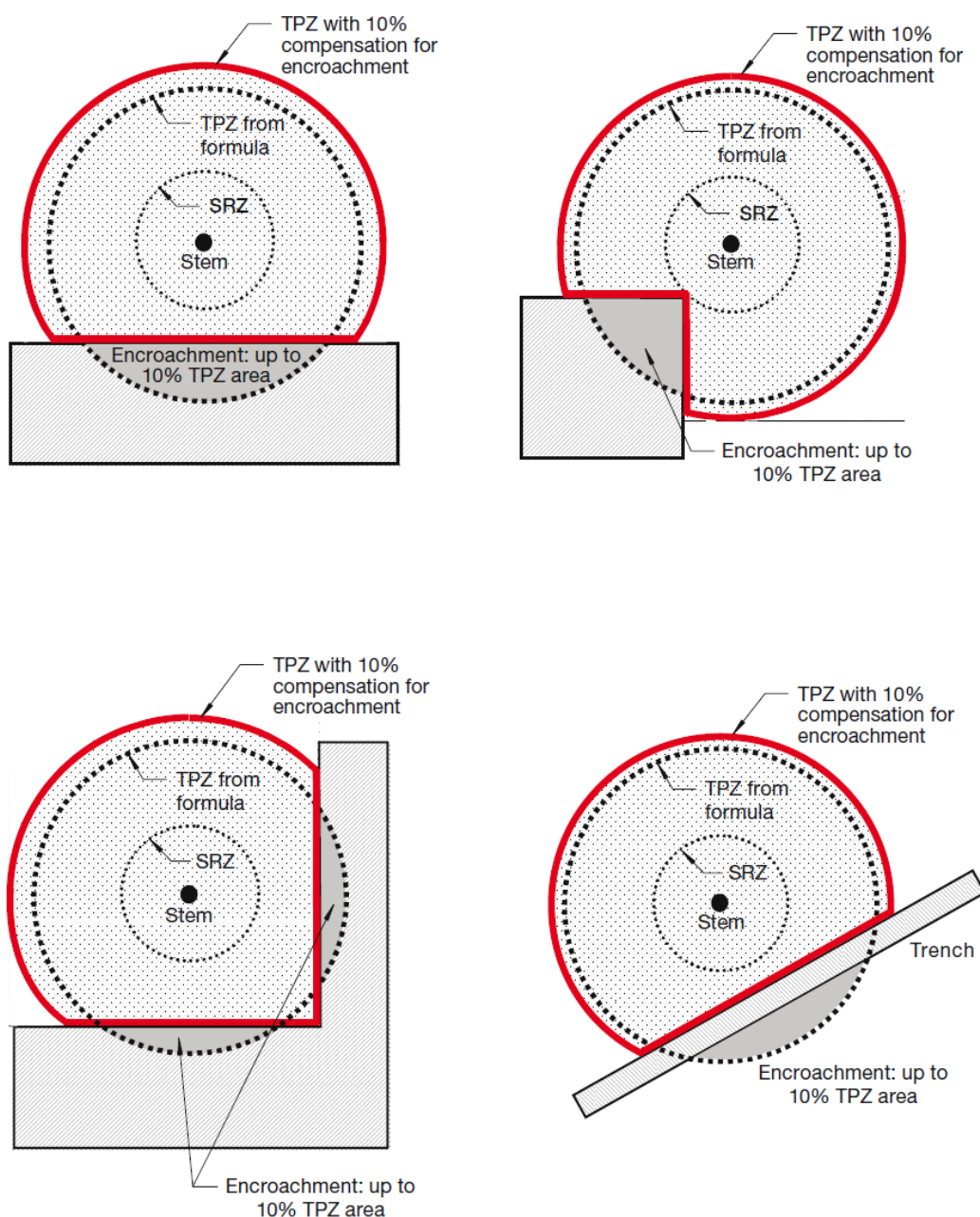




Appendix 4. Encroachment into tree protection zone

Extract from Appendix D of AS 4970-2009

Encroachment into the tree protection zone (TPZ) is sometimes unavoidable. Figure D1 provides examples of TPZ encroachment by area, to assist in reducing the impact of such incursions.



NOTE: Less than 10% TPZ area and outside SRZ. Any loss of TPZ compensated for elsewhere.

FIGURE D1 EXAMPLES OF MINOR ENCROACHMENT INTO TPZ



Appendix 5. Company Profile

Abel Ecology has been in the flora and fauna consulting business since 1991, starting in the Sydney Region, and progressively more state wide in New South Wales since 1998, and now also in Victoria. During this time extensive expertise has been gained with regard to Master Planning, Environmental Impact assessments including flora and fauna, bushfire reports, Vegetation Management Plans, Management of threatened species, Review of Environmental Factors, Species Impact Statements and as Expert Witness in the Land and Environment Court. We have done consultancy work for industrial and commercial developments, golf courses, civil engineering projects, tourist developments as well as residential and rural projects. This process has also generated many connections with relevant government departments and city councils in NSW. Our team consists of four scientists and two administrative staff, plus casual assistants as required.

Licences

NPWS s132C Scientific licence number is SL100780 expires 30 April 2014

NPWS GIS data licence number is CON95034

DG NSW Dept of Primary Industries Animal Care and Ethics Committee Approval expires 8 December 2015

DG NSW Dept of Primary Industries Animal Research Authority expires 8 December 2013

The Consultancy Team

Dr Danny Wotherspoon

Grad Dip Bushfire Protection (University of Western Sydney 2012)

PhD, researching Cumberland Plain vegetation and fauna habitat, at Centre for Integrated Catchment Management (University of Western Sydney, 2007)

MA (Macquarie University, 1991)

BSc (University of New England - Triple Majors in Zoology, incl. Ecological Zoology, 1974)

Dr Daniel McDonald

PhD (The University of Sydney 2006)

M. Agr (The University of Sydney 1996)

B. Ag Sc. (The University of Sydney 1991)

Mark Sherring

B.Mathematics (major statistics) (1990) University of Newcastle

Certificate of Horticulture (1995) Richmond TAFE

Certificate of Bush Regeneration (1992) Nepean TAFE

Certificate of Rural Operations. (1992) Nepean TAFE

Bush Fire Operations modules (1993) Mt. Riverview Fire Brigade

Bushfire Assessment Certificate (2003) Planning Institute of Australia

Certificate of Permaculture (Hazelbrook)

NPWS licence B2174

Member Australian Association of Bush Regenerators (MAABR)