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Bushfire Protection Assessment Services**

ARBORICULTURAL IMPACT APPRAISAL AND METHOD STATEMENT

19 December 2011

Port Macquarie Base Hospital
Port Macquarie, NSW

Prepared for
NSW Health Infrastructure

Summary

The proposed development is to carry out alterations and additions to the western end of the existing hospital plus the construction of a new access driveway and car parking spaces. I have inspected all the trees that could be affected and list their details in Appendix 2.

Seventy two high category trees and fifteen low category trees will be lost because of this proposal. The loss of the low category trees is not expected to have an impact on local character however the loss of the high category trees will have significant impact on local amenity, character and wildlife habitat. A comprehensive landscaping scheme to mitigate these losses is proposed that will include the planting of new trees. The proposed changes may adversely affect a further eleven high category trees if appropriate protective measures are not taken. However, if adequate precautions to protect the retained trees are specified and implemented through the arboricultural method statement included in this report, the development proposal will have no adverse impact on the contribution of trees to local amenity or character.

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Appendices

1. INTRODUCTION

1.1 **Instruction:** I am instructed by Aurecon to inspect the significant trees at Port Macquarie Base Hospital, Port Macquarie and to provide an arboricultural report to accompany a development application. This report investigates the impact of the proposed development on trees and provides the following guidelines for appropriate tree management and protective measures:

- a schedule of the relevant trees to include basic data and a condition assessment;
- an appraisal of the impact of the proposal on trees and any resulting impact that has on local character and amenity;
- a preliminary arboricultural method statement setting out appropriate protective measures and management for trees to be retained

1.2 **Purpose of this report**: This report provides an analysis of the impact of the development proposal on trees with additional guidance on appropriate management and protective measures. Its primary purpose is for the council to review the tree information in support of the planning submission and use as the basis for issuing a planning consent or engaging in further discussions towards that end. Within this planning process, it will be available for inspection by people other than tree experts so the information is presented to be helpful to those without a detailed knowledge of the subject.

1.3 **Qualifications and experience:** I have based this report on my site observations and the provided information, and I have come to conclusions in the light of my experience. I have experience and qualifications in arboriculture, and include a summary in Appendix 1.

1.4 **Documents and information provided:** Aurecon provided me with copies of the following documents:

- Test Location Plan, Dwg No. 1, by Douglas Partners dated 14 June 2011; and
- Landscape Concept Plan, Dwg No. A112, by Hassell dated 25 August 2011.

1.5 **Scope of this report:** This report is only concerned with trees located within ten metres of proposed works and illustrated on the survey plan. It takes no account of other trees, shrubs or groundcovers within the site unless stated otherwise. It includes a preliminary assessment based on the site visit and the documents provided, listed in 1.4 above.

2. THE LAYOUT DESIGN

2.1 **Tree AZ method of tree assessment:** The TreeAZ assessment method determines the worthiness of trees in the planning process. TreeAZ is based on a systematic method of assessing whether individual trees are important and how much weight they should be given in management considerations. Simplistically, trees assessed as potentially important are categorised as '**A**' and those assessed as less important are categorised as '**Z**'. Further explanation of TreeAZ can be found in Appendix 3.

In the context of new development, all the Z trees are discounted as a material constraint in layout design. All the A trees are potentially important and they dictate the design constraints. This relatively simple constraints information is suitable for use by the architect to optimise the retention of the best trees in the context of other material considerations.

2.2 Site visit and collection of data

2.2.1 **Site visit:** I carried out an accompanied site visit on 22 October 2011. All my observations were from ground level without detailed investigations and I estimated all dimensions unless otherwise indicated. The weather at the time of inspection was clear and dry with good visibility.

2.2.2 **Brief site description:** Port Macquarie Base Hospital is located in the suburb of Port Macquarie (refer figure 1). The site is on the northern side of Wrights Road and surrounded by residential development to the north, south and west and industrial development to the east. A variety of indigenous trees are scattered throughout the site and around the site boundaries. Many of the larger surveyed trees are believed to be remnant forest species.

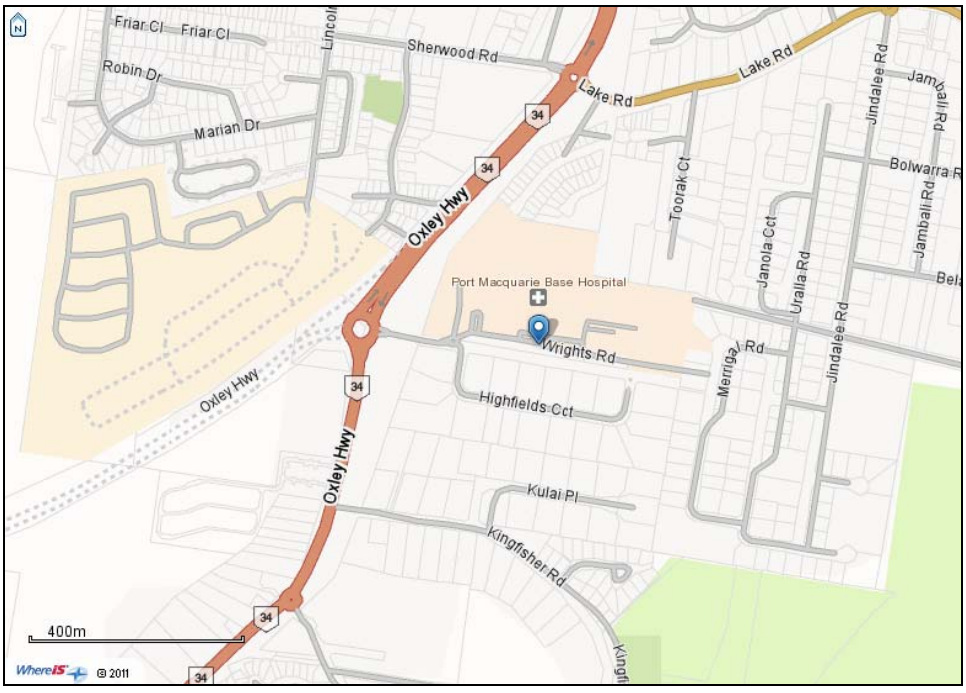

Figure 1: The location of the subject site (www.Whereis.com.au).

2.2.3 **Collection of basic data:** I inspected each tree and have collected information on species, height, diameter, maturity and potential for contribution to amenity in a development context. I have recorded this information in the tree schedule included, with explanatory notes, in Appendix 2. Each tree was then allocated to one of four categories (**AA**, **A**, **Z** or **ZZ**), which reflected its suitability as a material constraint on development.

I stress that my inspection was of a preliminary nature and did not involve any climbing or detailed investigation beyond what was visible from accessible points at ground level.

2.2.4 **Identification and location of the trees:** I have illustrated the locations of the significant trees on the Tree Management Plan (Plan TMP01) included as Appendix 8. This plan is for illustrative purposes only and it should not be used for directly scaling measurements.

2.2.5 **Advanced interpretation of data:** Australian Standard *Protection of trees on development sites* (AS4970-2009), recommends that the trunk diameter measurement for each tree is used to calculate the tree protection zone (TPZ), which can then be interpreted to identify the design constraints and, once a layout has been consented, the exclusion zone is to be protected by barriers.

2.2.6 **Plan updates:** During my site visit, I noted five trees (**45**, **46**, **47**, **51** and **95**) that were not shown on the land survey. I have illustrated their approximate locations on plan TMP01 but these positions have not been accurately surveyed. I do not consider that this has affected the conclusions of this report but if their locations are considered important, they should be accurately surveyed.

2.3 **The use of the tree information in layout design:** Following my inspection of the trees, the information listed in Appendix 2 was used to provide constraints guidance based on the locations of all the A trees. All the Z trees were discounted because they were not considered worthy of being a material constraint. This guidance identified two zones of constraint based on the following considerations:

- The tree protection zone (TPZ) is an area where ground disturbance must be carefully controlled. The TPZ was established according to the recommendations set out in AS4970-2009 and is the radial offset distance of twelve (x12) times the trunk diameter. In principle, a maximum encroachment of 10% is acceptable within the TPZ and a high level of care is needed during any activities that are authorised within it if important trees are to be successfully retained.

- The structural root zone (SRZ) is a radial distance from the centre of a tree's trunk, where it is likely that structural, woody roots would be encountered. The distance is generally based on trunk diameter, although this varies with tree height, crown area, soil type and soil moisture. The SRZ may also be influenced by natural or built structures, such as rocks and footings. The SRZ only needs to be calculated when major encroachment (>10%) into a TPZ is proposed.

3. ARBORICULTURAL IMPACT APPRAISAL

3.1 **Summary of the impact on trees:** I have assessed the impact of the proposal on trees by the extent of disturbance in TPZs and the encroachment of structures into the SRZ (as set out briefly in 2.3 above and more extensively in Appendix 2). All the trees that may be affected by the development proposal are listed in Table 1

Table 1: Summary of trees that may be affected by development

Impact	Reason	Important trees		Unimportant trees	
		AA	A	Z	ZZ
Retained trees that may be affected through disturbance to TPZs	Installation of new surfacing/structures/ landscaping	11, 12, 66, 67, 73, 83, 84, 85, 86	63, 64		
Trees to be removed	Building and/or driveway construction and/or level variations within TPZ	1, 6, 18, 20, 23, 24, 25, 38, 39, 42, 43, 47, 49, 50, 51, 53, 56, 58, 59, 62, 65, 68, 69, 70, 71, 72, 74, 76, 77, 78, 79, 82, 87, 88, 91, 93, 94, 98	7, 8, 9, 10, 14, 15, 16, 19, 21, 22, 27, 28, 29, 30, 31, 33, 34, 35, 36, 40, 41, 44, 45, 52, 54, 57, 75, 80, 81, 89, 90, 92, 95, 97	2, 3, 4, 5, 13, 17, 26, 46, 55, 61, 96	32, 37, 48, 60

3.2 **Detailed impact appraisal**

3.2.1 **Category AA and A trees to be lost:** There are seventy two (72) high category, AA and A, trees that will be directly impacted by the proposal. These are important trees with a high potential to contribute to amenity and their loss will have significant visual impact on local amenity, character and wildlife habitat in the wider setting.

3.2.2 **Category AA and A trees that could potentially be adversely affected through TPZ disturbance:** Eleven (11) category AA and A trees (**11**, **12**, **63**, **64**, **66**, **67**, **73**, **83**, **84**, **85** and **86**) could potentially be adversely affected through disturbance to their TPZs as follows:

- Trees **11**, **63**, **64**, **83**, **84** and **85**: These are important trees with a high potential to contribute to amenity so any adverse impacts on them should be minimised. The proposed works remain outside the TPZ of these trees and therefore impacts are not expected. I have reviewed the situation carefully and my experience is that these trees could be successfully retained without any adverse effects if appropriate protective measures are properly specified and controlled through a detailed arboricultural method statement.

- Trees **12**, **66**, **67**, **73** and **86**: These are important trees with a high potential to contribute to amenity so any adverse impacts on them should be minimised. The proposed works will encroach the TPZ of these trees by up to 12% and therefore adverse impacts are not expected. Tree sensitive construction measures must be implemented if works are to proceed within

the TPZ as prescribed by the Australian Standard AS4970-2009 Protection of trees on development sites. Similarly excavation works required to be undertaken within the TPZ should be performed by hand under the supervision of the project arborist. I have reviewed the situation carefully and my experience is that these trees could be successfully retained with acceptable effects if appropriate protective measures are properly specified and controlled through a detailed arboricultural method statement.

3.2.3 **Other trees to be removed:** There are eleven (11) category Z trees and four (4) category ZZ trees that will be lost under the current proposal. The loss of these trees will have no significant impact on local character because they are small, display signs of structural defects and/or in decline. The loss of the four category ZZ trees is not a direct consequence of this proposal because they should be removed for tree safety.

3.3 Proposals to mitigate any impact

3.3.1 **Protection of retained trees:** The successful retention of trees within the site will depend on the quality of the protection and the administrative procedures to ensure protective measures remain in place throughout the development. An effective way of doing this is through an arboricultural method statement that can be specifically referred to in the planning condition. An arboricultural method statement for this site is set out in detail in Section 4.

3.3.2 **New planting:** In the context of the loss of trees, a comprehensive new landscaping scheme is proposed including new trees to be planted within available areas in prominent locations. The new trees should have the potential to reach a significant height without excessive inconvenience and be sustainable into the long term, significantly improving the potential of the site to contribute to local amenity and character.

3.3.3 **Summary of the impact on local amenity:** Seventy two high category trees and fifteen low category trees will be lost because of this proposal. The loss of the low category trees is not expected to have an impact on local character however the loss of the high category trees will have significant impact on local amenity, character and wildlife habitat. A comprehensive landscaping scheme to mitigate these losses is proposed that will include the planting of new trees. The proposed changes may adversely affect a further eleven high category trees if appropriate protective measures are not taken. However, if adequate precautions to protect the retained trees are specified and implemented through the arboricultural method statement included in this report, the development proposal will have no adverse impact on the contribution of trees to local amenity or character.

4. ARBORICULTURAL METHOD STATEMENT

4.1 Introduction

4.1.1 **Terms of reference:** The impact appraisal in Section 3 identified the potential impacts on trees caused by proposed development. Section 4 is an arboricultural method statement setting out management and protection details that must be implemented to secure successful tree retention. It has evolved from Australian Standard AS4970-2009 Protection of trees on development sites.

4.1.2 **Plan TMP01:** Plan TMP01 in Appendix 8 is illustrative and based entirely on provided information. This plan should only be used for dealing with the tree issues and all scaled measurements must be checked against the original submission documents. The precise location of all protective measures must be confirmed at the pre-commencement meeting before any demolition or construction activity starts. Its base is the existing land survey, which has the proposed layout superimposed so the two can be easily compared. It shows the existing trees numbered, with high categories (A) highlighted in green triangles and low categories (Z) highlighted in blue rectangles. It also shows the locations of the proposed protective measures.

4.2 Tree protection with fencing and ground protection

4.2.1 **Protection fencing:** Tree protection fencing must comply with AS4970 (section 4.3) recommendations. An illustrative guide is included as Appendix 4. The approximate location of the barriers and the TPZs is illustrated on plan TMP01. The precise location of the fencing must be agreed with the project Arborist before any development activity starts.

4.2.2 **Ground protection:** Any TPZs outside the protective fencing must be covered in ground protection based on AS4970 (section 4.3.5) recommendations until there is no risk of damage from the demolition and construction activity. An illustrative specification for this ground protection is included as Appendix 5. On this site, it must be installed near Trees **12**, **66**, **67**, **73** and **86** as illustrated on plan TMP01 before any demolition and construction starts.

4.3 **Precautions when working in TPZs:** Any work in TPZs must be done with care as set out in Appendix 6. On this site, special precautions must be taken near all retained trees as illustrated on plan TMP01 and summarised below:

1. **Removal of existing surfacing/structures and replacement with new surfacing/structure:** The retained trees may be adversely affected by the proposed works. Any adverse impact must be minimised by following the guidance set out in Appendix 6.

2. **Installation of new soft landscaping:** All landscaping activity within TPZs has the potential to cause severe damage and any adverse impact must be minimised by following the guidance set out in section 5 of Appendix 6.

4. **Installation of new services or upgrading of existing services:** It is often difficult to clearly establish the detail of services until the construction is in progress. Where possible, it is proposed to use the existing services into the site and keep all new services outside TPZs. However, where existing services within TPZs require upgrading or new services have to be installed in TPZs, great care must be taken to minimise any disturbance. Trenchless installation should be the preferred option but if that is not feasible, any excavation must be carried out by hand according to the guidelines in Appendix 6. If services do need to be installed within TPZs, consultation must be obtained from the project Arborist and/or council before any works are carried out.

4.4 Other tree related works

4.4.1 **Site storage, cement mixing and washing points:** All site storage areas, cement mixing and washing points for equipment and vehicles must be outside TPZs unless otherwise agreed with the project Arborist and/or council. Where there is a risk of polluted water run off into TPZs, heavy-duty plastic sheeting and sandbags must be used to contain spillages and prevent contamination.

4.4.2 **Pruning:** Any pruning that is required to accommodate hoardings, scaffolding or to accommodate the unloading/loading of vehicles and has been approved by Council shall be carried out by a qualified Arborist (AQF3) and must be in accordance with AS4373 Australian Standards 'Pruning of Amenity Trees'.

4.5 Programme of tree protection and supervision

4.5.1 **Overview:** Tree protection cannot be reliably implemented without arboricultural input. The nature and extent of that input varies according to the complexity of the issues and the resources available on site. For this site, a summary of the level of arboricultural input that is likely to be required is set out in Appendix 7. An project arborist must be instructed to work within this framework to oversee the implementation of the protective measures and management proposals set out in this arboricultural method statement.

4.5.2 **Supervision and the discharge of planning conditions:** Arboricultural planning conditions cannot be reliably or effectively discharged without supervision by the project arborist. The framework in Appendix 7 must form the basis for the discharge of planning conditions through site visits by the project arborist. These supervisory actions must be confirmed by formal letters circulated to all relevant parties. These permanent records of each site visit will accumulate to provide the proof of compliance and allow conditions to be discharged as the development progresses. The developer must instruct the project arborist to comply with the supervision requirements set out in this document before any work begins on site.

4.5.3 **Phasing of arboricultural input:** Trees can only be properly budgeted for and factored into the developing work programmes if the overall project management takes full account of tree issues once consent is confirmed. The project arborist must be involved in the following phases of the project management:

1. **Administrative preparation before work starts on site:** It is normal for a development proposal to vary considerably from the expectations before consent as the detailed planning of implementation evolves. The early instruction of the project arborist ensures that tree issues are factored into the complexities of site management and can often help ease site pressures through creative approaches to tree protection. Pre-commencement discussions between the project arborist and the developer's team is an effective means of project managing the tree issues to maximise site efficiency within often difficult constraints.

2. **Pre-commencement site visit:** A pre-commencement meeting must be held on site before any of the demolition and construction work begins. This must be attended by the site manager and the project arborist. Any clarifications or modifications to the consented details must be recorded and circulated to all parties in writing. This meeting is where the details of the programme of tree protection will be agreed and finalised by all parties, which will then form the basis of any supervision arrangements between the project arborist and the developer.

3. **Site supervision:** Once the site is active, the project arborist must visit at an interval agreed at the pre-commencement site meeting. The supervision arrangement must be sufficiently flexible to allow the supervision of all sensitive works as they occur. The project arborist's initial role is to liaise with developer to ensure that appropriate protective measures are designed and in place before any works start on site. Once the site is working, that role will switch to monitoring compliance with arboricultural conditions and advising on any tree problems that arise or modifications that become necessary.

4.6 **Site management:** It is the developer's responsibility to ensure that the details of this arboricultural method statement and any agreed amendments are known and understood by all site personnel. Copies of the agreed documents must be kept on site at all times and the site manager must brief all personnel who could have an impact on trees on the specific tree protection requirements. This must be a part of the site induction procedures and written into appropriate site management documents.

5. HOW TO USE THIS REPORT

5.1 **Limitations:** It is common that the detail of logistical issues such as site storage and the build programme are not finalised until after consent is issued. As this report has been prepared in advance of consent, some of its content may need to be updated as more detailed information becomes available once the post-consent project management starts. Although this document will remain the primary reference in the event of any disputes, some of its content may be superseded by authorised post-consent amendments.

5.2 **Suggestions for the effective use of this report:** Section 4 of this report, including the relevant appendices, is designed as an enforcement reference. It is constructed so the council can directly reference the detail in a planning condition. Referencing the report by name and relating conditions to specific subsections is an effective means of reducing confusion and facilitating enforcement in the event of problems during implementation. More specifically, the following issues should be directly referenced in the conditions for this site:

1.	Pre-commencement meeting	4.6 and Appendix 7
2.	Barriers	4.2.1 and Appendix 4
3.	Ground protection	4.2.2 and Appendix 5
4.	Removal of surfacing	4.3 and Appendix 6 (Section 2)
5.	Installation of new surfacing	4.3 and Appendices 6 (Section 3)
6.	Removal of structures	4.3 and Appendix 6 (Section 2)
7.	Services	4.3 and Appendix 6 (Section 4)
8.	Installation of new landscaping	4.3 and Appendix 6 (Section 5)
9.	Programming of tree protection	4.6 and Appendix 7
10.	Arboricultural supervision	4.6 and Appendix 7

Each of the above matters must be supervised by the project arborist and the relevant conditions can only be discharged once that supervision has been confirmed in writing to the relevant parties. The last column of the table in Appendix 7 is to be used so that the various supervision issues can be recorded as they are confirmed by supervision letters. It is intended to act as a summary quick-reference to help keep track of the progress of the supervision.

6. OTHER CONSIDERATIONS

6.1 **Trees subject to statutory controls:** The subject trees are legally protected under Port Macquarie Council's Tree Preservation Order, it will be necessary to consult the council before any pruning/removal works other than certain exemptions can be carried out. The works specified above are necessary for reasonable management and should be acceptable to the council. However, tree owners should appreciate that the council may take an alternative point of view and have the option to refuse consent.

7. BIBLIOGRAPHY

7.1 **List of references:**

Australian Standard AS4373-2007 *Pruning of Amenity Trees*.
Standards Australia.

Australian Standard AS4970-2009 *Protection of trees on development sites*.
Standards Australia.

Barrell, J (2009) Draft for Practical Tree AZ version 9.02 A+NZ
Barrel Tree Consultancy, Bridge House, Ringwood BH24 1EX

Brooker, M. Kleinig, D (1999) Field guide to eucalypts – South eastern Aust.
Blooming Books, Hawthorn Vic.

Robinson, L (1994) Field Guide to the Native Plants of Sydney
Kangaroo Press, Kenthurst NSW

8. DISCLAIMER

8.1 Limitations on use of this report:

This report is to be utilized in its entirety only. Any written or verbal submission, report or presentation that includes statements taken from the findings, discussions, conclusions or recommendations made in this report, may only be used where the whole of the original report (or a copy) is referenced in, and directly attached to that submission, report or presentation.

ASSUMPTIONS

Care has been taken to obtain all information from reliable sources. All data has been verified insofar as possible: however, Naturally Trees can neither guarantee nor be responsible for the accuracy of information provided by others.

Unless stated otherwise:

- *Information contained in this report covers only those trees that were examined and reflects the condition of those trees at time of inspection: and*
- *The inspection was limited to visual examination of the subject trees without dissection, excavation, probing or coring. There is no warranty or guarantee, expressed or implied, that problems or deficiencies of the subject trees may not arise in the future.*

Yours sincerely

Andrew Scales

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Arboriculture Australia #2136
Dip. Horticulture / Arboriculture

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APPENDIX 1

Brief qualifications and experience of Andrew Scales

1. Qualifications:

Associate Diploma Horticulture	Northern Sydney Institute of TAFE	1995-1998
Certificate in Tree Surgery	Northern Sydney Institute of TAFE	1998
Associate Diploma Arboriculture	Northern Sydney Institute of TAFE	1999-2006

2. Practical experience: Being involved in the arboricultural/horticultural industry for in excess of 10 years, I have developed skills and expertise recognized in the industry. Involvement in the construction industry and tertiary studies has provided me with a good knowledge of tree requirements within construction sites.

As director of Naturally Trees, in this year alone I have undertaken hundreds of arboricultural consultancy projects and have been engaged by a range of clients to undertake tree assessments. I have gained a wide range of practical tree knowledge through tree removal and pruning works.

3. Continuing professional development:

Visual Tree Assessment (Prof. Dr. Claus Mattheck)	Northern Sydney Institute of TAFE 2001
Wood Decay in Trees (F.W.M.R.Schwarze)	Northern Sydney Institute of TAFE 2004
Visual Tree Assessment (Prof. Dr. Claus Mattheck)	Carlton Hotel, Parramatta NSW 2004
Tree A-Z / Report Writing (Jeremy Barrell)	Northern Sydney Institute of TAFE 2006
Up by Roots – Healthy Soils and Trees in the Built Environment (James Urban)	The Sebel Parramatta NSW 2008
Tree Injection for Insect Control (Statement of Attainment)	Northern Sydney Institute of TAFE 2008
Quantified Tree Risk Assessment (QTRA) Registered Licensee #1655	South Western Sydney Institute TAFE 2011
Practitioners Guide to Visual Tree Assessment	South Western Sydney Institute TAFE 2011

4. Current professional memberships:

Arboriculture Australia – (Registered Consulting & Practising Arborist #2136)

APPENDIX 2

Tree schedule

NOTE: Colour annotation is AA & A trees with green background; Z & ZZ trees with blue background; trees to be removed in red text.

No.	Species	Height	Spread	DBH	TPZ	Foliage	Age class	Defects	Location	Services	Significance	Tree AZ
1	*Eucalyptus microcorys*	10	10	350	**4200**	90%	M	Nil	Grass	Nil	M	**AA1**
2	*Cupaniopsis anacardioides*	4	3	150	**2000**	70%	M	Nil	Grass	Nil	L	**Z1**
3	*Cupaniopsis anacardioides*	4	3	150	**2000**	70%	M	Nil	Grass	Nil	L	**Z1**
4	*Cupaniopsis anacardioides*	4	3	150	**2000**	70%	M	Nil	Grass	Nil	L	**Z1**
5	*Cupaniopsis anacardioides*	4	4	200	**2400**	70%	M	Nil	Grass	Nil	L	**Z1**
6	*Eucalyptus pilularis*	28	24	900	**10800**	90%	M	Nil	Natural ground	Nil	H	**AA1**
7	*Eucalyptus pilularis*	22	14	860	**10320**	80%	M	Nil	Natural ground	Nil	H	**A1**
8	*Corymbia maculata*	12	4	150	**2000**	90%	S	Nil	Natural ground	Nil	M	**A1**
9	*Corymbia maculata*	12	4	150	**2000**	90%	S	Nil	Natural ground	Nil	M	**A1**
10	*Corymbia maculata*	12	4	200	**2400**	90%	S	Nil	Natural ground	Nil	M	**A1**
11	*Eucalyptus pilularis*	26	14	600	**7200**	90%	M	Nil	Natural ground	Nil	H	**AA1**
12	*Eucalyptus pilularis*	26	16	1100	**13200**	90%	M	Co-dominant	Natural ground	Nil	H	**AA2**
13	*Cinnamomum camphora*	14	10	150	**2000**	90%	M	Co-dominant	Natural ground	Nil	M	**Z3**
14	*Eucalyptus pilularis*	16	8	350	**4200**	80%	M	Nil	Natural ground	Nil	M	**A1**
15	*Eucalyptus tereticornis*	12	4	200	**2400**	80%	S	Nil	Natural ground	Nil	L	**A1**
16	*Eucalyptus microcorys*	16	8	350	**4200**	80%	M	Nil	Natural ground	Nil	M	**A1**
17	*Eucalyptus tereticornis*	16	8	350	**4200**	60%	M	Nil	Natural ground	Nil	M	**Z4**
18	*Eucalyptus microcorys*	18	12	350	**4200**	90%	M	Nil	Grass	Nil	H	**AA1**
19	*Acacia falcata*	8	6	150	**2000**	80%	M	Nil	Natural ground	Nil	L	**A1**
20	*Eucalyptus tereticornis*	18	10	380	**4560**	80%	M	Nil	Natural ground	Nil	M	**AA1**
21	*Acacia falcata*	8	6	150	**2000**	80%	M	Nil	Natural ground	Nil	L	**A1**
22	*Eucalyptus tereticornis*	16	8	380	**4560**	90%	M	Nil	Grass	Nil	M	**A1**
23	*Eucalyptus microcorys*	14	8	380	**4560**	90%	M	Nil	Grass	Nil	M	**AA1**
24	*Eucalyptus microcorys*	14	8	400	**4800**	90%	M	Nil	Grass	Nil	M	**AA1**
25	*Eucalyptus microcorys*	14	8	400	**4800**	90%	M	Nil	Grass	Nil	M	**AA1**
26	*Eucalyptus tereticornis*	14	10	400	**4800**	70%	M	Included bark	Grass	Nil	M	**Z9**
27	*Eucalyptus tereticornis*	14	4	150	**2000**	80%	M	Nil	Grass	Nil	L	**A1**

No.	Species	Height	Spread	DBH	TPZ	Foliage	Age class	Defects	Location	Services	Significance	Tree AZ
28	*Eucalyptus tereticornis*	14	8	180	**2000**	80%	M	Nil	Grass	Nil	M	**A1**
29	*Eucalyptus microcorys*	16	8	300	**3600**	90%	M	Nil	Grass	Nil	M	**A1**
30	*Eucalyptus microcorys*	16	8	300	**3600**	90%	M	Nil	Grass	Nil	M	**A1**
31	*Eucalyptus microcorys*	16	8	300	**3600**	90%	M	Nil	Grass	Nil	M	**A1**
32	*Eucalyptus pilularis*	10	3	150	**2000**	20%	S	Borer	Grass	Nil	L	**ZZ4**
33	*Eucalyptus microcorys*	16	8	300	**3600**	90%	M	Nil	Grass	Nil	M	**A1**
34	*Eucalyptus microcorys*	16	8	300	**3600**	90%	M	Nil	Grass	Nil	M	**A1**
35	*Eucalyptus microcorys*	16	8	300	**3600**	90%	M	Nil	Grass	Nil	M	**A1**
36	*Eucalyptus microcorys*	8	4	200	**2400**	80%	S	Nil	Grass	Nil	L	**A1**
37	*Acacia sp.*	8	6	300	**3600**	0%	O	Nil	Grass	Nil	M	**ZZ4**
38	*Eucalyptus tereticornis*	16	8	400	**4800**	80%	M	Nil	Grass	Nil	M	**AA1**
39	*Eucalyptus tereticornis*	16	8	300	**3600**	80%	M	Nil	Grass	Nil	M	**AA1**
40	*Eucalyptus microcorys*	14	4	200	**2400**	80%	S	Nil	Grass	Nil	L	**A1**
41	*Eucalyptus microcorys*	16	8	300	**3600**	90%	M	Nil	Grass	Nil	M	**A1**
42	*Eucalyptus tereticornis*	16	8	400	**4800**	80%	M	Nil	Grass	Nil	M	**AA1**
43	*Eucalyptus robusta*	18	14	480	**5760**	80%	M	Nil	Natural ground	Nil	H	**AA1**
44	*Eucalyptus microcorys*	16	6	300	**3600**	80%	M	Nil	Grass	Nil	M	**A1**
45	*Eucalyptus microcorys*	16	8	250	**3000**	90%	M	Nil	Grass	Nil	M	**A1**
46	*Eucalyptus tereticornis*	16	10	380	**4560**	70%	M	Bracket fungi	Grass	Nil	M	**Z5**
47	*Eucalyptus tereticornis*	18	10	480	**5760**	90%	M	Nil	Grass	Nil	H	**AA1**
48	*Eucalyptus nicholli*	12	4	180	**2000**	20%	O	Nil	Grass	Nil	L	**ZZ4**
49	*Eucalyptus tereticornis*	16	8	380	**4560**	80%	M	Nil	Grass	Nil	M	**AA1**
50	*Eucalyptus microcorys*	18	10	400	**4800**	90%	M	Nil	Grass	Nil	M	**AA1**
51	*Eucalyptus microcorys*	18	10	400	**4800**	90%	M	Nil	Grass	Nil	M	**AA1**
52	*Eucalyptus microcorys*	16	8	280	**3360**	90%	M	Nil	Grass	Nil	M	**A1**
53	*Eucalyptus microcorys*	18	12	480	**5760**	90%	M	Co-dominant	Grass	Nil	H	**AA2**
54	*Eucalyptus microcorys*	16	8	300	**3600**	80%	M	Nil	Grass	Nil	M	**A1**
55	*Eucalyptus microcorys*	8	6	150	**2000**	80%	S	Included bark	Grass	Nil	L	**Z9**
56	*Eucalyptus microcorys*	18	10	400	**4800**	90%	M	Nil	Grass	Nil	M	**AA1**
57	*Eucalyptus robusta*	16	14	400	**4800**	70%	M	Failures	Grass	Nil	M	**A2**
58	*Eucalyptus microcorys*	18	10	400	**4800**	90%	M	Nil	Grass	Nil	M	**AA1**

No.	Species	Height	Spread	DBH	TPZ	Foliage	Age class	Defects	Location	Services	Significance	Tree AZ
59	*Eucalyptus microcorys*	18	10	400	**4800**	90%	M	Nil	Grass	Nil	M	**AA1**
60	*Eucalyptus nicholli*	12	8	380	**4560**	10%	M	Nil	Grass	Nil	M	**ZZ4**
61	*Eucalyptus robusta*	16	10	480	**5760**	70%	M	Cavity, trunk wound	Grass	Nil	M	**Z9**
62	*Eucalyptus tereticornis*	16	8	400	**4800**	80%	M	Nil	Grass	Nil	M	**AA1**
63	*Ulmus parvifolia*	10	10	280	**3360**	90%	M	Nil	Garden bed	Adjacent structure	M	**A1**
64	*Ulmus parvifolia*	10	10	280	**3360**	90%	M	Nil	Garden bed	Adjacent structure	M	**A1**
65	*Eucalyptus microcorys*	20	16	600	**7200**	80%	M	Nil	Grass	Nil	H	**AA1**
66	*Eucalyptus pilularis*	28	24	860	**10320**	90%	M	Nil	Natural ground	Nil	H	**AA1**
67	*Eucalyptus microcorys*	20	16	600	**7200**	80%	M	Nil	Grass	Nil	H	**AA1**
68	*Eucalyptus pilularis*	28	24	880	**10560**	90%	M	Nil	Natural ground	Nil	H	**AA1**
69	*Eucalyptus microcorys*	24	16	600	**7200**	90%	M	Co-dominant	Grass	Nil	H	**AA1**
70	*Eucalyptus pilularis*	30	26	1100	**13200**	90%	M	Nil	Grass	Nil	H	**AA1**
71	*Eucalyptus pilularis*	24	12	600	**7200**	90%	M	Nil	Grass	Nil	H	**AA1**
72	*Eucalyptus pilularis*	24	12	600	**7200**	90%	M	Nil	Grass	Nil	H	**AA1**
73	*Eucalyptus pilularis*	24	12	600	**7200**	90%	M	Nil	Grass	Nil	H	**AA1**
74	*Eucalyptus pilularis*	26	14	700	**8400**	90%	M	Nil	Grass	Nil	H	**AA1**
75	*Eucalyptus pilularis*	14	6	250	**3000**	80%	M	Nil	Grass	Nil	M	**A1**
76	*Eucalyptus pilularis*	26	14	700	**8400**	90%	M	Nil	Grass	Nil	H	**AA1**
77	*Eucalyptus pilularis*	26	14	700	**8400**	90%	M	Co-dominant	Grass	Nil	H	**AA1**
78	*Eucalyptus pilularis*	22	16	700	**8400**	80%	M	Nil	Grass	Nil	H	**AA1**
79	*Eucalyptus pilularis*	26	14	700	**8400**	90%	M	Nil	Grass	Nil	H	**AA1**
80	*Eucalyptus microcorys*	14	8	400	**4800**	80%	M	Nil	Grass	Nil	M	**A1**
81	*Eucalyptus paniculata*	14	8	260	**3120**	70%	M	Nil	Grass	Nil	M	**A1**
82	*Eucalyptus piperita*	22	14	500	**6000**	80%	M	Nil	Grass	Nil	H	**AA1**
83	*Eucalyptus pilularis*	28	24	1000	**12000**	90%	M	Nil	Natural ground	Nil	H	**AA1**
84	*Eucalyptus pilularis*	28	24	780	**9360**	90%	M	Nil	Natural ground	Nil	H	**AA1**
85	*Eucalyptus pilularis*	28	24	1000	**12000**	90%	M	Nil	Natural ground	Nil	H	**AA1**
86	*Eucalyptus microcorys*	28	22	700	**8400**	90%	M	Nil	Dripline disturbance	Nil	H	**AA1**

No.	Species	Height	Spread	DBH	TPZ	Foliage	Age class	Defects	Location	Services	Significance	Tree AZ
87	*Eucalyptus microcorys*	28	22	700	**8400**	90%	M	Nil	Dripline disturbance	Nil	H	**AA1**
88	*Eucalyptus microcorys*	28	16	700	**8400**	90%	M	Nil	Dripline disturbance	Nil	H	**AA1**
89	*Eucalyptus nicholli*	14	12	500	**6000**	70%	M	Nil	Garden bed	Kerb	M	**A1**
90	*Lophostemon confertus*	10	6	250	**3000**	100%	M	Nil	Garden bed	Kerb	M	**A1**
91	*Eucalyptus microcorys*	28	16	600	**7200**	90%	M	Nil	Dripline disturbance	Nil	H	**AA1**
92	*Eucalyptus fibrosa*	14	8	350	**4200**	90%	M	Nil	Grass	Nil	M	**A1**
93	*Eucalyptus pilularis*	28	24	1000	**12000**	90%	M	Nil	Natural ground	Nil	H	**AA1**
94	*Eucalyptus microcorys*	16	10	350	**4200**	90%	M	Nil	Grass	Nil	H	**AA1**
95	*Eucalyptus microcorys*	8	4	150	**2000**	70%	S	Nil	Grass	Nil	L	**A1**
96	*Eucalyptus microcorys*	16	6	300	**3600**	60%	M	Nil	Grass	Nil	M	**Z4**
97	*Eucalyptus pilularis*	16	8	320	**3840**	80%	M	Nil	Grass	Nil	M	**A1**
98	*Eucalyptus microcorys*	22	12	600	**7200**	80%	M	Nil	Grass	Nil	H	**AA1**

Explanatory Notes

- **Measurements/estimates:** All dimensions are estimates unless otherwise indicated. Measurements taken with a tape or clinometer are indicated with a '*'. Less reliable estimated dimensions are indicated with a '?'.
- **Species:** The species identification is based on visual observations and the botanical name. In some instances, it may be difficult to quickly and accurately identify a particular tree without further detailed investigations. Where there is some doubt of the precise species of tree, it is indicated with a '?' after the name in order to avoid delay in the production of the report. The botanical name is followed by the abbreviation sp if only the genus is known. The species listed for groups and hedges represent the main component and there may be other minor species not listed.
- **Tree number:** relates to the reference number used on site diagram/report.
- **Height:** Height is estimated to the nearest metre.
- **Spread:** The average crown spread is visually estimated to the nearest metre from the outermost tips of the live lateral branches.
- **DBH:** These figures relate to 1.2m above ground level and are recorded in millimetres. If appropriate, diameter is measured with a diameter tape. 'M' indicates trees or shrubs with multiple stems.
- **Foliage Cover:** Percent of estimated live foliage cover for particular species range.
- **Age class:**

Y	Young = recently planted
S	Semi-mature (<20% of life expectancy)
M	Mature (20-80% of life expectancy)
O	Over-mature (>80% of life expectancy)

- **TPZ:** The Tree Protection Zone (TPZ) is the radial offset distance of twelve times the trunk diameter in (mm).
- **Tree AZ:** See reference for Tree AZ categories in Appendix 3.
- **Significance:** A tree's significance/value in the landscape takes into account its prominence from a wide range of perspectives. This includes, but is not limited to neighbour hood perspective, local perspective and site perspective. The significance of the subject trees has been categorized into three groups, such as: High, Moderate or Low significance.

APPENDIX 3

TreeAZ Categories (Version 9.02 A+NZ)

Z Category Z: Unimportant trees not worthy of being a material constraint

Local policy exemptions: Trees that are unsuitable for legal protection for local policy reasons including size, proximity and species

Z1	Young or insignificant small trees, i.e. below the local size threshold for legal protection, etc
Z2	Too close to a building, i.e. exempt from legal protection because of proximity, etc
Z3	Species that cannot be protected for other reasons, i.e. scheduled noxious weeds, out of character in a setting of acknowledged importance, etc

High risk of death or failure: Trees that are likely to be removed within 10 years because of acute health issues or severe structural failure

Z4	Dead, dying, diseased or declining
Z5	Severe damage and/or structural defects where a high risk of failure cannot be satisfactorily reduced by reasonable remedial care, i.e. cavities, decay, included bark, wounds, excessive imbalance, overgrown and vulnerable to adverse weather conditions, etc
Z6	Instability, i.e. poor anchorage, increased exposure, etc

Excessive nuisance: Trees that are likely to be removed within 10 years because of unacceptable impact on people

Z7	Excessive, severe and intolerable inconvenience to the extent that a locally recognised court or tribunal would be likely to authorise removal, i.e. dominance, debris, interference, etc
Z8	Excessive, severe and intolerable damage to property to the extent that a locally recognised court or tribunal would be likely to authorise removal, i.e. severe structural damage to surfacing and buildings, etc

Good management: Trees that are likely to be removed within 10 years through responsible management of the tree population

Z9	Severe damage and/or structural defects where a high risk of failure can be temporarily reduced by reasonable remedial care, i.e. cavities, decay, included bark, wounds, excessive imbalance, vulnerable to adverse weather conditions, etc
Z10	Poor condition or location with a low potential for recovery or improvement, i.e. dominated by adjacent trees or buildings, poor architectural framework, etc
Z11	Removal would benefit better adjacent trees, i.e. relieve physical interference, suppression, etc
Z12	Unacceptably expensive to retain, i.e. severe defects requiring excessive levels of maintenance, etc

NOTE: Z trees with a high risk of death/failure (Z4, Z5 & Z6) or causing severe inconvenience (Z7 & Z8) at the time of assessment and need an urgent risk assessment can be designated as ZZ. ZZ trees are likely to be unsuitable for retention and at the bottom of the categorisation hierarchy. In contrast, although Z trees are not worthy of influencing new designs, urgent removal is not essential and they could be retained in the short term, if appropriate.

A Category A: Important trees suitable for retention for more than 10 years and worthy of being a material constraint

A1	No significant defects and could be retained with minimal remedial care
A2	Minor defects that could be addressed by remedial care and/or work to adjacent trees
A3	Special significance for historical, cultural, commemorative or rarity reasons that would warrant extraordinary efforts to retain for more than 10 years
A4	Trees that may be worthy of legal protection for ecological reasons (Advisory requiring specialist assessment)

NOTE: Category A1 trees that are already large and exceptional, or have the potential to become so with minimal maintenance, can be designated as AA at the discretion of the assessor. Although all A and AA trees are sufficiently important to be material constraints, AA trees are at the top of the categorisation hierarchy and should be given the most weight in any selection process.

TreeAZ is designed by Barrell Tree Consultancy (www.treeaz.com/tree_az/)

APPENDIX 4

Protection fencing and signs - Illustrative specification

Protective fencing: Protective 1.8m high fencing should be installed at the location illustrated on the Tree Management Plan before any site works start. All uprights should be fixed in position for the duration of the development activity. The fixings must be able to withstand the pressures of everyday site work.

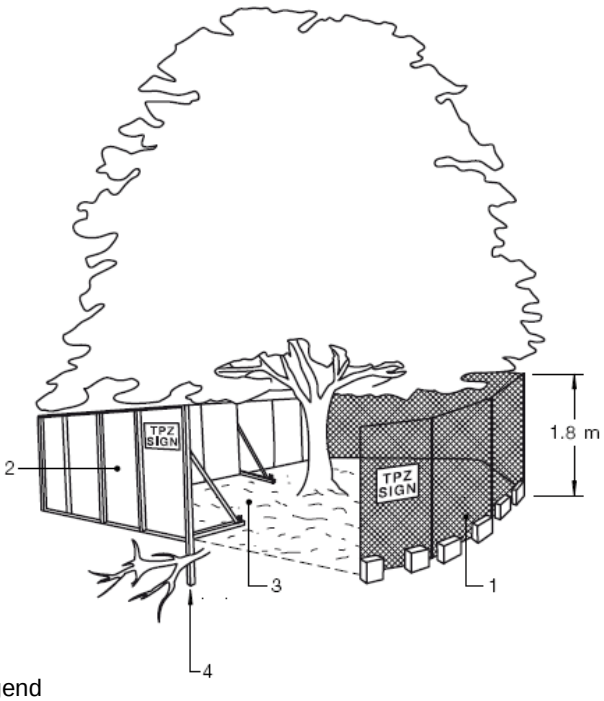
Inside the protective fencing, the following rules must be strictly observed:

- **No vehicular access**
- **No storage of excavated debris, building materials or fuels**
- **No excessive cultivation for landscape planting**
- **No fires**
- **No mixing of cement**
- **No service installation or excavation**

Once erected, protective fencing must not be removed or altered without consulting first with the project Arborist.

Shade cloth or similar should be attached to reduce the transport of dust, other particulate matter and liquids into the protected area and signage must be attached to outside of fencing.

Signage: All signs are to provide clear and readily accessible information to indicate that a TPZ has been established. Signage identifying the TPZ must be attached to outside of fencing and be visible from within the development site.



Signage example:

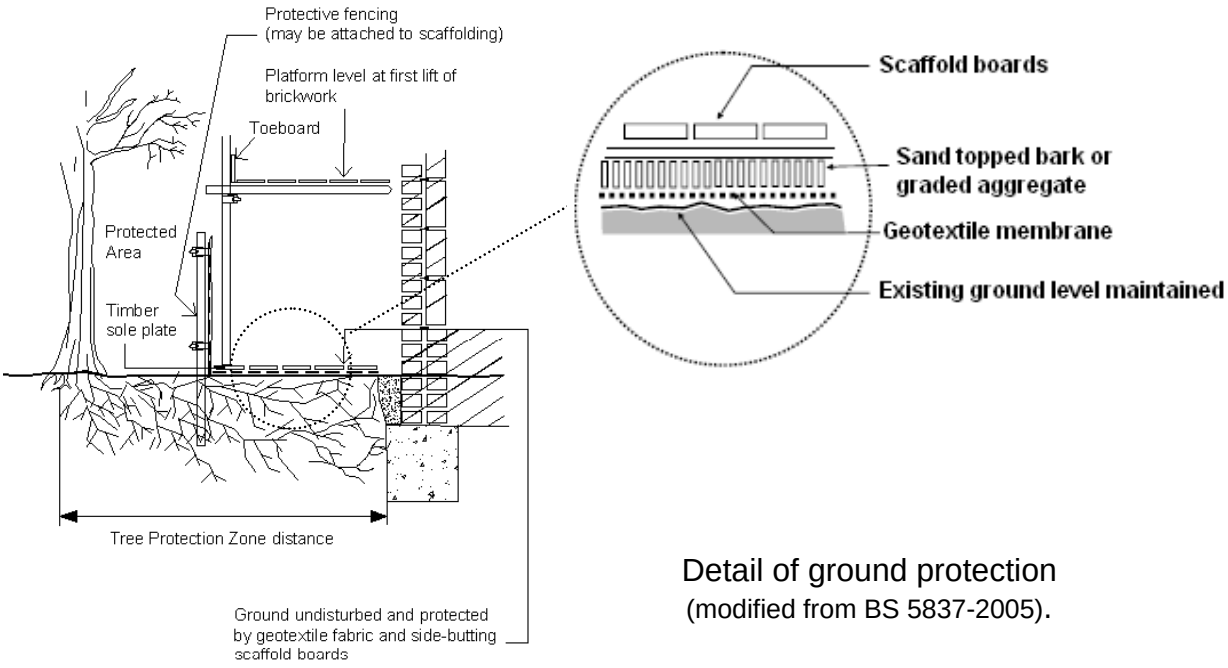
Legend

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

APPENDIX 5

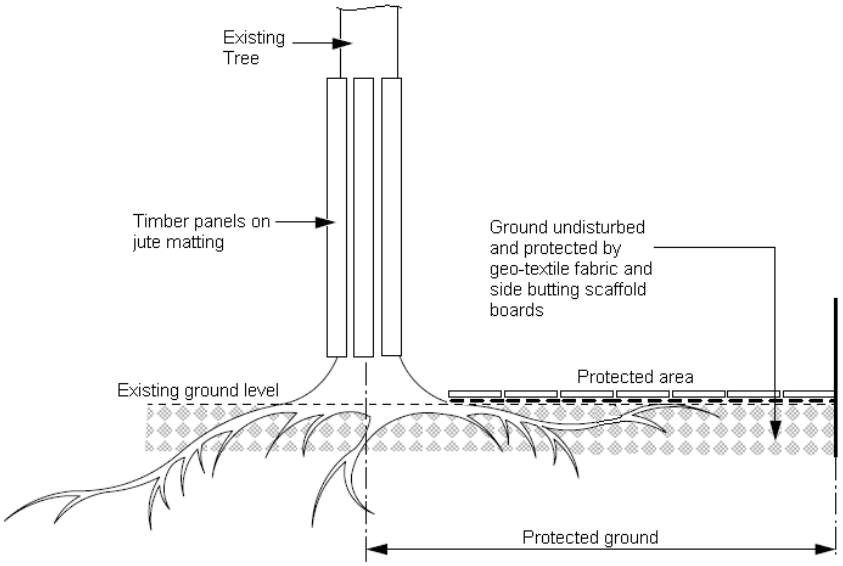
Ground and trunk protection - Illustrative specification

Ground protection: Where necessary, access through the TPZ can be achieved by laying aggregate and timber boards (or similar) over the root zone to protect roots. The ground beneath the boarding should be left undisturbed and should be protected with a porous geo-textile fabric covered with sand or mulch.



Detail of ground protection
(modified from BS 5837-2005).

Trunk protection: Where fencing cannot be installed, the vertical trunk of exposed trees shall be protected by the placement of 3.6m lengths of 50 x 100mm hardwood timbers, spaced vertically, at 150mm centres and secured by 2mm wire at 300mm wide spacing over suitable protective padding material e.g. Jute Matting. The trunk protection shall be maintained intact until the completion of all work on site.



Detail of trunk protection.

APPENDIX 6

General guidance for working in TPZ

1.1 **What is the purpose of this guidance?** This guidance sets out the general principles that must be followed when working in TPZs. Where more detail is required, it will be supplemented by illustrative specifications in other appendices in this document. Before work starts on site, the purpose of this guidance is to demonstrate to the council that tree protection issues have been properly considered and to provide a written record of how they will be implemented. Once the site works start, this guidance is specifically for the site personnel to help them understand what has been agreed and explain what is required to fully meet their obligations to protect trees. All personnel working in TPZs must be properly briefed about their responsibilities towards important trees based on this guidance.

1.2 **What are TPZs?** TPZs are the areas surrounding important trees where disturbance must be minimised if they are to be successfully retained. All TPZs close to the construction area are illustrated on the tree protection plans accompanying this guidance. Damage to roots or degradation of the soil through compaction and/or excavation within TPZs is likely to cause serious damage. Any work operations within TPZs must be carried out with great care if trees are to be successfully retained.

1.3 **When should this guidance be followed?** Anyone entering a TPZ must follow this guidance if important trees are to remain unharmed. Anyone working in a TPZ must take care to minimise excavation into existing soil levels and limit any fill or covering that may adversely affect soil permeability. There are two main scenarios where this guidance must be followed when entering and working within a TPZ:

1. Removal of existing surfacing/structures and replacement with new surfacing, structures and/or landscaping.

2. Preparation and installation of new surfacing, structures and/or landscaping. Broad definitions of surfacing, structures and landscaping are set out in the following sections.

1.4 **Where does this guidance apply?** This guidance should always be read in conjunction with the site plans illustrating the areas where specific precautions are necessary. Each area where precautions are required is annotated on the plans as identified on their keys. All plans are illustrative and intended to be interpreted in the context of the site conditions when the work is started. All protective measures should be installed according to the prevailing site conditions and agreed as satisfactory by the appropriate supervising officer before any demolition or construction work starts.

1.5 **What references is this guidance based on?** This guidance is based on the assumption that the minimum general standards for development issues are those set out in Australian Standards (2009) AS4970: Protection of Trees on Construction Sites. It is interpreted in the context of our experience of managing trees on development sites.

1.6 **Preventing adverse impact to the TPZ beyond the immediate work area:** Any part of the TPZ beyond the agreed work area must be isolated from the work operations by protective barriers or ground protection to at least the minimum standard described in AS4970 for the duration of the work.

1.7 **Excavation and dealing with roots:** All excavation must be carried out carefully using spades, forks and trowels, taking care not to damage the bark and wood of any roots. Specialist tools for removing soil around roots using compressed air may be an appropriate alternative to hand digging, if available. All soil removal must be undertaken with care to minimise the disturbance of roots beyond the immediate area of excavation. Where possible, flexible clumps of smaller roots, including fibrous roots, should be retained if they can be displaced temporarily or permanently beyond the excavation without damage. If digging by hand, a fork should be used to loosen the soil and help locate any substantial roots. Once roots have been located, the trowel should be used to clear the soil away from them without damaging the bark. Exposed roots to be removed should be cut cleanly with a sharp saw or secateurs 10–20cm behind the final face of the excavation. Roots temporarily exposed must be protected from direct sunlight, drying out and extremes of temperature by appropriate covering. Roots greater than 2.5cm in diameter should be retained where possible. Roots 2.5–10cm in diameter should only be cut in exceptional circumstances. Roots greater than 10cm in diameter should only be cut after consultation with the appropriate supervisory officer.

1.8 **Arboricultural supervision:** Any work within TPZs requires a high level of care. Qualified arboricultural supervision is essential to minimise the risk of misunderstanding and misinterpretation. Site personnel must be properly briefed before any work starts. Ongoing work must be inspected regularly and, on

completion, the work must be signed off by the arboriculturist to confirm compliance by the contractor. In the context of this guidance, an appropriate supervising officer would normally be an arboriculturist.

2 REMOVING SURFACING/STRUCTURES IN TPZs

2.1 **Definitions of surfacing and structures:** For the purposes of this guidance, the following broad definitions apply:

• **Surfacing:** Any hard surfacing used as a vehicular road, parking or pedestrian path including tarmac, solid stone, crushed stone, compacted aggregate, concrete and timber decking. This does not include compacted soil with no hard covering.

• **Structures:** Any man-made structure above or below ground including service pipes, walls, gate piers, buildings and foundations. Typically, this would include drainage structures, car-ports, bin stores and concrete slabs that support buildings.

2.2 **Access:** Roots frequently grow adjacent to and beneath existing surfacing/structures so great care is needed during access and demolition. Damage can occur through physical disturbance of roots and/or the compaction of soil around them from the weight of machinery or repeated pedestrian passage. This is not generally a problem whilst surfacing/structures are in place because they spread the load on the soil beneath and further protective measures are not normally necessary. However, once they are removed and the soil below is newly exposed, damage to roots becomes an issue and the following guidance must be observed:

1. No vehicular or repeated pedestrian access into TPZs unless on existing hard surfacing or custom designed ground protection.

2. Regular vehicular and pedestrian access routes must be protected from compaction with temporary ground protection as set out in AS4970.

3. TPZs exposed by the work must be protected as set out in AS4970 until there is no risk of damage from the development activity.

2.3 **Removal:** Removing existing surfacing/structures is a high-risk activity for any adjacent roots and the following guidance must be observed:

1. Appropriate tools for manually removing debris may include a pneumatic breaker, crow bar, sledgehammer, pick, mattock, shovel, spade, trowel, fork and wheelbarrow. Secateurs and a handsaw must also be available to deal with any exposed roots that have to be cut.
2. Machines with a long reach may be used if they can work from outside TPZs or from protected areas within TPZs. They must not encroach onto unprotected soil in TPZs.
3. Debris to be removed from TPZs manually must be moved across existing hard surfacing or temporary ground protection in a way that prevents compaction of soil. Alternatively, it can be lifted out by machines provided this does not disturb TPZs.
4. Great care must be taken throughout these operations not to damage roots as set out in 1.7 above.
5. If appropriate, leaving below ground structures in place should be considered if their removal may cause excessive root disturbance.

3 INSTALLATION OF NEW SURFACING IN TPZs

3.1 **Basic principles:** New surfacing is potentially damaging to trees because it may require changes to existing ground levels, result in localised soil structure degradation and/or disrupt the efficient exchange of water and gases in and out of the soil. Mature and overmature trees are much more prone to suffer because of these changes than young and maturing trees. Adverse impact on trees can be reduced by minimising the extent of these changes in TPZs. Generally, the most suitable surfacing will be relatively permeable to allow water and gas movement, load spreading to avoid localised compaction and require little or no excavation to limit direct damage. The actual specification of the surfacing is an engineering issue that needs to be considered in the context of the bearing capacity of the soil, the intended loading and the frequency of loading. The detail of product and specification are beyond the scope of this guidance and must be provided separately by the appropriate specialist.

3.2 **Establishing the depth of excavation and surfacing gradient:** The precise location and depth of roots within the soil is unpredictable and will only be known when careful digging starts on site. Ideally, all new surfacing in TPZs should be no-dig, i.e. requiring no excavation whatsoever, but this is rarely possible on

undulating surfaces. New surfacing normally requires an evenly graded sub-base layer, which can be made up to any high points with granular, permeable fills such as crushed stone or sharp sand. This sub-base must not be compacted as would happen in conventional surface installation. Some limited excavation is usually necessary to achieve this and need not be damaging to trees if carried out carefully and large roots are not cut. Tree roots and grass roots rarely occupy the same soil volume at the top of the soil profile, so the removal of a turf layer up to 5cm is unlikely to be damaging to trees. It may be possible to dig to a greater depth depending on local conditions but this would need to be assessed by an arboriculturist if excavation beyond 5cm is anticipated. On undulating surfaces, finished gradients/levels must be planned with sufficient flexibility to allow on-site adjustment if excavation of any high points reveals large unexpected roots near the surface. If the roots are less than 2.5cm in diameter, it would normally be acceptable to cut them and the gradient formed with the preferred minimal excavation of up to 5cm. However, if roots over 2.5cm in diameter are exposed, cutting them may be too damaging and further excavation may not be possible. If that is the case, the surrounding levels must be adjusted to take account of these high points by filling with suitable material. If this is not practical and large roots have to be cut, the situation should be discussed with the supervising officer before a final decision is made.

3.3 **Base and finishing layers:** Once the sub-base has been formed, the load spreading construction is installed on top without compaction. In principle, the load spreading formation will normally be cellular and filled with crushed stone although the detail may vary with different products. Suitable surface finishes include washed gravel, permeable tarmac or block paviours set on a sand base. However, for lightly loaded surfacing of limited widths (<3m) such as pedestrian paths, pre-formed concrete slabs may be appropriate if the sub-base preparation is as set out above. In some situations, limited width floating concrete rafts constructed directly on to the soil surface may be acceptable but the design must not include any strip-dug supports.

3.4 **Edge retention:** Conventional kerb edge retention set in concrete filled excavated trenches is likely to result in damage to roots and should be avoided. Effective edge retention in TPZs must be custom designed to avoid any significant excavation into existing soil levels. For most surfaces, the use of pre-formed edging secured by metal pins or wooden pegs is normally an effective way of minimising any adverse impact on trees from the retention structure.

3.5 **Installing new surfacing on top of existing surfacing:** In some instances, existing surfacing can be retained and used as a base for new surfacing. Normally, this will not result in significant excavation that could expose roots so special precautions are not necessary. However, if large roots already protrude above the proposed sub-base level, then the precautions and procedures set out above must be observed.

4 INSTALLATION OF NEW STRUCTURES IN TPZs

4.1 **Basic principles:** New structures in TPZs are potentially damaging to trees because they may disturb the soil and disrupt the existing exchange of water and gases in and out of it. Mature and over-mature trees are much more prone to suffer because of these changes than young and maturing trees. Adverse impact on trees can be reduced by minimising the extent of these changes in TPZs. This can be done by constructing the main structures above ground level on piled supports and redirecting water to where it is needed. The detailed design and specification of such structures is an engineering issue that should be informed and guided by tree expertise.

4.2 **Small sheds and bin stores:** These light structures do not normally require substantial foundations and can have permeable bases. Ideally, their bases should be of a no-dig, load-spreading construction set directly on to the soil surface. They require a flat base and so an undulating site will need levelling to provide a suitable surface. Excavation of any high points by up to 5cm and filling depressions with permeable fill to provide a flat base will normally be acceptable provided no roots greater than 2.5cm in diameter need to be cut. If large roots are found, the preferred course of action would be to raise the base level of the structure by filling rather than cutting roots. However, if this is not practical and large roots have to be cut, the situation should be discussed with the supervising officer before a final decision is made. Above the base, there will often be a protective covering fixed onto a frame that can rise directly from the base or be fixed to supports either banged into the ground or set in carefully dug holes. Provided the supports are well spaced, i.e. greater than 1.5m apart, and of a relatively narrow diameter, i.e. not in excess of 15cm, it is unlikely they will cause any significant disturbance to TPZs.

4.3 **Walls, gate piers, buildings and bridges on new foundations:** Conventional strip foundations in TPZs for any significant structure may cause excessive root loss and are unlikely to be acceptable. However, disturbance can be significantly reduced by supporting the above ground part of the structures on small

diameter piles and beams or cast floor slabs set above ground level. The design should be sufficiently flexible to allow the piles to be moved if significant roots are encountered in the preferred locations. Before the actual installation of the new structure starts, all TPZs that may be affected should be covered with temporary ground protection as set out in AS4970. Gaps in the ground protection should be left where it is expected to install the piles or dig the holes for gate piers. Pile locations should be initially hand dug to a depth of 75cm to establish if there are any significant roots over 2.5cm in diameter that could be damaged. If significant roots are found, then the pile location must be moved slightly and a new exploratory hole dug. Once the piles have been installed, the lowest points of the supporting beams for the structure must be above the ground level between the piles and there should not be any further excavation. The beams between the piles can be pre-cast and imported to the site ready to fix or can be cast in position using shuttering for the sides and a biodegradable void-former for the base. Gate piers generally require larger holes and have less flexibility for relocation if large roots are found. Localised loss of roots may be unavoidable so each situation should be assessed on its own merits by an appropriate supervising officer once the careful excavations have been completed. Any roots found should be dealt with as set out in 1.7 above. When installing any of these structures, the ground protection must remain in place until the construction is completed and there is no risk of damage to TPZs.

4.4 **Walls on existing foundations:** A free-standing wall on an existing foundation is unlikely to require any additional excavation and so its construction should have no adverse impact on TPZs if the appropriate protection is in place. However, replacing walls that retain the soil of TPZs normally requires some limited excavation back into the exposed soil face to provide a working space of at least 10–20cm behind the inside wall face. This should be done carefully and limited to no more than required to construct the new wall. Any roots found should be dealt with as set out in 1.7 above. Once the wall is completed, any voids behind it should be filled with good quality top soil and firmed into place but not over compacted. Specific difficulties with large roots that emerge during the course of the construction should be referred to the supervising officer.

4.5 **Services:** For the purposes of this guidance, services are considered as structures. Excavation to upgrade existing services or install new services in TPZs may damage retained trees and should only be chosen as a last resort. In the event that excavation emerges as the preferred option, the decision should be reviewed by the supervising officer before any work is carried out. If excavation is agreed, all digging should be done carefully and follow the guidance set out in 1.7 above.

5 SOFT LANDSCAPING IN TPZs

5.1 **Upgrading existing soft landscaping or replacing existing surfacing/structures with new soft landscaping:** For the purposes of this guidance, soft landscaping includes the reprofiling of existing soil levels and covering the soil surface with new plants or an organic covering (mulch). It does not include the installation of solid structures or compacted surfacing. Soft landscaping activity after construction can be extremely damaging to trees. No significant excavation or cultivation, especially by rotovators, should occur within TPZs. Where new designs require levels to be increased to tie in with new structures or the removal of an existing structure has left a void below the surrounding ground level, good quality and relatively permeable top soil should be used for the fill. It should be firmed into place but not over compacted in preparation for turfing or careful shrub planting. Ideally, all areas close to tree trunks should be kept at the original ground level and have a mulched finish rather than grass to reduce the risk of mowing damage.

APPENDIX 7

Programme of arboricultural input and hold points

Arboricultural action	Programming of action	Extent of arboricultural input	Signed off (project Arborist)
Pre-commencement site meeting with site manager to discuss tree protection and any emerging design issues that may affect trees	Before any site activity starts or once tree protective measures have been installed	• Meeting with relevant members of the developer's team to explain the extent of the tree constraints, i.e. architect, site manager, engineer, landscape architect, etc • Review working space requirements to consider fencing and ground protection adjustments to improve site functionality • Review drainage proposals and identify conflicts with TPZs • Review any post-consent layout changes that may affect trees • Review all special works that may affect trees • Identify any potential conflicts and work towards resolutions • Preparation of draft working drawings if necessary • Review any updated proposals • Confirm tree protective measures are acceptable if already installed	
Finalising tree protection proposals and installation for agreement by consent authority	Before any heavy machinery enters the site	• Preparation of final plans and specifications for agreement by the council • Provide photographs showing relevant aspect of installed tree protective measures • Meeting with contractor to finalise specifications and locations before installation with a further visit on completion to verify correct installation, at the discretion of the project Arborist	
Demolition / Construction	After protective measures are installed	• Meeting with contractor if necessary, at the discretion of arboricultural consultant	
Removal of existing structures inside TPZs but outside fencing to be replaced with ground protection or to remain 'out of bounds	At the discretion of the developer	• Meeting with contractor for briefing before work starts with further visits as necessary, at the discretion of the project Arborist	
Installation of new services	At the discretion of the developer	• Meeting with contractor for briefing before work starts with further visits as necessary, at the discretion of the project Arborist	
Removal of barriers and ground protection	When construction activity is finished	• Meeting with contractor for briefing before work starts	

APPENDIX 8

Tree management plan

-refer attached Tree Management Plan, Dwg No. TMP01,
by Naturally Trees dated 19 December 2011

Joins 2 of 2

199°23'22"
163.24

NEW CARPARK
24 SPACES

ADDITIONAL ED
14 SPACES

EXIST

DN

LEGEND:

- Category AA
- Category A

Trees worthy of being a constraint

- Category Z
- Category ZZ

Trees not worthy of being a constraint

- Existing layout
- Proposed layout
- Tree protection zone (TPZ) boundaries (Retained AA and A trees only)
- Protective fencing and TPZ area within
- TPZ where ground protection must be installed
- Tree to be removed

north

0 5 10 15m

NOTE: *This drawing to be reproduced in colour only*

PROJECT
Port Macquarie Base Hospital, Port Macquarie, NSW

CLIENT
NSW Health Infrastructure

DRAWING
Tree Management Plan

Naturally Trees

DWG #	REV
TMP01 Sheet 1 of 2	B

DATE 19/12/11
SCALE @ A3 Ref. Dwg
DRAWN AS

Naturally Trees Arboricultural Consulting
28 Coolangatta Avenue, Elanora Heights NSW 2101
W: www.naturallytrees.com.au **E**: sales@naturallytrees.com.au

PROPOSED EXTENSION

LEGEND:

- Category AA — Trees worthy of being a constraint
- Category A — Trees worthy of being a constraint
- Category Z — Trees not worthy of being a constraint
- Category ZZ — Trees not worthy of being a constraint
- Existing layout
- Proposed layout
- Tree protection zone (TPZ) boundaries (Retained AA and A trees only)
- Protective fencing and TPZ area within
- TPZ where ground protection must be installed
- Tree to be removed

north

0 5 10 15m

Joins 1 of 2

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PROJECT
Port Macquarie Base Hospital, Port Macquarie, NSW

CLIENT
NSW Health Infrastructure

DRAWING
Tree Management Plan

Naturally Trees

DWG #	REV
TMP01	
Sheet 2 of 2	B

DATE 19/12/11
SCALE @ A3 Ref. Dwg
DRAWN AS

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