Moore Trees
Arboricultural Services

ABN 90887347745

Arboricultural Development Assessment Report

206 West Dapto Road
Kembla Grange NSW 2526
Lot 1 DP 588139

December 2018
Updated August 2020
Draft 4

Prepared for: Cardno Limited
Ground Floor
16 Burelli Street
Wollongong NSW 2500

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Summary

This report has been compiled for Cardno Limited of Ground Floor, 16 Burelli Street, Wollongong NSW 2500. The report concerns a proposed Development Application for 206 West Dapto Road, Kembla Grange Residential Subdivision. This Arborist Report refers to one hundred and seventy four (174) individual and groups of trees located at 206 West Dapto Road, Kembla Grange NSW 2526. This report has been prepared for a Development Application with Wollongong City Council at this site.

This report contains the following information required in Wollongong City Council guidelines:-

1) All trees were assessed for Safe Useful Life Expectancy (SULE).
2) Genus and species of each tree identified.
3) Impact of the proposed development on each tree.
4) The Tree Protection Zone (TPZ) calculated for each tree to be retained.
5) Any branch or root pruning that may be required for trees.
6) List trees within fifteen (15) metres of the site boundary.

Due to the sudden death of Tree 11, which is unusual as this species can live for hundreds of years, further scientific testing has been recommended and undertaken. This group of trees (1-13) being a Heritage item would normally be required to be retained.

Soil and tissue samples were supplied to the Royal Botanic Gardens Pathology unit for pathogen testing. The results show that the more common soil borne pathogens that are extremely detrimental to tree health, being *Armillaria luteobubalina* and *Phytophthora cinnamomic,* were not present in the test. *Antrodia* genus, a species of Brown rot was detected in the tissue samples. Unfortunately information about this pathogen is limited.

At this stage, it would be anticipated that Council will want the design to retain Trees numbered as 1, 4, 7-11 and 13.

Only preliminary designs have been provided for the purpose of this report. Once designs have been finalised this development will require further assessment in relation to the site trees. Service plans will also be required to assess breaches to TPZ areas for each tree. The bulk earth works plan will be required to fully assess tree impacts. The eastern portion of the site still requires the trees to be assessed and included in this report.

Table of Contents

VERSION CONTROL

Date of Issue	Details
12 December 2018	Draft 1 issued
11 March 2019	Draft 2 issued
23 June 2020	Draft 3, updated for storm damage
12 August 2020	Draft 4, updated for test results

1 INTRODUCTION

1.1 This report has been conducted to assess the health and condition of one hundred and seventy four (174) individual and groups of trees located at 206 West Dapto Road, Kembla Grange NSW 2526. This report has been prepared for Cardno Limited of Ground Floor, 16 Burelli Street, Wollongong NSW 2500 as required for a Development Application with Wollongong City Council at this site.

The purpose of this report is to collect the appropriate tree related data on the subject trees and to provide advice and recommendations to the design and possible construction alternatives, to aid against any adverse impacts on the health of the subject trees to be retained.

The subject trees were assessed for their health and condition. Also included in this report are tree protection measures that will help retain and ensure that the long-term health of the trees to be retained are not adversely affected by the proposed development in the future.

As specified in the Wollongong City Council Development Application guidelines the following data was collected for each tree:

1) A site plan locating all trees over three (3) metres in height, including all street trees.
2) All trees were assessed for Safe Useful Life Expectancy (SULE), health and amenity value.
3) Genus and species identification of each tree.
4) Impact of the proposed development on each tree.
5) The Tree Protection Zone (TPZ) for each tree to be retained.
6) Any branch or root pruning that may be required for trees.

Also noted for the purpose of this report were:

- Health and Vigour; using foliage colour and size, extension growth, presence of deadwood, dieback and epicormic growth throughout the tree.
- Structural condition using visible evidence of bulges, cracks, leans and previous pruning.
- The suitability of the tree taking into consideration the proposed development.
- Age rating; Over-mature (>80% life expectancy), Mature (20-80% life expectancy), Young, Sapling (<20% life expectancy).

1.2 Documents and information provided: For this Arborist Report I was given a Native Vegetation and Vegetation Impact and Exclusion Zones plan by Cardno Limited. Preliminary residential lot layout by Cardno dated 01.03.19. Bulk earth works and service plans to be provided.

1.3 Location: The proposed development site is located at 206 West Dapto Road, Kembla Grange, known as Lot 1 DP 588139. The proposed development site from herein will be referred to as "the Site".

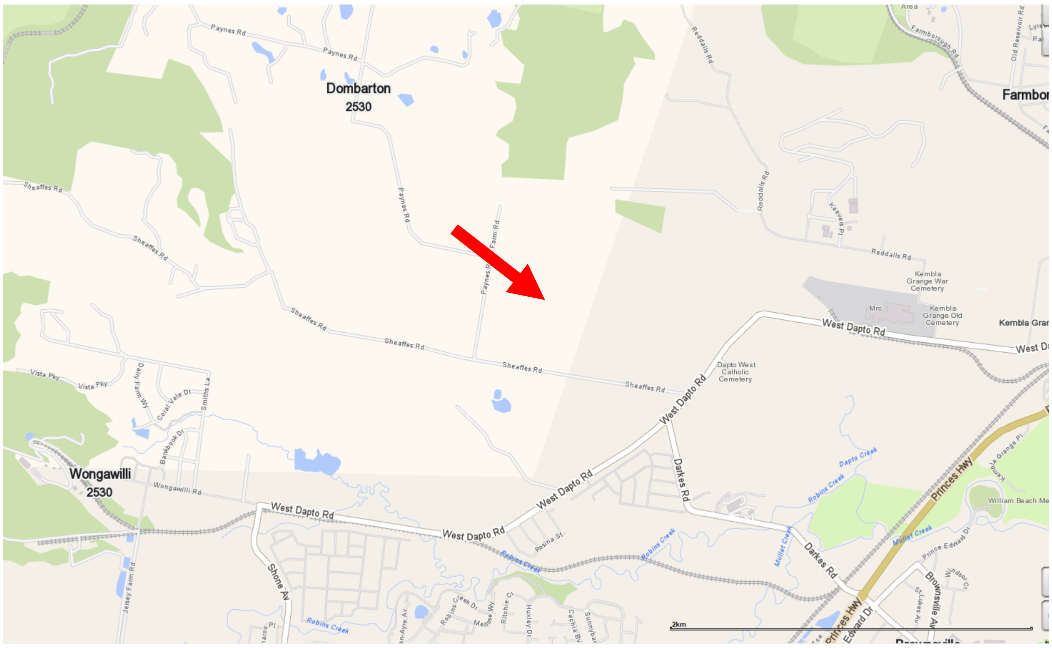


Diagram 1: Location of subject site, (Red arrow) (whereis.com.au, 2018).

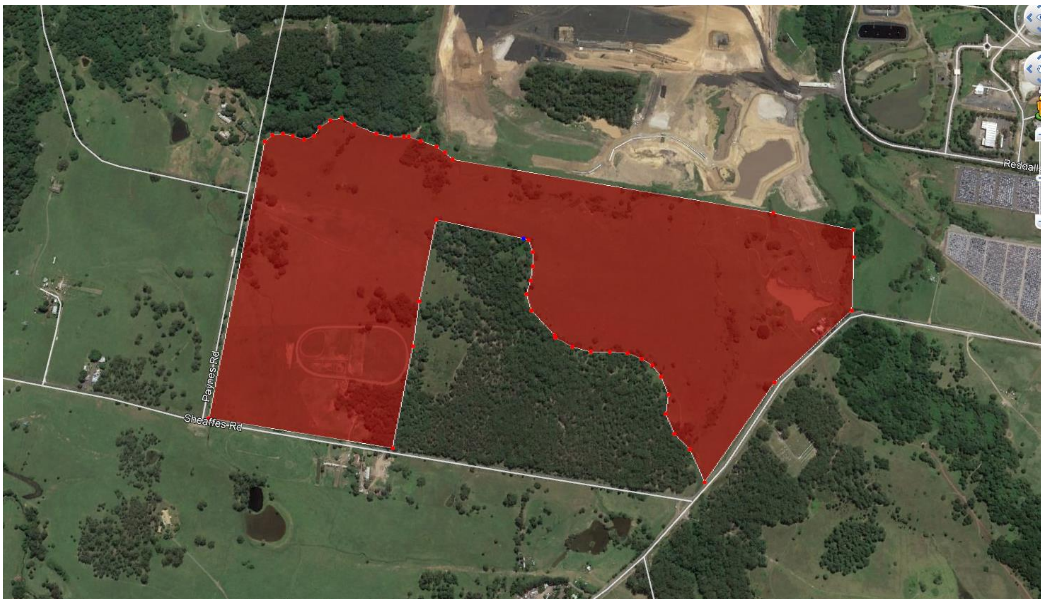


Diagram 2: Location of the study area (Google Earth, 2018).

2 METHODOLOGY

2.1 To record the health and condition of the trees, a Visual Tree Assessment (VTA) was undertaken on the subject trees on 26th November 2018. An additional site inspection was undertaken on 14th January 2019 of the eastern portion of the site, IN2 area. A current site inspection was undertaken on 4th June 2020. This method of tree evaluation is adapted from Matheny and Clark, 1994 and is recognised by The International Society of Arboriculture. Individual tree assessments are listed in Appendix 2 of this report. All inspections were undertaken from the ground. No diagnostic devices were used on these trees.

2.2 This report is only concerned with trees on the site that come under the Tree management permit policy that is part of the Wollongong City Council Development Control Plan, 2009 (Chapter E17 Preservation and management of Trees and vegetation). Under this Chapter (E17), a person must not ringbark, cut down, top, lop, remove, injure or wilfully destroy any prescribed tree or other vegetation, without development consent or a permit being granted by Council. Refer to Part 3 (Chapter E17) Definitions for the meaning of 'prescribed tree' and 'prescribed other vegetation'

Two application processes have been established to deal with the assessment and approval for prescribed trees:

a) Tree Management Permit (generally for individual/small scale tree removal and pruning in urban areas) - refer to Council's website for the Tree Management Permit Policy;

b) Development consent via either Complying Development or Development Application. This Chapter of the DCP should be read in conjunction with clauses 5.9 Preservation of trees or vegetation, 5.10 Heritage conservation, 5.11 Bush fire hazard reduction work and 7.2 Natural resource sensitivity – biodiversity of Wollongong Local Environmental Plan 2009.

This Report is required as per clause (b) via a Development Application for the site. This report takes no account of any tree or shrub under three (3) metres in height.

2.3 Height: The heights and distances within this report have been measured with a Bosch DLE 50 laser measure.

2.4 Tree Protection Zones (TPZ): The Tree Protection Zone (TPZ) is the principal means of protecting trees on development sites. The TPZ is a combination of the root area and crown area requiring protection. It is an area isolated from construction disturbance, so that the tree remains viable. TPZ's have been calculated for each tree. The TPZ calculation is based on the Australian Standard *Protection of trees on development sites,* AS 4970, 2009.

2.5 Structural Root Zone (SRZ): The Structural Root Zone (SRZ) is a specified distance measured from the trunk that is set aside for the protection of tree roots, both structural and fibrous. The woody root growth and soil cohesion in this area are necessary to hold the tree upright. The TPZ and SRZ are measured as a radial measurement from the trunk. <u>No roots should be severed within this area.</u> A detailed methodology on the TPZ and SRZ calculations can be found in Appendix 4.

2.6 Safe Useful Life Expectancy (SULE): The subject trees were assessed for a Safe Useful Life Expectancy (SULE). The SULE rating for each tree can be seen the Tree Assessment Schedule (Appendix 2). A detailed explanation of SULE can be found in Appendix 3.

2.7 Plans provided: Native Vegetation and Vegetation Impact and Exclusion Zones plan by Cardno Limited and Preliminary residential lot layout by Cardno dated 01.03.19.

2.8 Impact Assessment: An impact assessment was conducted on the site trees. This was conducted by assessing the site survey and plans provided by Cardno Limited. The plans provided were assessed for the following:

- Reduced Level (R.L.) at base of tree.
- Incursions into the Tree Protection Zone (TPZ).
- Assessment of the likely impact of the works.

3 RELEVANT BACKGROUND INFORMATION

3.1 The site is bounded by Sheaffes Road, Paynes Road and West Dapto Road, Kembla Grange. The site is generally level with the majority of the site having been highly modified and cleared for pastoral purposes. A small creek (Sheaffe's Creek) runs along the northern border of the site.

3.2 Soil mapping of Illawarra area by Hazelton and Tille (1990) indicates the occurrence of the Gwynneville Soil Landscape Group over the site. Soils of the Gwynneville Group are derived from Illawarra Coal Measures. Present are resistant interbedded quartz-lithic sandstone, grey siltstone and claystone, carbonaceous claystone, clay and laminate. Characterised by Undulating to steep hills that include broad to moderate ridges, steeply inclined to moderately inclined foot slopes and isolated rises on the coastal plain. The soil landscape is characterised by localised structural benches up to 80 metres wide, localised bedrock outcrops and deep colluvial deposits (Hazelton and Tille 1990).

3.3 **Environmental Significance**: All trees in the Wollongong Local Government Area are protected and cannot be removed without the adequate requirements being met. Specifications relating to what can and cannot be removed are detailed in the Wollongong City Council Development Control Plan (DCP), 2009 in Chapter E17 *'Preservation of trees & management of trees and vegetation'*. This DCP protects all trees above three (3) metres in height with a girth of twenty (20) centimetres or more, measured at a distance of one hundred (100) centimetres above the ground.

3.4 **Illegal tree removal:** Damaging or removing trees can result in heavy fines. Local Government does have the authority to issue on the spot fines known as penalty infringement notices (PINS) starting from $3,000 or can elect to have a potential tree damaging incident addressed in the Local Court. Recent cases, for example, include two (2) mature trees removed for development (Sutherland Shire Council (SSC) v Palamara, 2008) costing $4,500 in fines and $5,000 in court costs. SSC v El-Hage, 2010 concerning illegal tree removal of a single tree costing $31,500 in fines and $5,000 in costs. Poisoning trees can also incur substantial fines (SSC v Hill) resulted in a single tree fine that totalled $14,000 plus a $10,000 bond for a replacement tree. All of the above cases resulted in a criminal conviction for the guilty parties.

3.5 OEH Native vegetation Mapping: The online Native Vegetation Regulatory (NVR) Map was prepared by Office of Environment and Heritage (OEH) under Part 5A of the amended *Local Land Services Act 2013* (LLS Act) and supporting regulation.

The Native Vegetation Regulatory Map is a tool to give landholders certainty when planning future management of their land. The Map is a regulatory requirement. Part 5A of the Local Land Services Act 2013 (LLS Act), requires the Chief Executive of the Office of Environment and Heritage (OEH) to prepare and maintain a Native Vegetation Regulatory (NVR) Map (Diagram 2).

The NVR Map generally covers rural land in NSW. It categorises land where management of native vegetation can occur without approval or where management of native vegetation may be carried out in accordance with Part 5A of the LLS Act. A summary of categories used in the NVR Map is shown below (Table 1). As shown in Diagram 2 the land is not regulated by Part 5A of the LLS Act.

Colour	Category	Definition
Blue	**Category 1** Unregulated Land	Rural lands where clearing is not regulated by the Part 5A of the LLS Act. Other legislation may apply.
Yellow	**Category 2** Regulated Land	Rural lands where clearing is regulated and can be carried out in accordance with the Part 5A of the LLS Act or other legislation. This includes complying with the Codes and Allowable activities.
Orange	**Category 2** Vulnerable Regulated Land	Rural land where clearing of native vegetation is more restricted than on other Category 2 land. This includes steep and highly erodible lands and riparian land and special category land (as declared).
Pink	**Category 2** Sensitive Regulated Land	Rural lands where clearing of native vegetation is more restricted than other Category 2 land. This includes lands that are Sensitive Lands due to factors such as the presence of coastal wetlands, littoral rainforests, rainforest, or land that is subject to protection covenants such as conservation or incentive property vegetation plans.
Grey	Excluded Land	Land not regulated by the Part 5A of the LLS Act. This land includes urban zones, environmental conservation zones and R5 large lot residential as gazetted under a Local Environment Plan (LEP). It also includes public conservation lands such as National Parks and State Forests.

Table 1: Categories used in the NVR Map (OEH 2018)

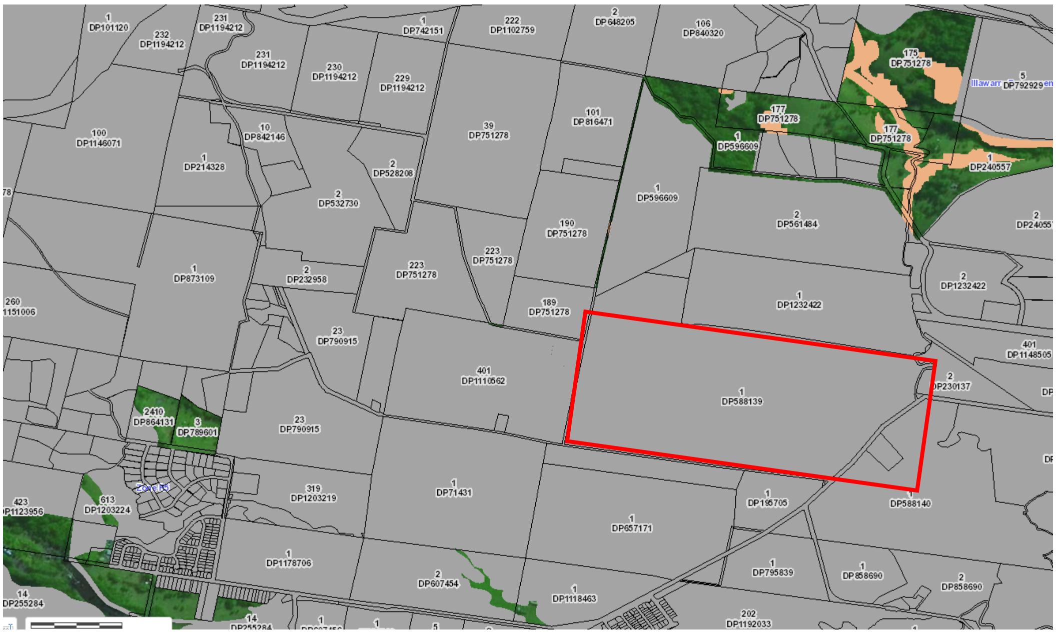


Diagram 2: Native Vegetation Regulatory Map near the approximate site area (OEH 2018).

3.6 **Zoning:** The site is zoned as R2 and E2, E3 and IN2 based on the Wollongong Local Environmental Plan 2009 (LEP 2009, Diagram 3). These being Zone R2 *Low density residential*, Zone E2 *Environmental conservation.* Zone E3 *Environmental management* and IN2 *Light Industrial.*

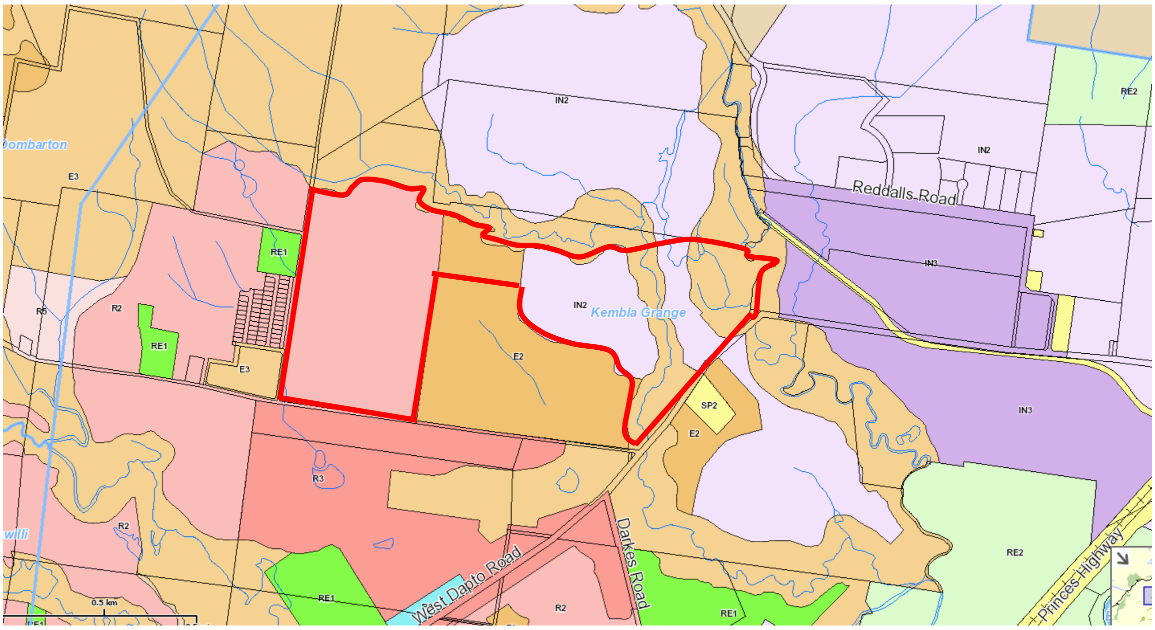


Diagram 3: WCC LGA zoning map (WCC Dekho 2018)

3.7 Diagram 4 shows portions of the study area being mapped as Natural resource sensitivity area (WCC LEP). Section 7.2 of the LEP is listed below.

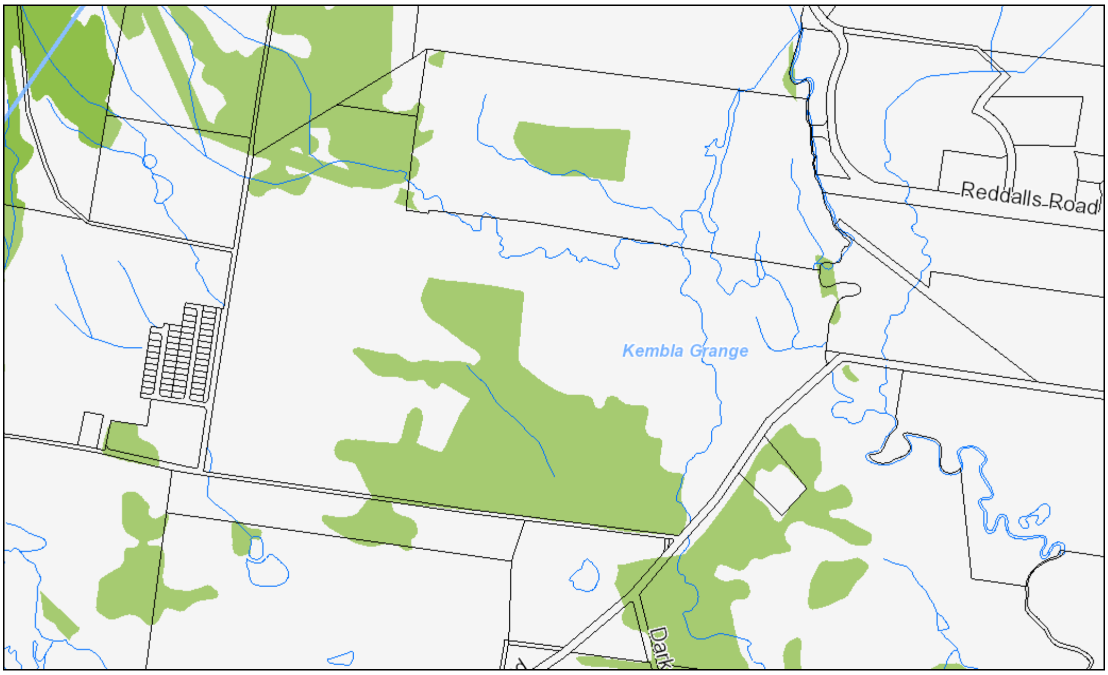


Diagram 4: Image showing the area mapped as Natural resource sensitivity area (WCC Dekho 2019)

3.8 **The Site Trees:** The site was inspected on 26th November 2018 and a subsequent inspection on 14th January 2019 of the IN2 area. A current site inspection was undertaken on 4th June 2020. Some trees have been given a unique number for this site and can be viewed on the Tree Protection Plan (Appendix 1). This plan is based on the plan provided by Cardno Limited. All site trees individually assessed have been tagged to correspond with the Tree Protection Plan.

3.9 The site has previously been utilised for farming purposes and, as such, has been extensively cleared of the majority of vegetation (Plate 1). Along the western boundary is a large, dense cluster of trees (Trees 1-20). Not far from Paynes Road is Heritage item 6326. This item is listed as; *Group of Bunya Pines, Moreton Bay Figs and Hills Figs*. This group of trees is numbered as 1-20 and appear to be associated with an old homestead that would have been located in this area. Since the 2019 site inspection, Tree 11 is almost dead and Tree 8 has gone into decline (Plate 1a). Plate 1b shows the extensive borer damage however this will be a secondary issue and not the cause of the decline.

Plate 1: Image showing the general layout of the site.
Heritage item 6326 can also be seen in this image in 2019. P. Vezgoff.

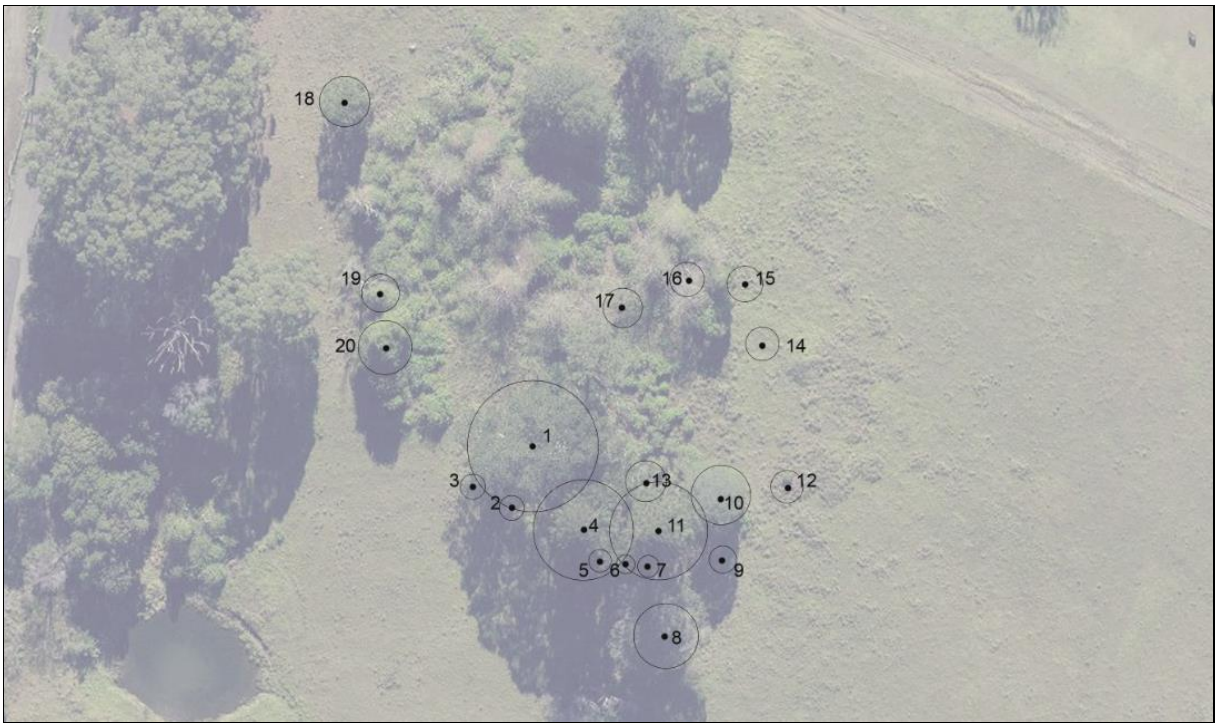


Diagram 5: Image showing the approximate tree locations of Trees 1-20 (Six Maps 2012)

Plate 1a: Image showing the almost dead Tree 11 in June 2020. **Plate 1b:** The base of Tree 11 had extensive borer damage. P. Vezgoff.

3.10 Trees 4 and 11 are large Bunya Pines (Plate 2). This species is known to eventually reach heights of 30 – 50 metres. The species has a broad conical with a dome shaped upper crown and has long been cultivated within the urban environment. The proportions of this tree are often statuesque and emergent specimens become prominent within the landscape due to their unique shape. Mature specimens can be found in established gardens, as individual specimen plantings, or small stands on large properties and in older public parks. Many of these trees in NSW may be heritage listed as individual items or as a component of the curtilage of a significant building. They are often reminders of old farming homesteads that have long since vanished as is the case at this site.

3.11 Trees 4 and 11 did have large portions of fruit within the canopy of these trees at the time of inspection (Plate 3). Although fruit growth of this species is usually encountered on a cycle of 2-3 years, a reduced volume or an absence of fruit production has been recorded in the intermittent years. On most occasions when the fruit falls it breaks apart and it falls through the tree's canopy.

Plate 2: Image showing heritage item 6326 in 2019. P. Vezgoff.

Plate 3: Image showing the size of cones present at the time of inspection. P. Vezgoff.

3.12 Tree 1 is a large mature Moreton Bay Fig. Although associated with a heritage group of trees, the form of this tree is poor due to the loss of one of the main stems, most likely due to storm damage (Plate 4). Due to the loss of a large portion of the canopy, a secondary canopy is forming around the lower portion of the tree. This tree is generally in good health however the cavity within the basal area and the asymmetrical canopy create a tree that is not a particularly good long term specimen to retain in a public open space.

Plate 4: Image showing Tree 1. The cavity can be seen at the base of the tree and the poor form of the upper canopy is apparent. P. Vezgoff.

3.13 In terms of Heritage value (not including current health or size) only Trees 1, 4, 7-11 and 13 would be considered to fit the WCC Heritage description of the matching species for Heritage item 6326.

3.14 Across the rest of the site are some large remnant, free standing specimens (Plate 5). Due to the age of these trees that have eluded the clearing process, they have survived to become large specimens with many hollows and stem fractures. These trees will likely require habitat inspections prior to any removal occurring. I have detailed the individual trees as having hollows within the *Tree Schedule* (Appendix 2) of this report. A Vegetation Management Plan is likely to make recommendations regarding the hollow bearing trees and it is recommended that this Arborist Report is provided so that the relevant trees can be identified and further assessed, as required.

3.15 Other large remnant trees assessed within the study area include Trees 63, 64 and 65 along with Tree 60, near Paynes Road. As with Tree 65 shown in Plate 5 these remnant trees have many old fractures and hollows that take decades to form, with the trees themselves likely to be well over 180 years old.

Plate 5: Image showing Tree 63 that would be considered a remnant specimen. P. Vezgoff.

3.16 Majority of the site trees are Forest red gum *(Eucalyptus tereticornis)*, Blackbutt *(Eucalyptus pilularis)* along the Paynes Road boundary. There are also scattered specimens of Cheese tree *(Glochidion ferdinandi).* Most of the understory in this area has been cleared (Plate 6). Since the 2019 inspection, Trees 14, 50 and 55 have suffered large diameter limb failure due to storm damage. It is possible a micro storm event occurred in this location as the damage appears to have occurred at around the same time.

Plate 6: Image showing the vegetation along the Paynes Road boundary. P. Vezgoff.

3.17 The creek along the northern boundary has many native trees and shrubs however it is heavily weed infested, mostly with *Lantana camara* (Plate 7). This area is within the E3 zoned area. Also growing around this area *Melaleuca styphelioides*, Forest red gum *(Eucalyptus tereticornis)* with scattered specimens of *Acacia maidenii* and *Acacia mearnsii*, Willow Bottle brush *(Callistemon salignus)* and Cheese tree *(Glochidion ferdinandi).*

Plate 7: Image showing the E3 vegetation along the northern boundary creek. P. Vezgoff.

Plate 8: Image showing the general layout of the site. P. Vezgoff.

3.18 The area zoned Industrial, just west of West Dapto Road is mostly clear, the creek along the northern boundary has many native trees and shrubs however it is heavily weed infested, mostly with *Lantana camara* (Plate 7). This area is within the E3 zoned area. Also growing around this area *Melaleuca styphelioides,* Forest red gum *(Eucalyptus tereticornis)* with scattered specimens of *Acacia maidenii* and *Acacia mearnsii,* Willow Bottle brush *(Callistemon salignus)* and Cheese tree *(Glochidion ferdinandi).* The vegetation in this area is all regrowth with the transition trees between the IN2 zoned area and the E2 zoned area. As seen in Diagram 5, the majority of this area has been totally cleared of any remnant vegetation.

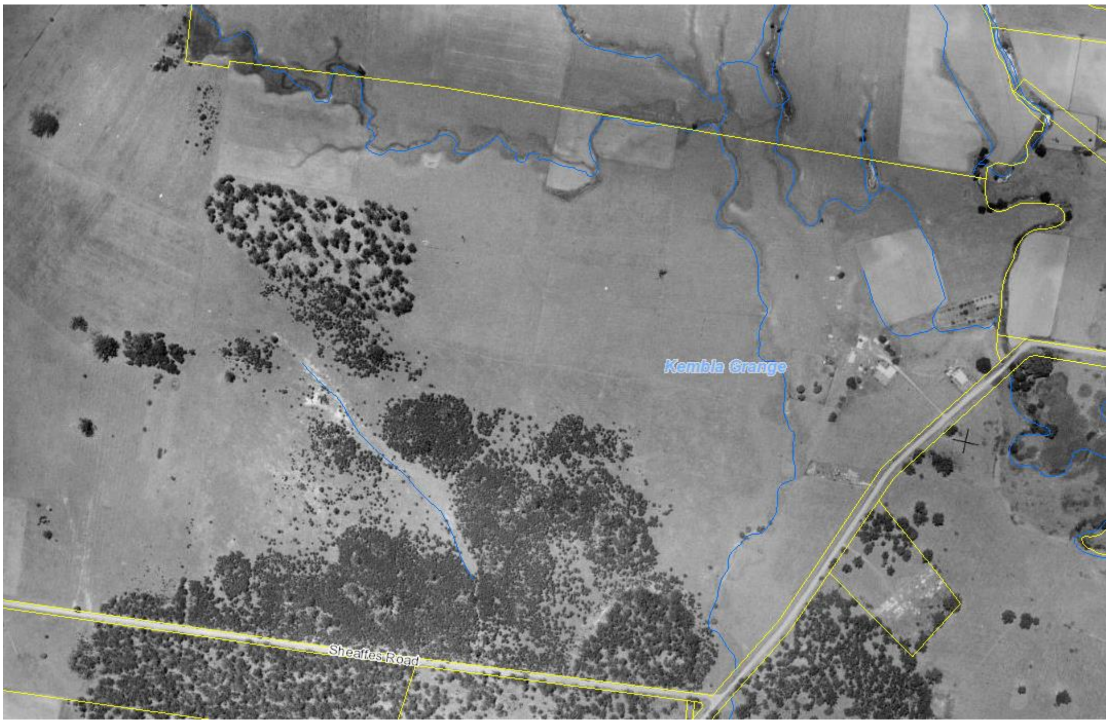


Diagram 5: Image showing the eastern area in 1948 (WCC Dekho 2019).

3.19 Between the Industrial area and West Dapto Road are scattered specimens of *Acacia maidenii,* and Cheese tree (Plate 9). Within this area is a collapsed old residential dwelling that is surround by mixed species being Camphor laurel *(Cinnamomum camphora),* Port jackson fig *(Ficus rubiginosa),* Cockspur coral tree *(Erythrina crista-galli),* Cheese tree *(Glochidion ferdinandi),* White stringy bark *(Eucalyptus globoidia).* Tree 152 is a large specimen of Moreton bay fig *(Ficus macrophylla)* that was most likely planted in association with the cottage. This tree has gown into a large significant tree that can be seen from West Dapto Road (Plate 10). This vegetation surrounds an old dwelling that can be seen in Diagram 5. Based on Diagram 5, Tree 152 will be approximately 100 years old.

Plate 9: Image showing the open area in the eastern section of the site. P. Vezgoff.

Plate 10: Image showing Tree 152 that, although not remnant, would be considered a significant specimen. P. Vezgoff.

3.20 Plate 11 shows Tree group 156 that consists of sapling regrowth containing mixed species of Silky oak, Cheese Tree, Privet, Pittosporum. This group is similar to the other groups numbered as 164-168 located along the northern boundary and a small stream that was not flowing at the time of inspection.

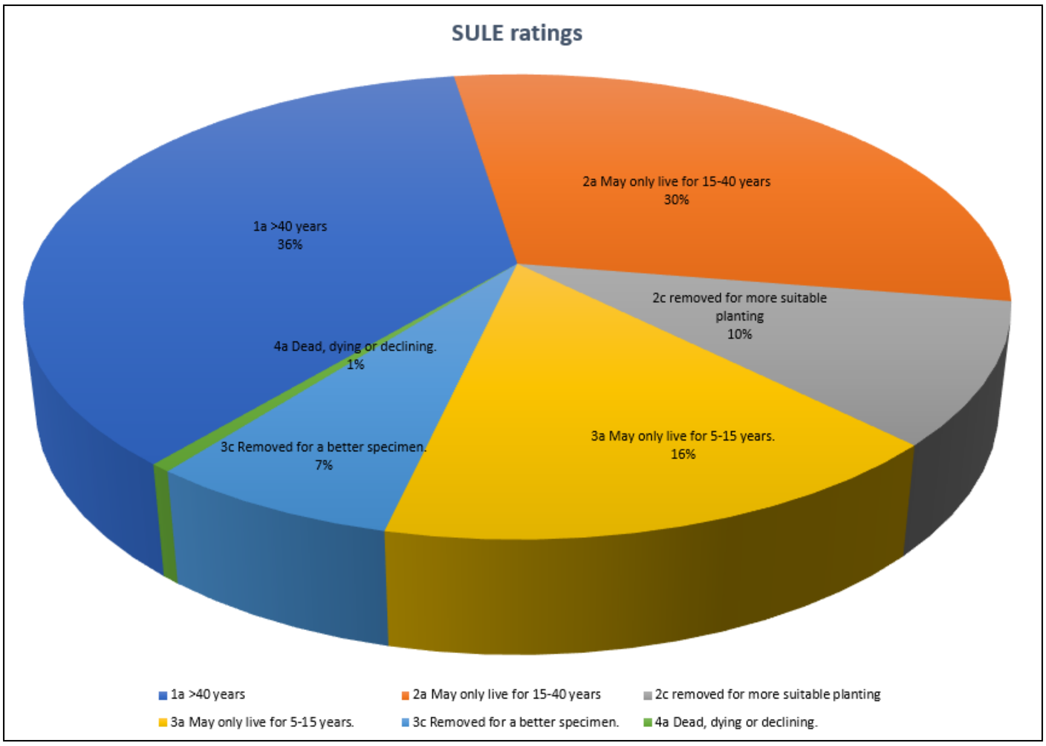
3.21 Two (2) of the larger trees along West Dapto Road are numbered as Trees 148 and 149 near west Dapto Road (Plate 12). These trees are large specimens of White stringy bark *(Eucalyptus globoidia)*. These trees are not remnant specimens but were most likely planted in association with a small dwelling that was once in this location.

Plate 11: Image showing Tree group 156.
This group is similar to the other groups numbered as 164-168. P. Vezgoff.

3.22 Tree groups 169 and 170 are located in the far eastern corner of the site. These areas are dense weed growth consisting of Coral tree *(Erythrina x sykesii)* and Weeping willow *(Salix babylonica)*. Both of these species are listed as exempt weed species in the WCC DCP.

Plate 12: Image showing Trees 148 and 149 near west Dapto Road. P. Vezgoff.

3.23 SULE: Safe Useful Life Expectancy (SULE) is a method of evaluating individual trees. The evaluation is a subjective assessment, not an absolute judgement, because the nature of trees and opinions on trees can vary greatly. SULE assessments are made only by those who are experienced and knowledgeable in tree management. SULE is generally accepted and used world-wide as a method of evaluating trees. Each category has a number of sub-categories. These sub-categories should always be recorded to help future users of the information appreciate the reason for each allocation decision. It is normal to have instances where trees will not fit neatly into a single SULE category. The assessment of the site trees can be seen in Graph 1. In general, the trees were mostly assessed as being in good health. SULE results show that 36% of the site's tree population has a life expectancy of greater than forty (40) years and 30% had a medium life expectancy and trees that were less significant totalled 33%.



Graph 1: SULE ratings for the site.

3.24 Potential habitat: For the purpose of this report, WCC defines a "Habitat tree" as follows;

Habitat tree means any tree which is a nectar feeding tree, roost and nest tree or a hollow-bearing tree which is suitable for nesting birds, arboreal marsupials (possums), micro-bats or which support the growth of locally indigenous epiphytic plants such as orchids. (DCP, 2010, Chapter E17 *'Preservation of trees & management of trees and vegetation').*

Hollow bearing trees were noted as being Trees 60, 63, 65, 76, 105, 106, 107, 108, 120-123. These hollows were observed from ground level thus not possible to determine if any habitat was present.

Plate 9: Image showing Tree 60 one of the several remnant trees on site. P. Vezgoff.

3.25 Impacts: Final plans will be required to be prepared in accordance with the recommendations within this report. BULK EARTHWORKS PLANS TO BE PROVIDED Based on the plans to be provided the trees required to be removed will be determined: These removals are due to the proposed bulk earth works shown in the plan titled *Concept earth works volumes* provided for this report. TBC.

3.26 Due to the sudden death of Tree 11, which is unusual as this species can live for hundreds of years, further scientific testing has been recommended and undertaken. This group of trees (1-13) being a Heritage item would normally be required to be retained.

3.27 Soil and tissue samples were supplied to the Royal Botanic Gardens Pathology unit for pathogen testing. The results show that the more common soil borne pathogens that are extremely detrimental to tree health, being *Armillaria luteobubalina* and *Phytophthora cinnamomic*, were not present in the test. *Antrodia* genus, a species of Brown rot was detected in the tissue samples. Unfortunately information about this pathogen is limited.

3.28 At this stage, it would be anticipated that Council will want the design to retain Trees numbered as 1, 4, 7-11 and 13.

Diagram 4: *Plan titled Concept earth works volumes* ***- to be provided****.*

4 RECOMMENDATIONS

4.1 A Project Arborist should be appointed to oversee the arboricultural related works for the project. The Project Arborist should be used for arboricultural certification services and also used as a point of contact should any questions arise during the project. As specified in AS 4970, 2009, a Project Arborist is a person with a minimum Australian Qualification Framework (AQF) level 5 Diploma of Arboriculture or Horticulture qualification.

4.2 Design around the Heritage item is recommended to retain Trees numbered as 1, 4, 7-11 and 13. A fifteen (15) metre set back is recommended for the Bunya Pines due to the mature height this species can reach. No playground or seating should be placed below these trees due to the size of fruit that they are known to produce. Effectively the area below these trees may have to be kept free of public use by installing a small fence to restrict public use (Plate.

Plate 10: Image showing a large mature tree fenced in the Hurstville area. P. Vezgoff.

4.3 Consideration to retain Tree 152 is recommended as Council has required smaller specimens of the same species to be retained on similar developments in the area.

4.4 The vegetation line along the northern boundary of the R2 zoned area and the vegetation line of the E2 area should be surveyed to enable this to be added to the bulk earthwork drawings. This needs to be completed to help determine the full extent of vegetation to be removed.

4.5 Only preliminary designs have been provided for the purpose of this report. Once designs have been finalised this development will require further assessment in relation to the site trees. Service plans will also be required to assess breaches to TPZ areas for each tree. The bulk earth works plan will be required to fully assess tree impacts. The eastern portion of the site still requires the trees to be assessed and included in this report.

4.6 A site-specific tree protection plan and specifications will be required to ensure trees to be retained will be protected during the construction process. This report can be updated for this purpose.

4.7 In general, a 10% encroachment of a TPZ is possible. Further incursions into the TPZ for each tree will require further assessment once the plans have progressed.

4.8 If there are any questions regarding how close a structure or path can be to any of the site trees then Moore Trees shall be contacted.

If you have any questions in relation to this report, please contact me.

Paul Vezgoff
Consulting Arborist
Dip Arb (Dist), Arb III, Hort cert, AA, ISA

12th December 2018
Updated 11 March 2019
Updated 24 June 2020
Updated 11 August 2020

Appendix 1

Tree Protection Plan TBC

Current only shows approximate tree locations.

Paynes Rd
Sheaffes Rd
Dapto Rd
1-20
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Appendix 2

Tree health & condition assessment schedule

TREE HEALTH AND CONDITION ASSESSMENT SCHEDULE – 206 West Dapto Road, Kembla Grange NSW 2526

Tree	Species	Height (m)	Spread (m)	DBH (m)	Live canopy %	Defects	SULE	Condition	Age	Comments	TPZ (m)	SRZ (m)
1	Moreton bay fig (Ficus macrophylla)	19	15	3	80	Open cavity with evidence of decay	2c removed for more suitable planting	Good	Mature	Large sections of dead wood cavity at bas	36	5.1
2	Acacia maidenii	5	3	0.2	60	Stem wounds	3c Removed for a better specimen.	Poor	Mature		2.4	1.9
3	Acacia maidenii	8	3	0.4	60	No Value	3a May only live for 5-15 years.	Poor	Mature		4.8	2.4
4	Bunya pine (Araucaria bidwillii)	27	6	1	80	No visual defects	1a >40 years	Good	Mature		12	3.5
5	Acacia maidenii	6	3	0.4	60	No Value	3a May only live for 5-15 years.	Poor	Mature		4.8	2.4
6	Bunya pine (Araucaria bidwillii)	15	5	0.5	80	No visual defects	1a- 3a May only live for 5-15 years.	Good	Mature	2020 insp. Tip is now dying. Possible soil pathogen.	6	2.6
7	Bunya pine (Araucaria bidwillii)	12	6	0.6	70	No visual defects	1a >40 years	Good	Mature		7.2	2.8
8	Pinus pinea	15	10	1	70	No visual defects	2a May only live for 15-40 years	Fair	Mature		12	3.3
9	Bunya pine (Araucaria bidwillii)	5	2	0.1	80	No visual defects	1a >40 years	Good	Mature		1.2	1.6
10	Bunya pine (Araucaria bidwillii)	15	4	0.7	100	No visual defects	1a >40 years	Good	Mature		8.4	2.9
11	Bunya pine (Araucaria bidwillii)	27	7	1.3	100	Included codom stems	4a Dead, dying or declining.	Poor	Mature	2020 insp. Tree is almost dead. Possible soil pathogen.	15.6	3.8
12	Red Ash (Alphitona excelsa)	10	5	0.5	80	No visual defects	2a May only live for 15-40 years	Good	Mature		6	2.6
13	Bunya pine (Araucaria bidwillii)	12	4	0.4	80	No visual defects	1a >40 years	Good	Mature		4.8	2.4
14	Acacia maidenii	5	3	0.2	80	Storm damage	4a Dead, dying or declining.	Poor	Mature	2020 insp. Tree has split.	2.4	1.9
15	Acacia maidenii	10	5	0.6	70	Included codom stems	3a May only live for 5-15 years.	Good	Mature	Split trunk	7.2	2.8
16	Cheese tree (Glochidion ferdinandi)	10	5	0.5	90	No visual defects	1a >40 years	Good	Mature		6	2.8
17	Cheese tree (Glochidion ferdinandi)	10	5	0.5	90	No visual defects	1a >40 years	Good	Mature		6	2.8
18	Cheese tree (Glochidion ferdinandi)	10	5	0.5	90	No visual defects	1a >40 years	Good	Mature		6	2.8
19	Cheese tree (Glochidion ferdinandi)	7	4	0.5	60	No visual defects	3a May only live for 5-15 years.	Poor	Mature	Covered in vine	6	2.8

Tree	Species	Height (m)	Spread (m)	DBH (m)	Live canopy %	Defects	SULE	Condition	Age	Comments	TPZ (m)	SRZ (m)
20	Cheese tree (Glochidion ferdinandi)	6	3	0.2	90	No visual defects	1a >40 years	Good	Mature		2.4	1.9
21	Cheese tree (Glochidion ferdinandi)	6	3	0.2	90	No visual defects	1a >40 years	Good	Mature	X7	2.4	1.9
22	Forest red gum (Eucalyptus tereticornis)	15	7	0.8	90	No visual defects	2a May only live for 15-40 years	Good	Mature		9.6	3.1
23	Forest red gum (Eucalyptus tereticornis)	15	7	0.8	90	No visual defects	2a May only live for 15-40 years	Good	Mature		9.6	3.1
24	Forest red gum (Eucalyptus tereticornis)	10	4	0.5	80	Storm damage	2a May only live for 15-40 years	Good	Mature		6	2.6
25	Forest red gum (Eucalyptus tereticornis)	15	7	0.8	80	No visual defects	2a May only live for 15-40 years	Good	Mature		9.6	3.1
26	Forest red gum (Eucalyptus tereticornis)	15	7	0.8	80	No visual defects	2a May only live for 15-40 years	Good	Mature		9.6	3.1
27	Forest red gum (Eucalyptus tereticornis)	15	7	0.8	80	Fruiting body (large)	2a May only live for 15-40 years	Good	Mature		9.6	3.1
28	Forest red gum (Eucalyptus tereticornis)	10	4	0.4	60	Stem wounds	3a May only live for 5-15 years.	Fair	Mature		4.8	2.4
29	Forest red gum (Eucalyptus tereticornis)	15	7	0.8	80	No visual defects	2a May only live for 15-40 years	Good	Mature		9.6	3.1
30	Cheese tree (Glochidion ferdinandi)	6	3	0.2	80	No visual defects	1a >40 years	Good	Mature		2.4	1.9
31	Cheese tree (Glochidion ferdinandi)	6	3	0.2	80	No visual defects	1a >40 years	Good	Mature	X 30 trees	2.4	1.9
32	Blackbutt (Eucalyptus pilularis)	15	5	1	0	No visual defects	4a Dead, dying or declining.	Dead	Dead		12	3.3
33	Blackbutt (Eucalyptus pilularis)	20	10	1	90	No visual defects	1a >40 years	Good	Mature		12	3.5
34	Blackbutt (Eucalyptus pilularis)	20	10	1	90	No visual defects	1a >40 years	Good	Mature		12	3.5
35	Blackbutt (Eucalyptus pilularis)	20	10	1	90	No visual defects	1a >40 years	Good	Mature		12	3.5
36	Blackbutt (Eucalyptus pilularis)	20	10	1	90	No visual defects	1a >40 years	Good	Mature		12	3.5
37	Blackbutt (Eucalyptus pilularis)	20	10	1	90	No visual defects	1a >40 years	Good	Mature		12	3.5
38	Blackbutt (Eucalyptus pilularis)	20	10	1	90	No visual defects	1a >40 years	Good	Mature		12	3.5
39	Blackbutt (Eucalyptus pilularis)	10	4	0.3	90	No visual defects	3a May only live for 5-15 years.	Fair	Mature	Suppressed	3.6	2.4
40	Blackbutt (Eucalyptus pilularis)	10	4	0.3	90	No visual defects	3a May only live for 5-15 years.	Fair	Mature	suppressed	3.6	2.4

Tree	Species	Height (m)	Spread (m)	DBH (m)	Live canopy %	Defects	SULE	Condition	Age	Comments	TPZ (m)	SRZ (m)
41	Blackbutt (Eucalyptus pilularis)	20	10	1	90	No visual defects	1a >40 years	Good	Mature		12	3.5
42	Blackbutt (Eucalyptus pilularis)	20	10	1	90	No visual defects	1a >40 years	Good	Mature		12	3.5
43	Blackbutt (Eucalyptus pilularis)	20	10	1	90	No visual defects	1a >40 years	Good	Mature		12	3.5
44	Blackbutt (Eucalyptus pilularis)	20	10	1	90	No visual defects	1a >40 years	Good	Mature		12	3.5
45	Red Ash (Alphitona excelsa)	8	4	0.4	90	Storm damage	2a May only live for 15-40 years	Good	Mature		4.8	2.4
46	Red Ash (Alphitona excelsa)	8	4	0.4	90	No Value	2a May only live for 15-40 years	Good	Mature		4.8	2.4
47	Rough bark apple (Angophora floribunda)	20	5	0.5	90	No visual defects	2a May only live for 15-40 years	Good	Mature		6	2.6
48	Rough bark apple (Angophora floribunda)	20	5	0.5	90	No visual defects	2a May only live for 15-40 years	Good	Mature		6	2.6
49	Rough bark apple (Angophora floribunda)	20	5	0.5	90	No visual defects	2a May only live for 15-40 years	Good	Mature		6	2.6
50	Rough bark apple (Angophora floribunda)	20	5	0.5	90	Large first order limb has failed	4c Dangerous tree due to failure.	Poor	Mature	2020 insp. Storm damage	6	2.6
51	Rough bark apple (Angophora floribunda)	20	5	0.5	90	No visual defects	2a May only live for 15-40 years	Good	Mature		6	2.6
52	Rough bark apple (Angophora floribunda)	20	5	0.5	90	No visual defects	2a May only live for 15-40 years	Good	Mature		6	2.6
53	Rough bark apple (Angophora floribunda)	20	5	0.5	90	No visual defects	2a May only live for 15-40 years	Good	Mature		6	2.6
54	Rough bark apple (Angophora floribunda)	20	5	0.5	90	No visual defects	2a May only live for 15-40 years	Good	Mature		6	2.6
55	Rough bark apple (Angophora floribunda)	20	5	0.5	90	Large first order limb has failed	4c Dangerous tree due to failure.	Poor	Mature	2020 insp. Storm damage	6	2.6
56	Blackbutt (Eucalyptus pilularis)	18	10	1	20	Included codom stems	4a Dead, dying or declining.	Poor	Mature	2020 insp. Tree now going into senescence .	12	3.7
57	Blackbutt (Eucalyptus pilularis)	8	3	0.3	90	No visual defects	1a >40 years	Good	Mature		3.6	2.2
58	Forest red gum (Eucalyptus tereticornis)	8	3	0.3	90	No visual defects	1a >40 years	Good	Mature		3.6	2.2
59	Blackbutt (Eucalyptus pilularis)	20	10	1	90	No visual defects	2a May only live for 15-40 years	Good	Mature		12	3.6
60	Blackbutt (Eucalyptus pilularis)	28	15	1.5	90	No visual defects	2c removed for more suitable	Good	Mature	Likely habitat hollows	18	4.3

Tree	Species	Height (m)	Spread (m)	DBH (m)	Live canopy %	Defects	SULE	Condition	Age	Comments	TPZ (m)	SRZ (m)
							planting					
61	Forest red gum (Eucalyptus tereticornis)	12	6	1	0	Stem wounds	3c Removed for a better specimen.	Poor	Mature	Horses	12	3.5
62	Cheese tree (Glochidion ferdinandi)	6	3	0.2	95	No visual defects	1a >40 years	Good	Mature		2.4	1.9
63	Blackbutt (Eucalyptus pilularis)	28	15	2	70	Dead wood >50mm	3a May only live for 5-15 years.	Fair	Mature	Likely habitat hollows, Remnant	24	5.7
64	Blackbutt (Eucalyptus pilularis)	20	10	1	0	No visual defects	1a >40 years	Good	Mature		12	3.6
65	Blackbutt (Eucalyptus pilularis)	20	10	1	0	No visual defects	1a >40 years	Good	Mature	Likely habitat hollows	12	3.6
66	Thin-leaved stringy bark (Eucalyptus eugenioides)	12	5	0.5	600	Stem wounds	3a May only live for 5-15 years.	Fair	Mature		6	2.6
67	Blackbutt (Eucalyptus pilularis)	15	8	0.9	800	No visual defects	2a May only live for 15-40 years	Good	Mature		10.8	3.2
68	White topped box (Eucalyptus quadrangulata)	15	8	1	60	No visual defects	3a May only live for 5-15 years.	Fair	Mature		12	3.3
69	Blackbutt (Eucalyptus pilularis)	12	5	0.6	890	No visual defects	1a >40 years	Good	Mature		7.2	2.8
70	White topped box (Eucalyptus quadrangulata)	15	8	0.6	80	No visual defects	2a May only live for 15-40 years	Good	Mature		7.2	2.8
71	Cheese tree (Glochidion ferdinandi)	8	4	0.5	900	No visual defects	1a >40 years	Good	Mature	Group of 3	6	2.8
72	Acacia maidenii	10	5	0.7	60	No visual defects	3a May only live for 5-15 years.	Poor	Mature		8.4	3.2
73	Thin-leaved stringy bark (Eucalyptus eugenioides)	15	7	0.7	800	Included codom stems	1a >40 years	Good	Mature		8.4	3.2
74	Thin-leaved stringy bark (Eucalyptus eugenioides)	10	7	1	60	Storm damage	3b 5-15 but removed for safety or nuisance reasons.	Poor	Mature		12	3.5
75	Thin-leaved stringy bark (Eucalyptus eugenioides)	15	7	0.7	800	Dead wood >50mm	2a May only live for 15-40 years	Fair	Mature		8.4	3.2

Tree	Species	Height (m)	Spread (m)	DBH (m)	Live canopy %	Defects	SULE	Condition	Age	Comments	TPZ (m)	SRZ (m)
76	Thin-leaved stringy bark (Eucalyptus eugenioides)	15	7	0.7	800	No Value	3a May only live for 5-15 years.	Good	Mature	Likely habitat hollows	8.4	3.2
77	Red Ash (Alphitona excelsa)	10	4	0.5	80	No visual defects	1a >40 years	Good	Mature		6	2.6
78	Thin-leaved stringy bark (Eucalyptus eugenioides)	15	7	0.8	80	No visual defects	2a May only live for 15-40 years	Good	Mature		9.6	3.2
79	Thin-leaved stringy bark (Eucalyptus eugenioides)	15	7	0.8	80	No visual defects	2a May only live for 15-40 years	Good	Mature		9.6	3.2
80	Thin-leaved stringy bark (Eucalyptus eugenioides)	18	1	1.1	80	No visual defects	1a >40 years	Good	Mature		13.2	3.2
81	Thin-leaved stringy bark (Eucalyptus eugenioides)	15	7	0.8	80	Included codom stems	2a May only live for 15-40 years	Good	Mature		9.6	3.2
82	Cheese tree (Glochidion ferdinandi)	8	4	0.5	900	No visual defects	1a >40 years	Good	Mature	Group of 3	6	2.8
83	Acacia mearnsii	8	4	0.4	60	No visual defects	3a May only live for 5-15 years.	Poor	Mature		4.8	2.4
84	Cheese tree (Glochidion ferdinandi)	8	4	0.5	900	No visual defects	1a >40 years	Good	Mature	Group of 3	6	2.8
85	Blackbutt (Eucalyptus pilularis)	25	10	1	800	No visual defects	1a >40 years	Good	Mature		12	3.3
86	Blackbutt (Eucalyptus pilularis)	28	10	1	800	No visual defects	1a >40 years	Good	Mature		12	3.3
87	Blackbutt (Eucalyptus pilularis)	25	10	1	800	No visual defects	1a >40 years	Good	Mature		12	3.3
88	Prickly leaved paperbark (Melaleuca stypheloides)	10	5	1.2	890	Storm damage	2a May only live for 15-40 years	Good	Mature		14.4	3.5
89	Cheese tree (Glochidion ferdinandi)	8	4	0.5	900	No visual defects	1a >40 years	Good	Mature		6	2.8
90	Acacia maidenii	8	4	0.4	700	No visual defects	3a May only live for 5-15 years.	Good	Mature		4.8	2.4
91	Blackbutt (Eucalyptus pilularis)	22	10	1	800	No visual defects	1a >40 years	Good	Mature	Two trunks	12	4.1
92	Blackbutt (Eucalyptus pilularis)	15		1	0	No visual defects	No Value	Dead	Dead		12	3.5
93	Cheese tree (Glochidion ferdinandi)	8	4	0.5	900	No visual defects	1a >40 years	Good	Mature	Group of 10	6	2.8
94	Acacia maidenii	8	4	0.4	700	No visual defects	3a May only live for 5-15 years.	Good	Mature		4.8	2.4
95	Acacia maidenii	8	4	0.4	700	No visual defects	3a May only live for 5-15 years.	Good	Mature		4.8	2.4
96	Prickly leaved paperbark (Melaleuca stypheloides)	12	6	0.6	800	No visual defects	1a >40 years	Good	Mature	Backhousia myrtifloia understory	7.2	2.9
97	Prickly leaved paperbark	12	6	0.6	800	No visual defects	1a >40 years	Good	Mature	Backhousia myrtifloia	7.2	2.9

Tree	Species	Height (m)	Spread (m)	DBH (m)	Live canopy %	Defects	SULE	Condition	Age	Comments	TPZ (m)	SRZ (m)
	(Melaleuca stypheloides)									understory		
98	Prickly leaved paperbark (Melaleuca stypheloides)	12	6	0.6	800	No visual defects	1a >40 years	Good	Mature	Backhousia myrtifloia understory	7.2	2.9
99	Prickly leaved paperbark (Melaleuca stypheloides)	12	6	0.6	800	No visual defects	1a >40 years	Good	Mature	Backhousia myrtifloia understory	7.2	2.9
100	Prickly leaved paperbark (Melaleuca stypheloides)	7	4	0.4	95	No visual defects	2c removed for more suitable planting	Good	Mature		4.8	2.4
101	Woollybutt (Eucalyptus longifolia)	19	10	1	70	No visual defects	2a May only live for 15-40 years	Good	Mature		12	3.5
102	Forest red gum (Eucalyptus tereticornis)	18	8	0.9	700	No visual defects	2a May only live for 15-40 years	Good	Mature		10.8	3.2
103	Woollybutt (Eucalyptus longifolia)	19	10	1	70	No visual defects	2a May only live for 15-40 years	Good	Mature		12	3.5
104	Woollybutt (Eucalyptus longifolia)	19	10	1	70	No visual defects	2a May only live for 15-40 years	Good	Mature		12	3.5
105	Woollybutt (Eucalyptus longifolia)	25	10	1	70	No visual defects	2a May only live for 15-40 years	Good	Mature	Likely habitat hollows	12	3.5
106	Woollybutt (Eucalyptus longifolia)	19	10	0.8	70	No visual defects	2a May only live for 15-40 years	Good	Mature	Likely habitat hollows	9.6	3.1
107	Woollybutt (Eucalyptus longifolia)	19	10	0.8	70	No visual defects	2a May only live for 15-40 years	Good	Mature	Likely habitat hollows	9.6	3.1
108	Woollybutt (Eucalyptus longifolia)	19	10	0.8	70	No visual defects	2a May only live for 15-40 years	Good	Mature	Likely habitat hollows	9.6	3.1
109	Woollybutt (Eucalyptus longifolia)	20	10	1.1	0	Fruiting body (large)	2a May only live for 15-40 years	Fair	Mature		13.2	3.5
110	Blackbutt (Eucalyptus pilularis)	20	10	1.2	900	No visual defects	1a >40 years	Good	Mature		14.4	3.6
111	Thin-leaved stringy bark (Eucalyptus eugenioides)	8	4	0.3	90	No visual defects	1a >40 years	Good	Mature		3.6	2.2
112	Melaleuca styphelioides	6	4	0.3	900	No visual defects	1a >40 years	Good	Mature		3.6	2.6
113	White stringy bark(Eucalyptus globoidia)	12	7	0.7	900	No visual defects	1a >40 years	Good	Mature		8.4	3.1
114	White stringy bark(Eucalyptus globoidia)	12	7	0.7	900	No visual defects	1a >40 years	Good	Mature		8.4	3.1
115	White stringy bark(Eucalyptus globoidia)	12	7	0.7	900	No visual defects	1a >40 years	Good	Mature		8.4	3.1
116	White stringy bark(Eucalyptus globoidia)	12	7	0.7	900	No visual defects	1a >40 years	Good	Mature		8.4	3.1
117	Woollybutt (Eucalyptus longifolia)	12	4	0.7	500	No visual defects	3c Removed for a better	Poor	Mature		8.4	2.9

Tree	Species	Height (m)	Spread (m)	DBH (m)	Live canopy %	Defects	SULE	Condition	Age	Comments	TPZ (m)	SRZ (m)
							specimen.					
118	Woollybutt (Eucalyptus longifolia)	19	10	1	70	No visual defects	2a May only live for 15-40 years	Good	Mature		12	3.5
119	Woollybutt (Eucalyptus longifolia)	10	6	0.5	80	No visual defects	2a May only live for 15-40 years	Good	Mature	Likely habitat hollows	6	2.8
120	Woollybutt (Eucalyptus longifolia)	12	6	0.5	80	No visual defects	2a May only live for 15-40 years	Good	Mature	Likely habitat hollows	6	2.8
121	White stringy bark(Eucalyptus globoidia)	5	3	0.3	690	No visual defects	3a May only live for 5-15 years.	Fair	Mature		3.6	2.2
122	Woollybutt (Eucalyptus longifolia)	20	6	0.5	80	No visual defects	2a May only live for 15-40 years	Good	Mature	Likely habitat hollows	6	2.8
123	Woollybutt (Eucalyptus longifolia)	20	6	0.8	700	No visual defects	2a May only live for 15-40 years	Good	Mature	Likely habitat hollows	9.6	3.2
124	Swamp mahogany (Eucalyptus robusta)	12	4	0.5	600	Storm damage	3a May only live for 5-15 years.	Fair	Mature		6	2.6
124	Woollybutt (Eucalyptus longifolia)	20	6	0.8	700	No visual defects	2a May only live for 15-40 years	Good	Mature	Likely habitat hollows	9.6	3.2
125	Woollybutt (Eucalyptus longifolia)	12	6	0.5	80	No visual defects	2a May only live for 15-40 years	Good	Mature	Likely habitat hollows	6	2.8
126	Woollybutt (Eucalyptus longifolia)	12	6	0.5	50	No visual defects	3a May only live for 5-15 years.	Poor	Mature		6	2.8
127	White stringy bark(Eucalyptus globoidia)	12	7	0.7	900	No visual defects	1a >40 years	Good	Mature		8.4	3.1
128	Prickly leaved paperbark (Melaleuca stypheloides)	8	5	0.6	800	No visual defects	2a May only live for 15-40 years	Good	Mature		7.2	2.8
129	White stringy bark(Eucalyptus globoidia)	12	5	0.6	800	No visual defects	1a >40 years	Good	Mature		7.2	2.8
130	White stringy bark(Eucalyptus globoidia)	12	5	0.6	800	No visual defects	1a >40 years	Good	Mature	Group of 4	7.2	2.8
131	Blackbutt (Eucalyptus pilularis)	12	5	0.6	800	No visual defects	1a >40 years	Good	Mature		7.2	2.8
132	White stringy bark(Eucalyptus globoidia)	17	9	0.7	800	No visual defects	1a >40 years	Good	Mature		8.4	2.9
133	White stringy bark(Eucalyptus globoidia)	17	9	0.4	90	No visual defects	1a >40 years	Good	Mature		4.8	2.4
134	White stringy bark(Eucalyptus globoidia)	13	9	0.3	90	No visual defects	1a >40 years	Good	Mature		3.6	2.2
135	White stringy bark(Eucalyptus globoidia)	13	9	0.3	90	No visual defects	1a >40 years	Good	Mature		3.6	2.2

Tree	Species	Height (m)	Spread (m)	DBH (m)	Live canopy %	Defects	SULE	Condition	Age	Comments	TPZ (m)	SRZ (m)
136	Blackbutt (Eucalyptus pilularis)	12	5	0.6	800	No visual defects	1a >40 years	Good	Mature		7.2	2.8
137	Cheese tree (Glochidion ferdinandi)	9	5	0.4	900	No visual defects	2c removed for more suitable planting	Good	Mature		4.8	2.4
138	Melaleuca decora	9	5	0.4	900	No visual defects	2c removed for more suitable planting	Fair	Mature		4.8	2.4
139	Melaleuca decora	9	5	0.4	900	No visual defects	2c removed for more suitable planting	Fair	Mature		4.8	2.4
140	White stringy bark(Eucalyptus globoidia)	16	9	0.6	90	No visual defects	2c removed for more suitable planting	Fair	Mature		7.2	2.8
141	White stringy bark(Eucalyptus globoidia)	16	9	0.6	90	No visual defects	2c removed for more suitable planting	Fair	Mature		7.2	2.8
142	White stringy bark(Eucalyptus globoidia)	16	9	0.6	90	No visual defects	2c removed for more suitable planting	Fair	Mature		7.2	2.8
143	White stringy bark(Eucalyptus globoidia)	16	9	0.6	90	No visual defects	2c removed for more suitable planting	Fair	Mature		7.2	2.8
144	Forest red gum (Eucalyptus tereticornis)	16	9	0.6	90	No visual defects	2c removed for more suitable planting	Fair	Mature		7.2	2.8
145	Melaleuca styphelioides	9	5	0.4	900	No visual defects	2a May only live for 15-40 years	Fair	Mature		4.8	2.4
146	Melaleuca styphelioides	9	5	0.4	900	No visual defects	2a May only live for 15-40 years	Fair	Mature		4.8	2.4
147	Melaleuca styphelioides	9	5	0.4	900	No visual defects	2a May only live for 15-40 years	Fair	Mature		4.8	2.4
148	White stringy bark(Eucalyptus globoidia)	18	11	0.9	90	No visual defects	2a May only live for 15-40 years	Fair	Mature		10.8	3.1
149	White stringy bark(Eucalyptus globoidia)	18	11	0.9	90	No visual defects	2a May only live for 15-40 years	Fair	Mature		10.8	3.1
151	Melaleuca styphelioides	9	5	0.4	900	No visual defects	2a May only live for 15-40 years	Fair	Mature		4.8	2.4
152	Moreton bay fig (Ficus macrophylla)	17	14	2.5	950	No visual defects	1a >40 years	Good	Mature		30	0
153	Cockspur coral tree (Erythrina crista-galli)	12	7	0.9	950	No visual defects	2c removed for more suitable planting	Good	Mature	Bats wing	10.8	3.1
154	Silky oak (Grevillea robusta)	15	5	0.6	900	No visual defects	2c removed for more suitable planting	Fair	Mature		7.2	2.8
155	Port jackson fig (Ficus rubiginosa)	10	7	0.4	90	No visual defects	2c removed for more suitable	Fair	Mature		4.8	2.4

Tree	Species	Height (m)	Spread (m)	DBH (m)	Live canopy %	Defects	SULE	Condition	Age	Comments	TPZ (m)	SRZ (m)
							planting					
156	Mixed species group	7	4	0.25	900	No visual defects	2c removed for more suitable planting	Good	Mature	Group of Silky oak, Cheese Tree, Privet, Pittosporum	3	1.9
157	Moreton bay fig (Ficus macrophylla)	14	6	0.6	950	No visual defects	2c removed for more suitable planting	Good	Mature	Fig attached to old damage paperbark	7.2	2.8
158	Cheese tree (Glochidion ferdinandi)	8	4	0.3	95	No visual defects	2c removed for more suitable planting	Good	Mature	Group of 8	3.6	2.2
159	Acacia maidenii	9	6	0.4	800	No visual defects	3a May only live for 5-15 years.	Fair	Mature		4.8	2.4
160	Acacia maidenii	9	6	0.4	800	No visual defects	3a May only live for 5-15 years.	Fair	Mature		4.8	2.4
161	Acacia maidenii	9	6	0.4	800	No visual defects	3a May only live for 5-15 years.	Fair	Mature		4.8	2.4
162	Camphor laurel (Cinnamomum camphora)	5	2	0.25	95	No visual defects	3c Removed for a better specimen.	Good	Mature		3	1.9
163	Camphor laurel (Cinnamomum camphora)	7	3	0.25	95	No visual defects	3c Removed for a better specimen.	Good	Mature		3	1.9
164	Mixed species group	5	2.5	0.2	90	No visual defects	3c Removed for a better specimen.	Good	Mature	Group of Silky oak, Cheese Tree, Privet, Pittosporum regrowth	3	1.9
165	Mixed species group	5	2.5	0.2	90	No visual defects	3c Removed for a better specimen.	Good	Mature	Group of Silky oak, Cheese Tree, Privet, Pittosporum regrowth	3	1.9
166	Mixed species group	5	2.5	0.2	90	No visual defects	3c Removed for a better specimen.	Good	Mature	Group of Silky oak, Cheese Tree, Privet, Pittosporum regrowth	3	1.9
167	Mixed species group	5	2.5	0.2	90	No visual defects	3c Removed for a better specimen.	Good	Mature	Group of Silky oak, Cheese Tree, Privet, Pittosporum regrowth	3	1.9
168	Coral tree (Erythrina x sykesii)	12	8	.5-.7	100	No visual defects	3c Removed for a better specimen.	Good	Mature	Very large group of mature specimens.	7.2	2.8
169	Weeping willow (Salix babylonica)	14	9	.5-.7	100	No visual defects	3c Removed for a better specimen.	Fair	Mature	Large group along water course	3	1.9
170	Acacia maidenii	5	3	0.2	80	No visual defects	3a May only live for 5-15 years.	Fair	Mature		3	1.9
171	Acacia maidenii	5	3	0.2	80	No visual defects	3a May only live for 5-15 years.	Fair	Mature		3	1.9

Tree	Species	Height (m)	Spread (m)	DBH (m)	Live canopy %	Defects	SULE	Condition	Age	Comments	TPZ (m)	SRZ (m)
172	Acacia maidenii	5	3	0.2	80	No visual defects	3a May only live for 5-15 years.	Fair	Mature		3	1.9
173	Acacia maidenii	5	3	0.2	80	No visual defects	3a May only live for 5-15 years.	Fair	Mature		3	1.9
174	Acacia maidenii	5	3	0.2	80	No visual defects	3a May only live for 5-15 years.	Fair	Mature		3	1.9

KEY

Tree No: Relates to the number allocated to each tree for the Tree Plan.

Height: Height of the tree to the nearest metre.

Spread: The average spread of the canopy measured from the trunk.

DBH: Diameter at breast height. An industry standard for measuring trees at 1.4 metres above ground level, this measurement is used to help calculate Tree Protection Zones.

Live Crown Ratio: Percentage of foliage cover for a particular species.

Age Class:	Young:	Recently planted tree	Semi-mature:< 20% of life expectancy
	Mature:	20-90% of life expectancy	Over-mature:>90% of life expectancy

SULE: See SULE methodology in the Appendix 3

Tree Protection Zone (TPZ): The minimum area set aside for the protection of the trees trunk, canopy and root system throughout the construction process. Breaches of the TPZ will be specified in the recommendations section of the report.

Structural Root Zone (SRZ): The SRZ is a specified distance measured from the trunk that is set aside for the protection of the trees roots both structural and fibrous.

Appendix 3

SULE categories (after Barrell, 2001)[1]

SULE Category	Description
Long	*Trees that appeared to be retainable at the time of assessment for more than 40 years with an acceptable level of risk.*
1a	Structurally sound trees located in positions that can accommodate for future growth
1b	Trees that could be made suitable for retention in the long term by remedial tree care.
1c	Trees of special significance that would warrant extraordinary efforts to secure their long term retention.
Medium	*Trees that appeared to be retainable at the time of assessment for 15-40 years with an acceptable level of risk.*
2a	Trees that may only live for 15-40 years
2b	Trees that could live for more than 40 years but may be removed for safety or nuisance reasons
2c	Trees that could live for more than 40 years but may be removed to prevent interference with more suitable individuals or to provide for new planting.
2d	Trees that could be made suitable for retention in the medium term by remedial tree care.
Short	*Trees that appeared to be retainable at the time of assessment for 5-15 years with an acceptable level of risk.*
3a	Trees that may only live for another 5-15 years
3b	Trees that could live for more than 15 years but may be removed for safety or nuisance reasons.
3c	Trees that could live for more than 15 years but may be removed to prevent interference with more suitable individuals or to provide for a new planting.
3d	Trees that require substantial remedial tree care and are only suitable for retention in the short term.
Remove	*Trees that should be removed within the next five years.*
4a	Dead, dying, suppressed or declining trees because of disease or inhospitable conditions.
4b	Dangerous trees because of instability or loss of adjacent trees
4c	Dangerous trees because of structural defects including cavities, decay, included bark, wounds or poor form.
4d	Damaged trees that are clearly not safe to retain.
4e	Trees that could live for more than 5 years but may be removed to prevent interference with more suitable individuals or to provide for a new planting.
4f	Trees that are damaging or may cause damage to existing structures within 5 years.
4g	Trees that will become dangerous after removal of other trees for the reasons given in (a) to (f).
4h	Trees in categories (a) to (g) that have a high wildlife habitat value and, with appropriate treatment, could be retained subject to regular review.
Small	*Small or young trees that can be reliably moved or replaced.*
5a	Small trees less than 5m in height.
5b	Young trees less than 15 years old but over 5m in height.
5c	Formal hedges and trees intended for regular pruning to artificially control growth.

updated 01/04/01)

1 (Barrell, J. (2001) "SULE: Its use and status into the new millennium" in *Management of mature trees*, Proceedings of the 4th NAAA Tree Management Seminar, NAAA, Sydney.

Appendix 4

TPZ and SRZ methodology

Determining the Tree Protection Zone (TPZ)

The radium of the TPZ is calculated for each tree by multiplying its DBH x 12.

TPZ = DBH x 12

Where

DBH = trunk diameter measured at 1.4 metres above ground

Radius is measured from the centre of the stem at ground level.

A TPZ should not be less than 2 metres no greater than 15 metres (except where crown protection is required.). Some instances may require variations to the TPZ.

The TPZ of palms, other monocots, cycads and tree ferns should not be less than 1 metre outside the crown projection.

Determining the Structural Root Zone (SRZ)

The SRZ is the area required for tree stability. A larger area is required to maintain a viable tree.

The SRZ only needs to be calculated when major encroachment into a TPZ is proposed.

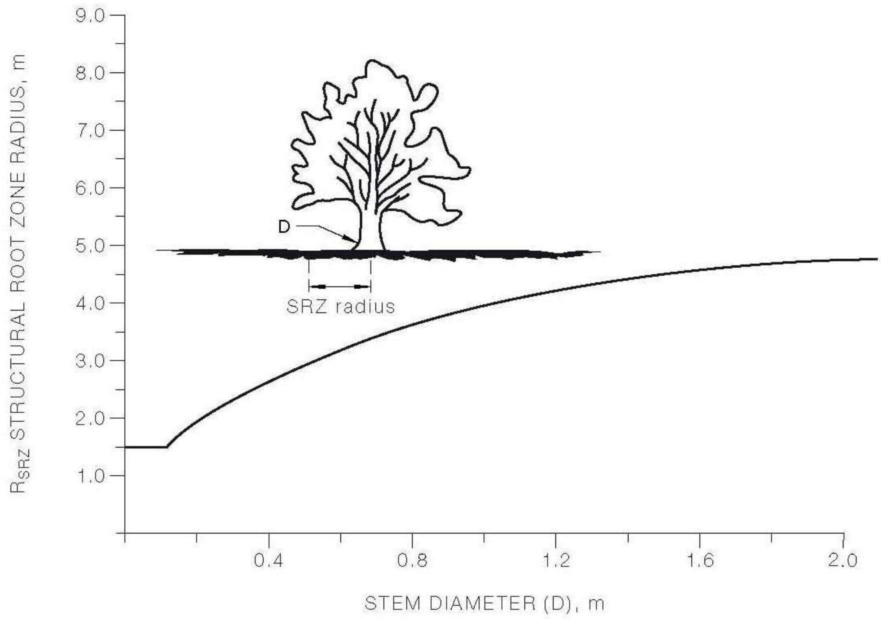
There are many factors that affect the size of the SRZ (e.g. tree height, crown area, soil type, soil moisture). The SRZ may also be influenced by natural or built structures, such as rocks and footings. An indicative SRZ radius can be determined from the trunk diameter measured immediately above the root buttress using the following formula or Figure 1. Root investigation may provide more information on the extent of these roots.

SRZ radius = $(D \times 50)^{0.42} \times 0.64$

Where

D = trunk diameter, in m, measured above the root buttress

NOTE: The SRZ for trees with trunk diameters less than 0.15m will be 1.5m (see Figure 1).



The curve can be expressed by the following formula:
$R_{SRZ} = (D \times 50)^{0.42} \times 0.64$

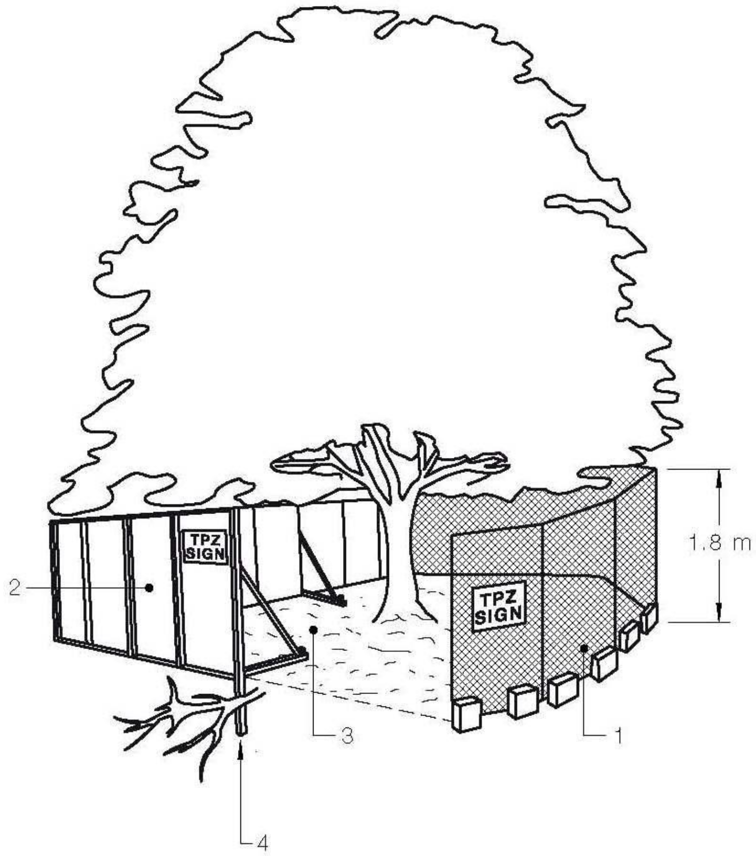
FIGURE 1 - STRUCTURAL ROOT ZONE

Notes:

1 R_{SRZ} is the structural root zone radius.
2 *D* is the stem diameter measured immediately above root buttress.
3 The SRZ for trees less than o.15 metres diameter is 1.5 metres.
4 The SRZ formula and graph do not apply to palms, other monocots, cycads and tree ferns.
5 This does not apply to trees with an asymmetrical root plate.

Appendix 5

Tree protection fencing specifications



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.

Figure 1: Protective fencing as specified in AS 4970, 2009.

Appendix 6

Tree protection sign sign sample

Moore Trees
Tree Consultancy
0411 712 887

Tree Protection Zone

Fence not to be moved without approval from Arborist

Within this fence there is to be
NO
Storage of materials
Trenching or excavation
Washing of tools or equipment

Appendix 7

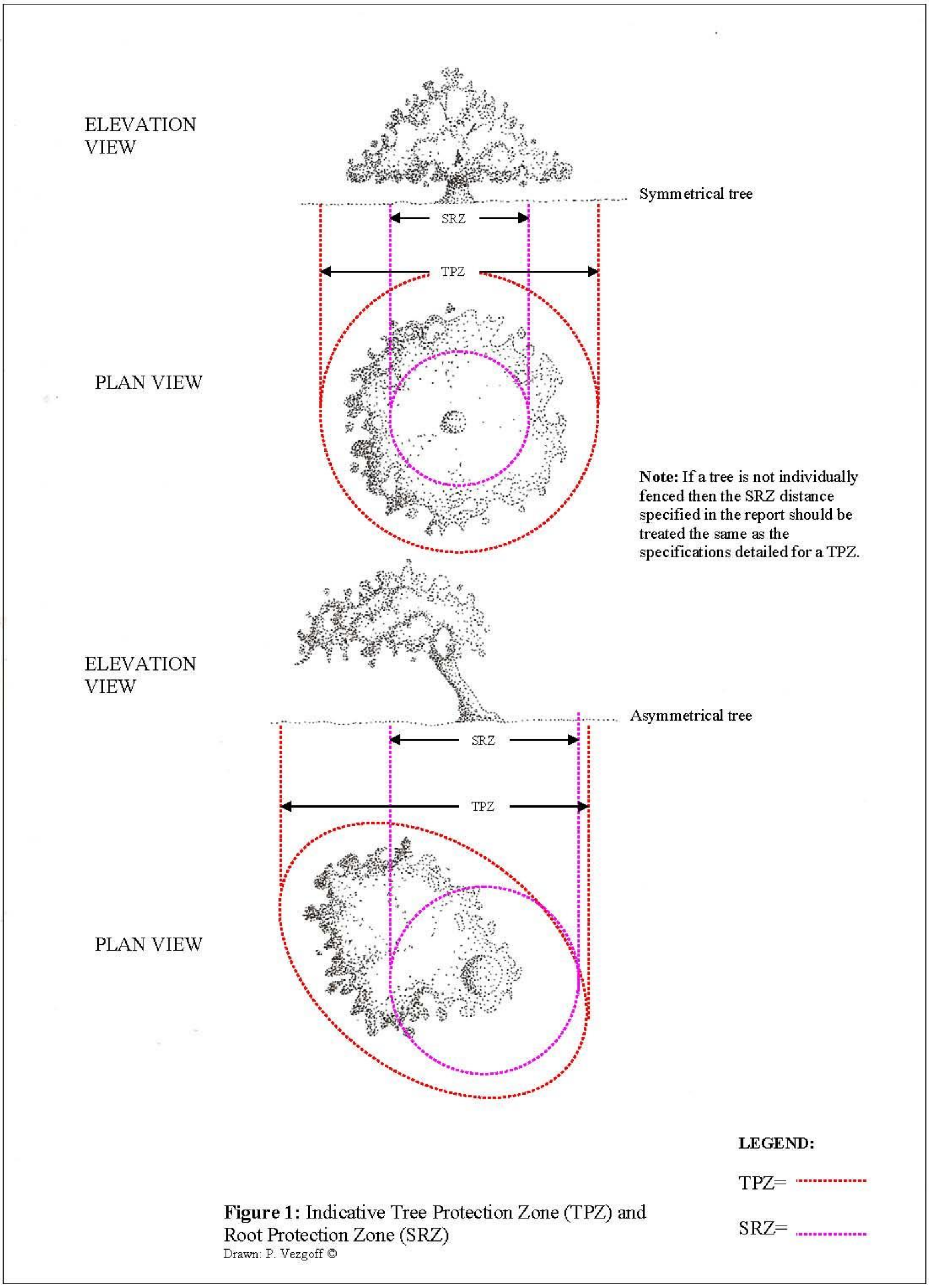


Figure 1: Indicative Tree Protection Zone (TPZ) and Root Protection Zone (SRZ)
Drawn: P. Vezgoff ©

Appendix 8

Tree structure information diagram

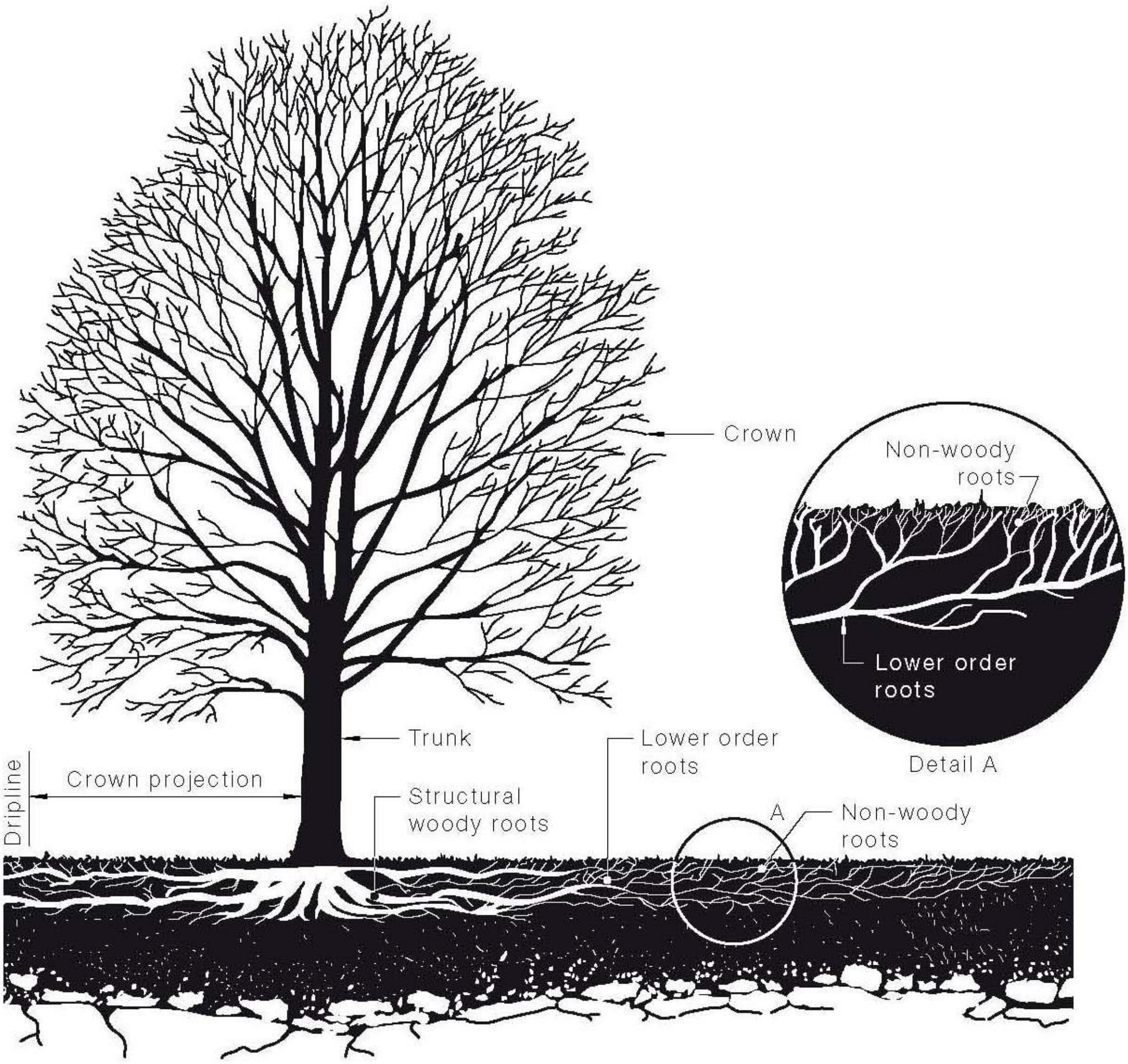


Figure 2: Structure of a tree in a normal growing environment (AS 4970, 2009.).

Appendix 9

Explanatory Notes

- **Mathematical abbreviations:** > = Greater than; < = Less than.

- **Measurements/estimates:** All dimensions are estimates unless otherwise indicated. Less reliable estimated dimensions are indicated with a '?'.

- **Species:** The species identification is based on visual observations and the common English name of what the tree appeared to be is listed first, with the botanical name after in brackets. 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.

- **Height:** Height is estimated to the nearest metre.

- **Spread:** The maximum crown spread is visually estimated to the nearest metre from the centre of the trunk to the tips of the live lateral branches.

- **Diameter:** These figures relate to 1.4m above ground level and are recorded in centimetres. If appropriate, diameter is measure with a diameter tape. ‘M’ indicates trees or shrubs with multiple stems.

- **Estimated Age:** Age is estimated from visual indicators and it should only be taken as a provisional guide. Age estimates often need to be modified based on further information such as historical records or local knowledge.

- **Distance to Structures:** This is estimated to the nearest metre and intended as an indication rather than a precise measurement.

Appendix 10

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Appendix 11

Pathogen Testing Results

PlantClinic

Plant Disease Diagnostic Unit

The Royal
BOTANIC GARDEN
Sydney

Client	Moore Trees
Attention	Paul vezgoff
Reference	E20_115, UID624328219
Client Reference	
Test(s)	PHYTO & DFPP
Sample Received	22.6.2020

Introduction

We have completed processing the samples sent to our laboratory for Plant Pathology testing. A summary of the results is in the table below. The 'Client References' field for sample submissions greater than 10 are in the linked spreadsheet below the table. For further details on the samples submitted and the testing methodologies please refer to Appendices 1 & 3.

Summary of Results

PlantClinic Ref.	Sample type	Client Ref.	PHYTO/WDF	DFPP
S1	Soil	S1	Negative	-
S2	Plant tissue	S2	WDF Negative	*Antrodia malicola* (syn. *Brunneoporus malicola*)
S3	Plant tissue	S3	WDF Negative	*Antrodia malicola* (syn. *Brunneoporus malicola*)
S4			-	-
S5			-	-
S6			-	-
S7			-	-
S8			-	-
S9			-	-
S10			-	-

Spreadsheet Results:

Recommendations

The *Antrodia* genus contains species that are reported to cause 'brown rot' wood decay and this is consistent with the cubical brown rot observed in the specimens. The virulence of this genus is largely unknown, but it is potentially a tree pathogen. The term 'brown rot' refers to the characteristic colour of the decayed wood, as most of the cellulose is degraded, leaving the lignin more or less intact as a brown, chemically modified framework, giving the rotted wood a brown appearance. As cellulose is a cell wall component for structural integrity, the tree may be structurally compromised. We recommend that an arborist assess the structural integrity of any infected trees especially if they are located near buildings or a thoroughfare.

Please contact Dr Matthew Laurence via email if you have any questions regarding this report (matthew.laurence@rbgsyd.nsw.gov.au).

Dr Matthew Laurence

BSc. (Hons), PhD (Plant Pathology), GradCert (Arboriculture)
Institute of Australian Consulting Arboriculturists (Accredited Member – ACM0502016)
Australasian Plant Pathology Journal-Senior Editor
Australasian Plant Pathology Society-Member
ResearchGate Profile - https://www.researchgate.net/profile/Matthew_Laurence

PlantClinic

Plant Disease Diagnostic Unit

The Royal Botanic Garden Sydney

Appendix 1 – Client Submitted Data

Invoicee	Moore Trees
Client Reference	
ABN or Date of Birth	90887347745
Purchase Order No.	
Purchase Order	
Primary Contact(s)	Paul vezgoff
Email	paul@mooretrees.com.au
Phone numbers	0411712887
Street Address	65 Moore Street
Description of Problem(s)	Large mature Bunya Pine (Araucaria bidwillii). Whole tree has died. Last 12 months. No site changes. Tree is located in an open paddock and is part of a heritage item of Wollongong Council. Has been extended drought up to Christmas. This tree is one of two large specimens (Within 10 metres of each other) with some smaller specimens growing around the base of these two. Two photos included. One shows the group of trees. The other shows some borer holes that are around the lower portion of the main trunk.
Further Information	
Client Photo 1	https://drive.google.com/uc?id=12qznu9Xfcj-EPl1nvoZwmEDCOhdPqUsl&export=download&display=/404034964040349840911441409114524091150640911597409115994091160240911604409116134091161640911649_40403494_Group.jpg
Client Photo 2	https://drive.google.com/uc?id=1e4F3hqM-8IRdBia1HHgMjfvvfhCFRRmy&export=download&display=/404034964040349840911441409114524091150640911597409115994091160240911604409116134091161640911649_66271824_Borerdamage.jpg
Fee Rate	Commercial or Organisation
Do you agree to the charges?	Yes
Foundation & Friends Membership Number	

Test Required:

PlantClinic Ref.	Client Ref.	Sample type	Test Required
S1	S1	Soil	PHYTO
S2	S2	Plant tissue	WDF
S3	S3	Plant tissue	WDF
S4			
S5			
S6			
S7			
S8			
S9			
S10			

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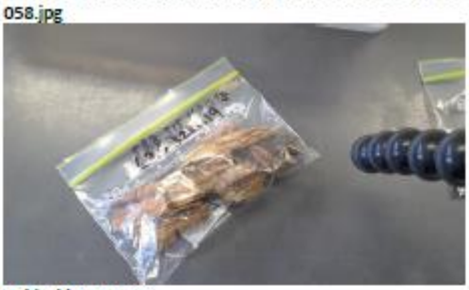
Appendix 2 – Samples Received

Test Week: 20W20

S1		**S2**	https://s3.amazonaws.com/files.formstack.com/uploads/2294320/40403564/624328219/15927860776691427495058.jpg 
Notes		Notes	Cubical brown rot
S3	https://s3.amazonaws.com/files.formstack.com/uploads/2294320/40403563/624328219/15927860862591755620284.jpg 	**S4**	
Notes		Notes	
S5		**S6**	
Notes		Notes	
S7		**S8**	
Notes		Notes	
S9		**S10**	
Notes		Notes	

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Appendix 3 – Methodologies

PHYTO Test

The soil sample is mixed with deionised water to form a soil/water mixture and baited for *Phytophthora* using New Zealand blue lupin seedlings (*Lupinus angustifolius*) (Pratt and Heather 1972). In addition, a *Phytophthora* selective agar bait (PARP-V8 agar) is also added to the soil/water mixture for detection of both *Phytophthora* & *Pythium* (Erwin and Ribeiro 2005).

The baited soil/water mixture is incubated at room temperature for 7 days. Total DNA is extracted from the blue lupin radicles using a modified version of the FastDNA® Kit (Q-biogene Inc.) according to the manufacturer's instructions. *Phytophthora* detection is based on a Polymerase Chain Reaction (PCR) approach using primers and PCR conditions described in (Schena et al. 2008). This method detects species in the genus *Phytophthora* and specifically *P. cinnamomi*. Species other than *P. cinnamomi* are recorded in the Report as *Phytophthora* sp.

If *Phytophthora* species identification is required (this must be specified on sample submission) then the ras-related protein gene (Ypt1) and ribosomal DNA, internal transcribed spacer 1 and 2 (ITS) is sequenced using the Sanger sequencing method and PCR primers and amplification conditions described in (Nikolcheva and Bärlocher 2004; Schena et al. 2008). The PCR amplicons are purified using ExoSAP-IT (USB Corporation) following the manufacturer's instructions and sequenced using the aforementioned PCR primers. The purified amplicons are then sent to the Ramaciotti Centre for Gene Function Analysis at the University of New South Wales where DNA sequences are determined using an ABI PRISM® 3700 DNA Analyser (Applied Biosystems Inc.).

The Basic Local Alignment Search Tool (BLAST) algorithm is used to match DNA sequences to species (Altschul et al. 1990). This algorithm compares the similarity of the sample DNA sequence with all samples in the National Centre for Biotechnology Information database (International online database). The BLAST then returns a list of species that are most similar to the sample DNA based on sequence identity (similarity) and assigns a probability value (E) that gives an indication of the reliability of the match. Because of this, BLAST usually returns multiple species and we include only the top three matches.

If species identification by BLAST is ambiguous then a phylogenetic analysis approach is attempted. Sequences are aligned for each isolate using the multiple alignment program ClustalW (Version 1.83) plug-in in the software Geneious (Version 10.3.9) (Thompson et al. 1997; Kearse et al. 2012) with reference taxa selected from the literature and BLAST analysis. Alignments are edited manually using the sequence alignment editing program Geneious (Version 10.3.9) and all polymorphisms confirmed by re-examining the electropherograms. Phylogenetic trees are generated using unweighted parsimony analysis in PAUP 4.0b10 (Swofford 2002) using the heuristic search option with 1,000 random addition sequences and tree bisection reconnection branch swapping. Gaps were treated as missing data. Clade stability is assessed in PAUP 4.0b10 (Swofford 2002) using 1,000 heuristic search bootstrap replications with random sequence addition.

WDF Test

Total DNA is extracted from the decayed/diseased wood tissue using a modified version of the FastDNA® Kit (Q-biogene Inc.) according to the manufacturer's instructions. Detection of wood decay fungi is based on multiplex PCR (Guglielmo et al. 2007, 2010) and a Sanger sequencing method using fungal specific ITS primers (Gardes and Bruns 1993; Manter and Vivanco 2007).

The multiplex PCR method detects the following wood decay fungi in the *Armillaria, Phellinus* and *Ganoderma* genera. This method cannot be used to identify species in these genera. Species identification is attempted using Sanger sequencing of the ITS region with fungal specific primers.

The PCR amplicons are purified using ExoSAP-IT (USB Corporation) following the manufacturer's instructions and sequenced using the aforementioned PCR primers. The purified amplicons are then sent to the Ramaciotti Centre for Gene Function Analysis at the University of New South Wales where DNA sequences are determined using an ABI PRISM® 3700 DNA Analyser (Applied Biosystems Inc.).

The Basic Local Alignment Search Tool (BLAST) algorithm is used to match DNA sequences to species (Altschul et al. 1990).. This algorithm compares the similarity of the sample DNA sequence with all samples in the National Centre for Biotechnology Information database (International online database). The BLAST then returns a list of species that are most similar to the sample DNA based on sequence identity (similarity) and assigns a probability value (E) that gives an indication of the reliability of the match. Because of this, BLAST usually returns multiple species and we include only the top three matches.

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If species identification by BLAST is ambiguous then a phylogenetic analysis approach is attempted. Sequences are aligned for each isolate using the multiple alignment program ClustalW (Version 1.83) plug-in in the software Geneious (Version 10.3.9) (Thompson et al. 1997; Kearse et al. 2012) with reference taxa selected from the literature and BLAST analysis. Alignments are edited manually using the sequence alignment editing program Geneious (Version 10.3.9) and all polymorphisms confirmed by re-examining the electropherograms. Phylogenetic trees are generated using unweighted parsimony analysis in PAUP 4.0b10 (Swofford 2002) using the heuristic search option with 1,000 random addition sequences and tree bisection reconnection branch swapping. Gaps were treated as missing data. Clade stability is assessed in PAUP 4.0b10 (Swofford 2002) using 1,000 heuristic search bootstrap replications with random sequence addition.

RID Test

Total DNA is extracted from the plant specimen(s) using a modified version of the FastDNA® Kit (Q-biogene Inc.) according to the manufacturer's instructions. The ribosomal DNA, internal transcribed spacer 1 and 2 (ITS), maturase K (matK) gene and the ribulose-1,5-bisphosphate carboxylase/oxygenase large subunit (rbcL) gene regions are amplified using PCR primers and amplification conditions described in CBOL Plant Working Group et al. 2009; Ford et al. 2009; Hollingsworth et al. 2009 and Singh et al. 2012. The PCR amplicons are purified using ExoSAP-IT (USB Corporation) following the manufacturer's instructions and sequenced using the aforementioned PCR primers. The purified amplicons are then sent to the Ramaciotti Centre for Gene Function Analysis at the University of New South Wales where DNA sequences are determined using an ABI PRISM® 3700 DNA Analyser (Applied Biosystems Inc.).

The Basic Local Alignment Search Tool (BLAST) algorithm is used to match DNA sequences to species (Altschul et al. 1990).. This algorithm compares the similarity of the sample DNA sequence with all samples in the National Centre for Biotechnology Information database (International online database). The BLAST then returns a list of species that are most similar to the sample DNA based on sequence identity (similarity) and assigns a probability value (E) that gives an indication of the reliability of the match. Because of this, BLAST usually returns multiple species and we include only the top three matches.

FID Test

Genomic DNA is extracted from the fungal specimen(s) using a modified version of the FastDNA® Kit (Q-biogene Inc.) according to the manufacturer's instructions. Fungal specific ITS primers are used to amplify the nuclear ITS region using PCR primers and amplification conditions described in (Gardes and Bruns 1993; Manter and Vivanco 2007).

PCR amplicons are purified using ExoSAP-IT (USB Corporation) following the manufacturer's instructions and sequenced using the aforementioned PCR primers. The purified amplicons are then sent to the Ramaciotti Centre for Gene Function Analysis at the University of New South Wales where DNA sequences are determined using an ABI PRISM® 3700 DNA Analyser (Applied Biosystems Inc.).

The Basic Local Alignment Search Tool (BLAST) algorithm is used to match DNA sequences to species (Altschul et al. 1990). This algorithm compares the similarity of the sample DNA sequence with all samples in the National Centre for Biotechnology Information database (International online database). The BLAST then returns a list of species that are most similar to the sample DNA based on sequence identity (similarity) and assigns a probability value (E) that gives an indication of the reliability of the match. Because of this, BLAST usually returns multiple species and we include only the top three matches.

FOC Test

The detection of *F. oxysporum* f.sp. *canariensis* (Foc), the causal agent of Fusarium wilt of Phoenix palms, uses two diagnostic approaches. Further, a Sanger sequencing method using fungal specific ITS primers (Gardes and Bruns 1993; Manter and Vivanco 2007) is also used to detect palm pathogens other than Foc.

The first approach involves total DNA extraction from the symptomatic rachis tissue followed by a PCR test to differentiate pathogenic 'canariensis' strains from any non-pathogenic *F. oxysporum* endophytes. The DNA is extracted using a modified version of the FastDNA® Kit (Q-biogene Inc.) according to the manufacturer's instructions. PCR detection is based on primers and PCR conditions described in (Plyler et al. 1999; Laurence et al. 2015).

The second approach uses a fungal isolation and morphological identification approach followed by the aforementioned PCR test. Rachis tissue is surface sterilised with 70% ethanol for one minute and internal sections are plated onto a *Fusarium* specific isolation medium (PPA) (Leslie et al. 2008).

The PPA plates are incubated under alternating 12h light and 12h darkness for up to 5 days. Resulting *Fusarium* colonies are subcultured onto carnation leaf agar (CLA) for morphological identification. *Fusarium oxysporum* is identified based on the morphological characters described in Leslie et al. (2008). Genomic DNA is extracted from any *F. oxysporum* isolates and the previously described PCR test is used to differentiate pathogenic 'canariensis' strains from any non-pathogenic *F. oxysporum* endophytes.

DFPP Test

The Detection of Fungal Plant Pathogens test uses two diagnostic approaches; one based on traditional fungal isolation using a selective agar medium(s) and the second using a total DNA extraction followed by fungal specific ITS PCR, Sanger DNA sequencing and sequence analysis.

Diseased plant tissue is firstly surface sterilised with 70% ethanol for one minute. Tissue is selected from the dead cell junction (disease margin) for both fungal isolation with selective media and total DNA extraction. The media used for each DFPP test is selected on the basis of the disease symptoms, tissue type, host, literature and the likely causal organism.

The agar isolation medium(ia) is incubated for up to 7 days and resulting fungal colonies are sub-cultured onto carnation leaf agar (CLA) for morphological identification. Isolates are grouped morphologically and saprophytic genera are excluded from any further processing. Representatives from each morphological group are further identified using fungal specific ITS PCR, Sanger DNA sequencing and sequence analysis.

Genomic and total DNA is extracted from the CLA isolates and from the dead cell junction of the disease symptoms (second step or approach), respectively, using a modified version of the FastDNA® Kit (Q-biogene Inc.) according to the manufacturer's instructions. Fungal specific ITS primers are used to amplify the nuclear ITS region using PCR primers and amplification conditions described in Gardes and Bruns (1993); Nikolcheva and Bärlocher (2004) and Manter and Vivanco (2007).

The PCR amplicons are purified using ExoSAP-IT (USB Corporation) following the manufacturer's instructions and sequenced using the aforementioned PCR primers. The purified amplicons are then sent to the Ramaciotti Centre for Gene Function Analysis at the University of New South Wales where DNA sequences are determined using an ABI PRISM® 3700 DNA Analyser (Applied Biosystems Inc.).

The Basic Local Alignment Search Tool (BLAST) algorithm is used to match DNA sequences to species (Altschul et al. 1990). This algorithm compares the similarity of the sample DNA sequence with all samples in the National Centre for Biotechnology Information database (International online database). The BLAST then returns a list of species that are most similar to the sample DNA based on sequence identity (similarity) and assigns a probability value (E) that gives an indication of the reliability of the match. Because of this, BLAST usually returns multiple species and we include only the top three matches.

Appendix 4 – References

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Curriculum Vitae

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EDUCATION and QUALIFICATIONS

- 2007 – Diploma of Arboriculture (AQF Cert V) Ryde TAFE. (Distinction)
- 1997 – Completed Certificate in Crane and Plant Electrical Safety
- 1996 – Attained Tree Surgeon Certificate (AQF Cert II) at Ryde TAFE
- 1990 – Completed two month intensive course on garden design at the Inchbald School of Design, London, United Kingdom
- 1990 – Completed patio, window box and balcony garden design course at Brighton College of Technology, United Kingdom
- 1989 – Awarded the Big Brother Movement Award for Horticulture (a grant by Lady Peggy Pagan to enable horticulture training in the United Kingdom)
- 1989 – Attained Certificate of Horticulture (AQF Cert IV) at Wollongong TAFE

INDUSTRY EXPERIENCE

Moore Trees Arboricultural Services **January 2006 to date**

Tree Consultancy and tree ultrasound. Tree hazard and risk assessment, Arborist development application reports
Tree management plans.

Woollahra Municipal Council **Oct 1995 to February 2008**

ARBORICULTURE TECHNICAL OFFICER
August 2005 – February 2008
Tree asset management, programmed inspection, inventory and condition surveys of council trees, hazard and risk appraisal, Tree root damage investigation and reporting, assessment of impacts of capital works projects on council trees.
ACTING COORDINATOR OF TREES MAINTENANCE
June – July 2005, 2006
Responsible for all duties concerning park and street trees. Prioritising work duties, delegation of work and staff supervision.
TEAM LEADER
January 2003 – June 2005
TEAM LEADER
September 2000 – January 2003
HORTICULTURALIST
October 1995 – September 2000

Northern Landscape Services **July to Oct 1995**

Tradesman for Landscape Construction business

Paul Vezgoff Garden Maintenance (London, UK) **Sept 1991 to April 1995**

CONFERENCES AND WORKSHOPS ATTENDED

- International Society of Arboriculture Conference (Canberra May 2017)
- QTRA Conference, Sydney Australia (November 2016)
- TRAQ Conference, Auckland NZ / Sydney (October 2013/2018)
- International Society of Arboriculture Conference (Brisbane 2008)
- Tree related hazards: recognition and assessment by Dr David Londsdale (Brisbane 2008)
- Tree risk management: requirements for a defensible system by Dr David Londsdale (Brisbane 2008)
- Tree dynamics and wind forces by Ken James (Brisbane 2008)
- Wood decay and fungal strategies by Dr F.W.M.R. Schwarze (Brisbane 2008)
- Tree Disputes in the Land & Environment Court – The Law Society (Sydney 2007)
- Barrell Tree Care Workshop- Trees on construction sites (Sydney 2005).
- Tree Logic Seminar- Urban tree risk management (Sydney 2005)
- Tree Pathology and Wood Decay Seminar presented by Dr F.W.M.R. Schwarze (Sydney 2004)
- Inaugural National Arborist Association of Australia (NAAA) tree management workshop- Assessing hazardous trees and their Safe Useful Life Expectancy (SULE) (Sydney 1997).